THE EFFECTS OF AN ACUTE ADMINISTRATION OF NITROUS OXIDE ON FEAR

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ABSTRACT

THE EFFECTS OF AN ACUTE ADMINISTRATION
OF NITROUS OXIDE ON FEAR

By

Lance A. Harris

This study investigated the effects of an acute administration of nitrous oxide on fear.

There were two hypotheses and two exploratory questions regarding the effects of gas inhalation: Hypothesis 1a) Nitrous oxide inhalation will function to increase approach to a feared stimulus, with the extent of increase corresponding to increasing dosage levels; Hypothesis 1b) Nitrous oxide inhalation will function to decrease the level of self-reported fear in the presence of a phobic stimulus, with the extent of decrease corresponding to increasing dosage levels.

Exploratory question 1) Do S attitudes and expectations about the experiment (subjective set) correlate with the extent of change in the experimental measures?

Exploratory question 2) Does the extent of S's previous drug-taking behavior correlate with the extent of change in the experimental measures?

Forty female undergraduate student volunteers who indicated a high degree of fear of snakes on a Fear Survey Schedule were assigned to one of four dosage level groups: (1) no nitrous control--room air gas; (2) four balloons of nitrous oxide; (3) seven balloons of nitrous oxide;

and (4) ten balloons of nitrous oxide. Three measures of fear change were administered: (1) behavioral approach to a live tame snake (Distance); (2) a self report measure of fear--the Fear Thermometer (FT); and (3) Post-Experiment questionnaire.

Hypothesis 1a) was partially confirmed in that while nitrous oxide acted to decrease fear, the effect was not dependent on dosage level. Hypothesis 1b) was not confirmed. Both the experimental and control groups reflected a significant decrease in the extent of self-reported fear. Both exploratory questions were answered in the negative. No dosage level effects were noted for all measures.

Correlations between all measures show a general trend toward independence. Of particular importance are the non-significant correlations between the Distance and FT measures. These data support the hypothesis that fear is not a unitary response, but is composed of several independent responses: overt-behavioral; somatic-physiological; and verbal-cognitive.

The Post-Experiment questionnaire data indicated a decrease in verbal-cognitive fear lasting at least 20 minutes. Since neither the Distance nor FT measures reflected such a long-lasting effect further support is lent to the hypothesis of independent fear response systems. In addition, the pervasiveness of the effects of inhaling nitrous oxide were illustrated in response to the Post-Experiment questionnaire with 100% of the experimental group Ss noting effects of a psychological nature, 97% indicating physical effects, and 43% experiencing sensory alterations.

The significant reduction in fear noted for the control group is not explainable in terms of a placebo response since the control Ss described the "gas" (air) as generally innane and ineffective. Instead, it was proposed that the inhalation of nitrous oxide produced clear feedback to the experimental group Ss that something had happened and that change was therefore expected. Thus, it was hypothesized that the demand characteristics of the experimental and control conditions differed in terms of the experiential effects produced by gas inhalation.

According to this hypothesis, the differential demand characteristics in the control and experimental conditions would result in greater change on the dependent variables whether or not nitrous oxide in fact exerts a specific effect on fear.

This methodological problem is present in any drug research where the ingestion of the experimental drug results in an experiential effect compared to the absence of such effect from the control substance. It is concluded that while comparative drug research is a possible solution to the problem, data concerning the effects of demand characteristics in drug research is preferable.

Approved: Robert A. Zuelke

Date: 4/20/73

THE EFFECTS OF AN ACUTE ADMINISTRATION OF NITROUS OXIDE ON FEAR

By
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A THESIS

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DEDICATION

I have long intended that this page would serve as the final platform upon which I might vent my anger and disillusionment with the university system. I have since learned that there are more important things in this world.

I dedicate this labor and any dreams within to Bob Zucker and Ed Lynn. When I needed you, you were there.

Sometimes I find some of the neatest people in some of the weirdest places!

ACKNOWLEDGMENTS

I would like to thank my committee members for being on my committee. It must be a real drag sometimes.

Much appreciation, thanks, and a kiss or two for my favoritest person: Mary.

I would also like to thank my own psyche for staying glued together through all this.

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CHAPTER I

INTRODUCTION

> "With me, as with every other person whom I have heard, the keynote of the experience is the tremendously exciting sense of an intense metaphysical illumination. Truth lies open to the view in depth beneath depth of almost blinding evidence. The mind sees all the logical relations of being with an apparent subtlety and instantaneity to which its normal consciousness offers no parallel; only as sobriety returns, the feeling of insight fades, and one is left staring vacantly at a few disjointed words and phrases, as one stares at a cadaverous-looking snowpeak from which the sunset glow has just fled, or at the black cinder left by an extinguished brand.... I strongly urge others to repeat the experiment, which with pure gas is short and harmless enough." William James.[1]

Drugs have long been primary or adjunctive tools in psychological therapy. Recently, Wolpe and other practitioners of behavior modification have found the use of carbon dioxide particularly beneficial for aiding relaxation in systemmatic desensitization, not only in terms of the relaxing properties of the gas but also in the safety and ease of administration (Wolpe and Lazarus, 1966). Recently, other therapists familiar with the effects and usefulness of carbon dioxide in therapy have found that another gas, nitrous oxide, equals carbon dioxide in safety and ease of administration but seems to surpass carbon dioxide in the treatment of phobic states and other pathologies that involve chronic anxiety (Lynn, 1971).

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[1]From Mind, Vol. 7, 1882, pp. 186-208.

In addition, informal surveys indicate that while the non-medical, or "street" use of nitrous oxide is not epidemic, it is rapidly growing (Lynn, Walter, Harris, Dendy, and James, 1972) even though the procurement of the gas is considerably more difficult than highly illegal drugs as L.S.D. and heroin. However, ingenious as the drug using culture is, simple and relatively safe methods of making the gas are well-known and published for the public (Claussen, 1971).

In spite of the prevalance of nitrous oxide in both medical and non-medical settings, and despite the potential benefits of its use in therapy, very little research concerning the effects of the gas on human behavior and personality has been done. Accordingly, this study will attempt an initial investigation of the post-administration relaxation effects of nitrous oxide as it relates to approach behavior towards a fear eliciting stimulus. It is expected that the results of this study will have some generalizability to both the possible use of nitrous oxide as a therapeutic adjunct in inducing relaxation, and in suggesting implications concerning the motivations and effects of the street use of the drug.

Literature Review

Nitrous Oxide as an Anesthetic: The most prevalent feature of nitrous oxide as an anesthetic is its weakness. In fact, in comparison to other commonly used anesthetics nitrous oxide has been largely regarded as the least potent (Gould, 1943). However, certain other aspects of nitrous oxide are considered to be positive enough to preclude

the complete replacement of the gas in surgery. The most important positive property of nitrous oxide is that unlike most other anesthetics the rapidity of its effect allows for moment-to-moment control of the depth of anesthesia. Other positive aspects of the drug include the non-irritating induction phase, the freedom from discomfort in the recovery phase, the fairly wide margin of safety in the administration of the gas, and the low potential for permanent organic destruction (Bourne, 1967; Heironimus, 1964).

The typical method of administration in anesthesia is immediate flooding of 100% nitrous oxide which is continued until the patient loses consciousness. This is followed with the addition of anywhere from 5% to 30% oxygen; the most commonly used mixture being 80% to 90% nitrous oxide with 20% to 10% oxygen. As is indicated by the wide range of nitrous oxide-oxygen mixtures, there are vast individual differences in reaction to nitrous oxide and careful and close attention must be maintained by the anesthesiologist to insure that no destructive oxygen deprivation is allowed to occur. In the recovery phase the flow of nitrous oxide is stopped and the mask is flooded with 100% oxygen with saturation of the blood with oxygen occurring rapidly, usually in about 20 seconds (Christiansen, 1971).

The primary danger of nitrous oxide as an anesthetic refers not to the gas itself, but to the danger of oxygen deprivation. Careful attention is required to insure that respiratory obstruction, cardiovascular collapse, and brain damage do not occur as a result (Eastwood, 1964). There is really only one unyielding contraindication to the use of nitrous oxide in anesthesia and that is a skull fracture. However, any

physical conditions that would tend to interfere with oxygen uptake or subsequent tissue utilization of oxygen as well as the elimination of carbon dioxide can lead to abrupt and indistinct changes in the plane of anesthesia. Therefore, great care must be exercised whenever nitrous oxide is used as an anesthetic in these cases. Such conditions include cardiovascular diseases, alcoholism, diabetes, nephritis, emphysema, asthma, anemia, colds and upper respiratory infections, pregnancy, hyperthyroidism, tuberculosis, patients saturated with sulfonamide drugs, patients with an enlarged thymus pressing on the trachea, and patients who have survived wartime gas attacks especially mustard gas. In addition, pre-psychotic and psychotic states are considered by some anesthesiologists and surgeons to be a contraindiction to the use of nitrous oxide as an anesthetic largely because the individual mental reaction to the induction and recovery phases are too unpredictable, ranging from acute psychosis in pre-psychotic patients to violence (Christiansen, 1971).

Nitrous Oxide as an Analgesic: As mentioned, one of the most profound deficits of nitrous oxide as an anesthetic is its weakness. As an analgesic (the elimination of pain without the loss of consciousness) the weakness of the gas is considered to be highly beneficial primarily because the development of anesthesia is easily and rapidly prevented by simply adding more oxygen to the mixture (Bourne, 1967). As an analgesic the most commonly used mixture is 70% nitrous oxide with 30% oxygen, but the differences in individual reaction as well as the cumulative effects that are sometimes found over a length of time under the

gas require that adjustments be made and the amount of nitrous oxide in oxygen frequently varies from 40% to 80%.

Most writers agree that the use of nitrous oxide as an analgesic is extremely safe and that there are no real contraindications to its use, with its major benefits listed as ease of administration, rapidity of effect, the generally pleasant effects, and the rarity of gas-related nausea (Clement, 1945). As is usually true there are those who disagree. In an experiment by Parkhouse, Henrie, Duncan, and Rome (1960), three concentrations of nitrous oxide in oxygen (20%, 30%, and 40%) were used with an air control group to determine whether nitrous oxide could alleviate pain without impairing what the authors term "protective reflexes" (which were in reality a series of mental tasks involving both learning and recall). The essential conclusion was that due to vast individual differences there was no way of determining a priori whether a given concentration of nitrous oxide would eliminate pain without impairing cognitive functioning. The authors also noted (contrary to almost all other experimental data) a high incidence of nausea and refusal to cooperate. It is difficult to explain with confidence the contrary effects of the gas in this experiment but it seems likely that two factors might have operated in such a way so as to produce the undesirable effects. Firstly, the subject population was unlike other research in that of the 24 Ss, 14 were professionals (5 psychologists, 8 physicians, 1 anesthesiologist) and the remaining 10 were technical employees. It seems entirely possible that these Ss were more anxious than the typical college student about receiving the gas. Even more outstanding is the fact that the

first test for all Ss involved the use of a sphygmomanometer cuff and a bulb squeezing task as a painful stimulus. In this test all Ss were required to squeeze the bulb until either intolerable pain or extreme muscle fatigue made continuance impossible. It seems highly likely that this noxious test alone could easily produce the negative reactions to the gas by association.

Specific Action of Nitrous Oxide: Since the introduction of nitrous oxide as an anesthetic there has been controversy regarding the specific way in which the anesthetic and analgesic effects are produced. The most serious of these concerns were voiced by those who believed that nitrous oxide was an inert gas, and that the effects were produced by the exclusion of oxygen resulting in hypoxemia (a general oxygen deficiency in the circulatory blood). This theory was based largely on clinical observations that indicated that no organ other than the brain seemed to be effected and that any circulatory and respiratory changes could be explained as an effect of hypoxemia. As support for this theory it was contended that since nitrous oxide is 100 times more soluble than oxygen in body fluids it is possible that the rapid effect and elimination of nitrous oxide was due to the immediate crowding out of oxygen (Brown, Lucas, and Henderson, 1927; Christiansen, 1971) and various clinical observations seemed to support this notion (e.g., Fletcher, 1945). However, the preponderance of data strongly contradict this theory and Seldin (1943) states "Nitrous oxide anesthesia is not produced by anoxia and its administration can be made anoxia free. If a safe oxygen level is maintained at all times, anoxia is avoided. The occurrence

of severe anoxia is due primarily to either carelessness or inexperience. When anoxia is produced, nitrous oxide ceases to be a harmless agent...." One observational source of evidence that clearly indicates a specific action of nitrous oxide comes from Lehman and Bos (1947) who found that, while both nitrous oxide and nitrogen are highly soluble in body fluids, the psychological effects of the gases are markedly different with nitrogen producing none of the euphoria, spontaneity, insight or decrease in resistance that is commonly associated with nitrous oxide administration.

More convincing evidence has been accumulated in favor of the specific action hypothesis with advances in the knowledge of the molecular action of gases. It has been found that the rates of diffusion of oxygen and nitrous oxide are independent of each other and that the absorption coefficient of oxygen and nitrous oxide are independent of the solution of nitrous oxide. Therefore, the two gases can be considered to be entirely independent of each other in producing their effects on the body (Clement, 1945).

A rather conclusive study (Faulconer, Pender, and Bickford, 1949) showed that when anesthesia is maintained in humans with a mixture of 50% nitrous oxide in 50% oxygen there are the electroencephalographic changes normally associated with anesthesia while the monitored oxygen content of the blood shows no traces of hypoxemia.

Given that nitrous oxide is considered to have a specific action on the brain, exactly what that action is is still not understood (Eastwood, 1964). In a review of the literature on nitrous oxide Christiansen (1971) presents supporting evidence from both a physiological and

psychological framework arguing for the hypothesis that the effect of nitrous oxide is centered in the reticular formation rather than the higher, or cortical, areas of the brain.

In any event, statements concerning the specific action of nitrous oxide in the brain are at this point conjecture and the only concrete position is that while nitrous oxide does in fact exert a specific influence, the method by which that effect is accomplished is unknown.

Nitrous Oxide in Psychiatric Treatment: There are basically three ways in which nitrous oxide has been used in psychiatry: a shocking agent; a sedative; and a narcoanalytic agent.

As a shocking agent it was believed that nitrous oxide could be used to induce the acute cerebral anoxia considered to be the major factor in the success of shock therapy with drugs such as insulin and metrazol (Fogel and Gray, 1940). Among the reasons that nitrous oxide was placed in consideration for use as a shocking agent was that it produced a pleasant induction phase, allowed for a wider margin of safety than insulin, and was less time-consuming in administration and control. In its use as a shocking agent Fogel and Gray would produce a fairly deep level of oxygen deficiency where extreme caution was required to prevent respiratory failure or irreversible brain damage. Although the authors reported no accidents or untoward effects the method is obviously a very dangerous one, particularly in light of the widely reported vast range of individual differences in reaction to the gas. The report by the authors is not a study in the scientific sense and the results are based on clinical observations of 27 cases of nitrous oxide-produced anoxia in

which Ss also received standard psychiatric treatment. Such as they are, the results indicate that the use of nitrous oxide as a shocking agent produce good to complete remission in patients having less than a 2 year history of illness.

The use of nitrous oxide as a sedative by Lehman and Bos (1947) is essentially the same as its use as a shocking agent but involving a less profound level of anoxia. In this method nitrous oxide is terminated and oxygen flooded in before clonic contraction and extensor spasms ensue whereas in the shocking method nitrous oxide is continued through this phase up to muscular rigidity. According to the authors the benefits of such usage of nitrous oxide are largely those found immediately post administration and include: a period of sedation lasting for several hours that is not associated with sleepiness or confusion; increased spontaneity; feelings of well-being (lasting for up to hours after the treatment); reduced resistance on the part of the patient to talking about himself; and increased insight.

Rogerson (1944) first introduced nitrous oxide as a narcoanalytic agent after noting that while intraveneous injections of barbiturates often induces a desirable state of reduced criticism and an increase in the production of painful and repressed ideations, the method can be very hazardous, especially when it is frequently repeated (addiction). Also, the method is time consuming, requiring the presence of resuscitation materials. Rogerson believed that nitrous oxide inhalation could avoid these difficulties while still providing for the reduced self criticism during which time the patient is more accepting of suggestions (likened by the author to a state of light hyponosis), and the decreased resistance.

Rogerson's use of the gas involved the breathing of a 45% nitrous oxide with 55% room air (typical mixture only--the percentage of nitrous oxide was increased or decreased according to individual responsivity). During this period suggestions were made that the patient was becoming more relaxed and that painful ideas would come more readily to mind.

Rogerson claims the greatest success with conversion hysterics, particularly hysterical fuges and anxiety neuroses or other psychological disorders where repressed ideas, events and complexes may be theorized as composing the core of the illness. Rogerson is careful to emphasize that it is doubtful that anything was accomplished by using nitrous oxide that could not have been done with more traditional, non-drug related methods and the real benefit of its use should be put in terms of efficiency.

It should be made clear that in none of the previously described uses of nitrous oxide as a shocking agent, a sedative or a narcoanalytic agent, were scientific studies conducted. The results, therefore, must be carefully interpreted.

Experimental Research with Nitrous Oxide: Because nitrous oxide has been largely regarded as an anesthetic-analgesic agent that is used primarily in medical, and in rare instances psychiatric settings, the experimental evidence concerning the psychological effects of the drug on normal Ss has been conspicuously sparse. The first known attempt at the quantification of these effects by McKinney (1932) used only nine Ss to evaluate the effects of nitrous oxide on 10 learning and performance tests. The control utilized the same Ss in the absence of any gas, and no

statistics were calculated. McKinney labeled the study as exploratory in nature, and this, in combination with poor experimental design, make it appear that the study is more of a plea for further data than a source of data in itself. McKinney felt that the potential for using nitrous oxide as a tool for studying altered states of consciousness at varying concentrations with different tasks was great and that it should not be ignored. Unfortunately, until the 1950's it was McKinney that was ignored while the gas continued to be used in medicine and psychiatry and data consisted largely of clinical observations and impressions.

In 1950 a study by Wilson, Crockett, Exton-Smith, and Steinberg, indicated that nitrous oxide produced a profound decrement in motor skills at concentrations insufficient to produce anesthesia. A later study by Steinberg (1954) indicated that while a mixture of 30% nitrous oxide and 70% oxygen distrupts motor tasks considerably more than hypothesized, the effects of the gas on cognitive tasks were a function of complexity with the most complex tasks showing the greatest decrement.

Other studies have shown that while there are certain subjective effects of nitrous oxide-oxygen inhalation that are commonly reported there is little correlation between some of these subjective experiences and objective behavior. For instance, it has frequently been reported that audition seems to be improved with the inhalation of nitrous oxide but a study by Westerlund, Pittinger, and Reger (1961), demonstrated that this was not the case. Similarly, time perception is often subjectively affected but no objective quantification of this effect was possible in a study by Steinberg (1955). Also, in many clinical reports on the use of nitrous oxide the authors have stated that they believe the effects of

the gas on personality are a function of the emotional stability of the subject. An experiment by Steinberg (1956) indicated (although because a very crude measure of emotional stability was used, by no means proved) that in relatively normal Ss (medical students) there is no correlation between emotional stability and either the number of different types of reported subjective effects, or the extent of disruption on the performance of cognitive tasks.

The most complete literature concerning the effects of nitrous oxide on behavior has come from studies on learning. In a study by Summerfield and Steinberg (1957), it was demonstrated that when a mixture of 30% nitrous oxide and 70% oxygen was inhaled during a 12.5 minute break in a nonsense syllable learning task, the nitrous oxide groups were significantly superior to the group receiving a room air control gas in recalling syllables at the resumption of learning. The results of a second study (Steinberg and Summerfield, 1957) indicated that the facilitating effects of the previous experiment were due to a lessening of the interference-forgetting effects caused by a color naming task imposed during the gas inhalation.

In an earlier study (Russell and Steinberg, 1955) the authors used a design that enabled them to investigate the potential of a 30% nitrous oxide in oxygen mixture in reducing the detrimental effects of stress on learning. The design involved a stressor task composed of an insoluble temporal maze. The authors hypothesized that the experimental groups receiving the nitrous oxide during the stressor task would not be as susceptible to the disrupting effects of the stress and would therefore be superior to the air control groups on learning and performance of a

subsequent soluble temporal maze. The results were as hypothesized but the authors concede that since the insoluble and soluble tasks were very similar in both response and stimulus characteristics that transference interference effects should be maximal and the design allowed no means of parcelling the effects of stress from the effects of interference. Accordingly, a second design (Steinberg and Russell, 1957) was employed where the only essential difference from the preceding experiment was that the task to be completed after the insoluble maze was a list of serial nonsense syllables. Since the stimulus and response characteristics of the serial task were quite different from those of the stressor task, a comparison with the 1955 experiment was possible whereby the transfer and the stressor effects could be analyzed. The results indicated that both the interference and the stressor effects were indeed present, and that both were significantly reduced with the inhalation of nitrous oxide. It should be noted that although the authors conclude that the stress effects were reduced along with the transfer effects, they admit the difficulty in identifying exactly what the stress effects are ("... "anxiety" and other "unique properties" ...") and that the parcelling out of these effects is very difficult and tentative.

In another experiment (Summerfield and Steinberg, 1967) a more direct test of the action of nitrous oxide-oxygen inhalation on transfer effects was employed. In this design 15 learning trials of nonsense syllables were followed with either a similar (second list of nonsense syllables) or a dissimilar (color naming) task during which time the gas was inhaled. Following this procedure all Ss were required to participate in recall of the original list. The results show the superiority of both nitrous oxide

groups over their corresponding control groups, with the maximum difference between experimental and control groups occurring when the transfer effects are maximal.

In a review by Steinberg and Tomkiewicz (1967) the authors cite data that both support and dispute the general rule of thumb that a post-learning administration of an anesthetic drug will serve to improve later performance or recall. However, the authors contend that the differences in design (one trial vs. multi-trial learning) as well as the type of drug, dosage, and administration method, have made general conclusions unavailable and that more standardization is required.

In a recent study (Lynn et al., 1972) the administration of nitrous oxide mirrored the street use of the drug: instead of utilizing the complicated mixing apparatus and inhalation masks with both nitrous oxide and oxygen mixed together, Ss inhaled a single breathful of pure nitrous oxide from a balloon. Thirty seconds after inhalation (peak effect) Ss were required to perform one of 3 cognitive tasks (addition, digit symbol, symbol analogies). Ss were also retested at 5 minutes and 10 minutes post-inhalation such that each S received all three tests over a span of three days and repeated only one test (pre-inhalation test: parallel form). The results show that there was statistically significant cognitive disruption at the peak experience for the digit symbol and the addition tasks but not for the symbol analogies, and that all cognitive effects had disappeared by 5 minutes post-inhalation. The design also incorporated a subject assignment based on previous drug experience into a "straight" group (no history of non-medical use of drugs other than alcohol) or a "freak" group (regular use of drugs for other than medical

reasons). Interestingly, no consistent differences in performance were found between the two groups. But in terms of subjective experience the freaks tended to liken the experience to psychedelic drug effects, while the straights compared the nitrous oxide effects to alcohol and sexual orgasm. Most notable in this experiment are the administration method approximating street usage, and the fact that a single breathful of nitrous oxide held for less than 30 seconds will produce a significant cognitive disruption. Also significant are the reports on subjective experiences that indicate relatively long-lasting (up to hours after the experiment) effects, including increased relaxation.

Individual Differences with Nitrous Oxide: Study after study and years of clinical use involving nitrous oxide as an analgesic, anesthetic, and experimental variable have repeatedly indicated the wide range of individual variability in the reaction to the gas. In well-controlled clinical use of nitrous oxide over a span of 200 patients, Bourne (1967) noted that the range of nitrous oxide mixed with oxygen that would produce anesthesia varied from 30% to 70%. However, the author noted that when the patient had developed a tolerance to central nervous system depressants (e.g., barbiturates, alcohol) the effects of nitrous oxide were considerably lessened. Bourne presents well-documented data that strongly support the notion that the effect of nitrous oxide as an anesthetic is dependent on the extent of the patient's use of central nervous system depressants, and he feels that the effect is so marked that one is justified to speak in terms of cross-tolerance.

CHAPTER II

STATEMENT OF PROBLEM AND HYPOTHESES

It should be clear that the vast preponderance of data concerning nitrous oxide and its effects are concerned only with the anesthetic and analgesic properties of the gas or its effects on learning and performance of rote tasks. Few studies have looked at the therapeutic possibilities of nitrous oxide and even these studies have frequently involved radical and potentially extremely hazardous procedures.

Relaxation can and has been facilitated with the use of carbon dioxide and other drugs (Wolpe and Lazarus, 1966). Since any number of anectodal reports in the literature have indicated a long-lasting relaxing effect of nitrous oxide inhalation, this study will attempt a direct investigation of the extent of any relaxation effects of nitrous oxide in relation to fear of snakes.

The "street" use of nitrous oxide has never involved the use of complex equipment designed to mix the nitrous oxide and oxygen at the correct percentages and flow rates. The typical non-medical use of the gas involves filling a balloon or bag with nitrous oxide and either holding a full breath for as long as possible, or re-breathing the gas until oxygen is physically required. As long as the user insures that oxygen will automatically be received if unconsciousness ensues (i.e., expel the gas from the lungs, drop the balloon) these methods can be considered

safe. However, these procedures have only once been utilized in the laboratory and there remains, then, essential differences between the scientific methodologies and the street usage of the drug. In the present study two of these factors were corrected in exactly the same fashion as the Lynn et al. study (1972). They are: (a) drug composition and duration: whereas the typical laboratory gas is a percentage mixture of nitrous oxide in oxygen administered in a chronic (to blood saturation) fashion the present study utilized an acute administration of pure nitrous oxide; and (b) administration route: the present study involved breathing from a balloon and holding that breath rather than breathing the gas from a facemask.

That the experiential effects of inhaling pure nitrous oxide rather than a nitrous oxide-oxygen mixture may well be different can be predicted on the basis of tissue absorption rates which are dependent on the concentration of not only gases (Eger, 1964) but of any drug (Goodman and Gilman, 1970).

In addition, it is only reasonable to expect that the effects of set and setting will be radically different when Ss are confronted with a facemask and a host of official looking medical support equipment instead of a simple balloon. As an indication of the effects of the mask alone, Wolpe (1969) notes that any patient who is given carbon dioxide as a therapeutic adjunct cannot be afraid of suffocation or the use of the mask will frighten them. Contrary to this, no such problems were noted in the Lynn et al. (1972) study where a balloon was used for administration.

In a more general sense, because set and setting frequently play such an important role in determining the objective and subjective effects of

the drug (Goodman and Gilman, 1970), any attempts to more accurately reflect the setting present in the street use of the drug should provide data that are more generalizable to the effects of the non-medical usage of nitrous oxide.

Hypotheses

Hypothesis 1a): Nitrous oxide inhalation will function to increase approach behavior, with the extent of increase corresponding to increasing dosage levels.

Hypothesis 1b): Nitrous oxide inhalation will function to decrease the level of self-reported fear on the Fear Thermometer, with the extent of decrease corresponding to increasing dosage levels.

Exploratory questions: Two questions, based on pre-inhalation behavior and questionnaire results, are of interest:

1. Do S's attitudes and expectations about the experiment (subjective set) correlate with the extent of change in the Distance and FT measures?

2. Does the extent of S's previous drug-taking behavior correlate with the extent of change in the Distance and FT measures?

CHAPTER III

METHOD

Design: The design utilized 4 groups of 10 Ss each with the following dosage levels: Group 1, no nitrous oxide (4 balloons of room air); Group 2, four balloons of nitrous oxide; Group 3, seven balloons of nitrous oxide; Group 4, ten balloons of nitrous oxide. The dependent variables were measured at three points in time: Pre gas-inhalation; 1 minute post gas-exhalation (T_1); and 20 minutes post gas-exhalation (T_2).

Subjects: The subjects were 40 female volunteers who indicated "terror" or "very much" on the snake item of the Fear Survey Schedule. The schedule was handed out to introductory psychology classes and returned during the next class meeting. Based on the extent of approach during the pre-inhalation test Ss were assigned to one of two categories: Hi fear, Ss who could approach to within one foot of the snake; and Lo fear, Ss who could approach to less than one foot of the snake. The Ss were assigned in such a way as to insure that each of the fear categories were equally represented in each of the four experimental groups. Within this restriction, Ss were randomly assigned.

The safety and rights of Ss volunteering for the experiment were protected in the following ways: 1. At all times a second E (female)

was present to reassure S of the propriety of the primary E's behavior as a safeguard against Ss conscious fantasies regarding the experiment, and to provide all necessary assistance in the event that an emergency arose; 2. The Ss were instructed concerning the general nature of the effects of the gas and the procedure of the experiment prior to the experiment itself (see Appendices 1 & 4); 3. All Ss had reached the age of majority (18) prior to the start of the experiment; 4. Their willingness to participate was indicated on a signed consent form (Appendix 5); 5. The Ss were informed that they had the option to terminate the experiment whenever they so desired; 6. A medical history (Appendix 3) was obtained and screened by a physician prior to the experiment to insure that Ss were physically capable of participating in the experiment with complete safety; 7. The safety of the procedure of gas administration has been demonstrated in prior research (see Lynn et al., 1972); 8. One of three physicians was available at all times by telephone; 9. The primary E has had considerable training in emergency medical and psychological treatment; 10. Finally, all data collected during the experiment and the results of all post-test questionnaires were coded in order to insure total confidentiality of the data and anonymity of Ss (all identifying materials were removed during the experiment).

Measures: The initial screening measure was the Fear Survey Schedule, Form II (FSS II) devised by Greer (1965). This instrument can be found in Appendix 2. In his research Greer found that the degree of fear indicated on the FSS discriminated S behavior toward the feared object when fear was measured by latency, distance, S rating of felt fear, and E rating of

apparent fear. However, other studies by Lang (1968) have demonstrated that the correlation between the FSS and behavioral approach can be as low as -.26; therefore, the FSS was used as an initial screening device only.

The primary dependent variable was behavioral approach (Distance) (Lang & Lazovik, 1963). Ss were instructed to approach as close as they could to a live tame water snake housed in a clear glass cage (see Appendix 8 for instructions and Appendix 9 for a sample scoring sheet).

The extent of approach to the snake was scored in the following manner: a score of 1 was assigned to Ss who touched the snake; a score of 2 was assigned to Ss who laid both hands on the top of the snake cage; scores above 2 were calculated by adding the number of one foot increments to the number 2.

A second measure of fear, the Fear Thermometer (FT) was used to determine the extent of S's felt fear at the point of closest approach to the snake (Appendix 10). The FT was developed by Walk (1956); it is essentially a 10 point scale ranging from "no fear" to "extreme fear" in 10 equal units that is shaped like a thermometer. In his research Walk found that the FT could predict the quality of a parachute jump where the extent of fear could be hypothesized as the major variable in determining the quality of performance. In a study by Lang, Lazovik, and Reynolds (1966), it was shown that the FT could discriminate between treated and pseudo-treated snake phobic groups. It also could differentiate between those treated phobics who completed 15 or more hierarchy items in the desensitization procedure from those Ss who completed fewer

than 15 items. In another study (Lang, 1968) it was shown that the correlation between the FT and the behavioral approach test was statistically significant at +.43.

The score was derived by simply noting the level at which S indicated her fear at the closest point of approach.

A third measure of change utilized a combination of the Distance and FT scores. The rationale for this data treatment lies in the fact that, as noted by Lang (1968), a given subject can respond to a reduction in the intensity of the phobic fear by either reducing the distance between herself and the fear stimulus, or by going no closer but feeling less fear. Therefore, it is reasonable to expect that a combination of the two measures will yield a more complete reflection of the actual status of the phobia than can either measure taken separately.

Since the Distance and FT scores are not in the same units, a linear transformation of the Distance data was calculated in order to insure that the Combined score reflected an equal weighting and distribution of both the distance and FT scores. The transformation used was as follows: $D_{ij} = s_{FT}/s_D\ (Dij) + (\overline{X}_{FT} - \overline{X}_D)$, where s = standard deviation of scores over all levels of treatment and time samples and $\overline{X}$ = the mean of scores over all levels of treatment and time samples. The transformed Distance scores were then added to the FT scores to form the Combined score.

In addition to the previous measures four questionnaires were administered. The first was a structured questionnaire, administered prior to gas inhalation. Its construction was based on research by Barber (1970). In a series of experiments, Barber was able to demonstrate that a number of variables, related to the experimental situation, the

experimentor, and the subject, will affect the extent to which Ss will respond to hypnotic suggestions. The vast majority of these variables were controlled in the present experiment (e.g., wording and tone of instructions, E's role behavior, definition of the situation). However, two categories of variables are subject-dependent and as such can only be measured rather than controlled or manipulated. They are the subject's attitude toward the experimental situation, and her expectations concerning the experiment. These variables were measured with a S Attitude and Expectations (S A&E) questionnaire (Appendix 7). The instrument was specifically designed for use in this research.

Three subscales and one total scale were derived for this questionnaire. The M scale refers to the extent to which S indicated that she would like to get rid of her fear of snakes and was composed of one question (question #4). The S's score was derived by simply recording the number assigned by S. Therefore, a higher score indicates greater motivation to be rid of the fear of snakes.

The UC scale is an index of how uncomfortable S was with breathing a gas, breathing from a balloon, and being in the experiment. It was composed of three questions (items #2, 3, & 5). The score was derived by assigning a score (Yes = 1; No = 0) to question 3, and adding that score to the numbers indicated by S for questions 2 & 5. Therefore, a high score indicates that S felt more uncomfortable with the gas and the procedures.

The scores for the F scale were derived by adding together the numbers indicated by S on questions 6, 7, and 8, and refers to the extent

to which Ss felt that a gas could alter their general anxiety level or change their fear and attitudes concerning snakes. A higher score indicates that Ss believed their fear, etc., more likely to be lessened by a gas.

The total score was compiled by adding the M and F subscales together and subtracting from that score the value obtained for the UC subscale. A higher score represents Ss who feel comfortable with the experiment and the procedures; who believe a gas can alter their anxieties and attitudes; and who would like to get rid of their fear of snakes; and can therefore be considered as having attitudes and expectations most conducive to a lessening of fear as indicated by the Distance and FT measures.

A second questionnaire (Appendix 12) concerned the nature and extent of S's previous drug-taking behavior. Although an experiment by Lynn et al. (1972) indicated that sophistication in the use of drugs does not alter cognitive response after inhalation of nitrous oxide, it is quite possible that when fear rather than cognition is the dependent variable, there may be an effect based upon S's previous drug history.

The Drug History was scored according to the following formulation[1]: a score of 1 was assigned if the drug had ever been used; for frequency the scores were 0 if the drug was used once per year or less, 1 for once

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[1]A second Drug History score was computed that eliminated all low and medium alcohol use. In this way it was hoped that a score more accurately reflecting drug use with intent to become "high," as well as illegal drug use would be derived. Since these scores yielded essentially identical results it is not reported here.

per month to once per year, 2 for once per week to once per month, and 3 if used more frequently than once per week; for the length of time used, zero was assigned when S indicated that she had used the drug only five times or less, 1 for one year to five times, 2 for two years to one year, 3 for three years to two years, and 4 for more than 3 years; for the amount on a typical occasion, zero was scored for low dosage (less than 1/4 "joint" or pipeful of marijuana, one small tablet or capsule, one or two beers, one or two shots or mixed drinks, one or two small glasses of wine, less than one-half of a "hit" of psychedelics), a score of 1 was given for medium dosage (1/4 to less than one joint or pipeful of marijuana, two small tablets or capsules, three or four beers, shots, mixed drinks, or glasses of wine, and one-half to one "hit" of psychedelics); a score of 2 was given for high dosage which was defined as anything greater than the medium dosage category.

The third questionnaire (Appendix 13) was a semi-structured paper and pencil form designed to briefly survey S's perceptions of the experiment, the gas, and their own behavior and attitudes after the completion of the experiment. The primary purpose of this form was to provide a possible index of other, uncontrolled, sources of variance, as well as supply directions for further research.

Since the primary intent of this form was for descriptive purposes no scores were derived.

Two additional forms were provided to assess S's reaction to and evaluation of the gas. The Adjective Checklist (ACL) involved a series of adjectives that were checked by Ss to indicate the extent to which

the word described their present state with the options being "not at all," "a little" and "very much" (Appendix 11). The adjectives used in this present experiment were taken from Davis (1969), and represented three content areas: Inhibited vs. Impulsive; Relaxed vs. Tense; and Happy vs. Sad. Each area was assessed by four pairs of polar-opposite adjectives (i.e., eight words per category). Since adjective checklists are ordinarily used to describe the present rather than a remembered state, the list was completed by Ss immediately following the first post-inhalation Distance and FT tests in order to provide an assessment of short-term aftereffects of the gas.

In scoring the ACL, 0 was assigned to any adjective where S indicated "not at all," a score of 1 was assigned when the adjective described S's state "a little," and a score of 2 was assigned to an adjective where S answered "a lot." Within each category or theme (i.e., Inhibited-Impulsive, Relaxed-Tense, Happy-Sad) a score was then derived for each opposing member of the category by summing the individual adjective scores that were relevant to that category. From this a final algebraic summation was made for the score on that particular scale. The IN-IM scale represents the Inhibited-Impulsive scale, where a positive score indicates that Ss described themselves as more inhibited. The R-T scale represents the Relaxed-Tense score, where a positive number indicates that Ss described themselves as more relaxed. The final scale, H-S, is the Happy-Sad continuum where a positive number indicates that Ss described themselves as more happy.

The second of these forms was the Semantic Differential (Osgood, Suci, and Tannenbaum, 1957). The Ss were instructed to describe their

remembered experience at the peak effect of the gas, using a series of 15 bi-polar opposite words (Appendix 13). Based on Factor analytic studies various categories of description have been compiled (Osgood et al., 1957). The present list of word pairs represents 6 of these categories: Evaluation (5 pairs); Potency (3 pairs); Oriented Activity (2 pairs); Receptivity (2 pairs); Novelty (2 pairs) and Aggressiveness (1 pair).

In scoring the Semantic Differential, the scales were first grouped into their respective categories with the polar-ends oriented so that in all cases a higher score indicated more of that category label (e.g., more potent, more active). Individual S category scores were then derived by summing the numbers indicated by S on the relevant scales.

Procedure: Both the compressed room air and the nitrous oxide were scented with a peppermint extract so that they could not be discriminated by taste or smell. In addition, the gas bottles were arranged so that S could not see them.

As previously stated, the first S contact was in a large introductory psychology course where the FSS was distributed. Those Ss who indicated "terror" or "very much" on the snake item of the FSS were contacted by telephone. A log was kept concerning all telephone contacts and the reasons for refusal to participate in the experiment were recorded. Of the total of 10 refusals, the primary reasons given were: five people said they already had enough experimental credit; three felt that the experiment sounded too frightening; one person refused due to asthma; and one said she had previously had a bad experience with a gas given her at

the dentist and did not want to risk any recurrance. Two additional people had volunteered for the experiment but later withdrew with the primary reason being that the experiment sounded too frightening.

Upon volunteering, Ss were scheduled for a specific experiment appointment time and informed that they were being sent a medical survey form for them to complete. They were told that the form was to be screened by a physician to insure that their physical health was sufficient to allow completion of the experiment with complete safety.

After the Health Surveys had been screened by the physician, qualified Ss were recontacted and the time previously established for their participation in the experiment was verified. Those Ss who, in the opinion of the physician, were not physically qualified for participation in the experiment were recontacted and the reason for their disqualification was explained.

Although there were several Ss who had to be rescheduled in order to allow mild cold symptoms to abate, only two people were permanently disqualified due to information provided in the Medical History form; one because of severe cold symptoms including nose bleed, and the other due to a confirmed pregnancy. These Ss were allowed 1 hour of experimental credit for their participation in the initial screening process.

Upon arriving at the experiment, the general description of the experiment and procedures (Appendix 4) was read, followed by an oral administration of the S A&E questionnaire. After this, the pre-inhalation Distance and FT tests were completed. Next, training on how to breathe from the balloon was accomplished using scented balloons followed by a single balloonful of the gas type assigned to S (nitrous

oxide or room air) using the same scent. After it was established that S was breathing from the balloon in such a way as to insure that she was getting a full breath of the gas, the remainder (3, 6, or 9) of the balloons were administered. All Ss were required to hold the breathful of gas for 15 seconds before exhaling to insure equal time exposure to the nitrous oxide. The balloonsful of gas were administered at a rate of one per minute.

One minute after the final dose of gas had been exhaled the first post-inhalation Distance and FT tests were administered. Following this Ss were ushered back to the inhalation room and the ACL and Drug History questionnaires were administered. The S was then instructed that she could read the magazines provided or just relax for the time remaining to the second post-inhalation test. At 20 minutes post-exhalation, the final Distance and FT tests were conducted. Finally, S was given the Post-experiment questionnaire and the Semantic Differential to complete.

CHAPTER IV

RESULTS AND DISCUSSION

Summary: Because the results section involves a large number of analyses a brief summary of the major findings will be presented prior to any extensive examination of the data.

The results of the analyses of all sources of data indicate a general lack of effect corresponding to nitrous oxide dosage level. Furthermore, the results of all change in fear measures (Distance, FT, Post-Experiment questionnaire) indicate a strong placebo or procedural effect with control Ss showing a significant reduction in fear at one minute post-exhalation (T_1).

The Distance measure reflects a significant reduction in fear as a result of nitrous oxide inhalation at T_1, but not at 20 minutes post-exhalation (T_2). While the FT does not show a significant reduction in fear for the experimental compared to the control group Ss, the results of regression slope analyses indicate a significantly more rapid increase in fear from T_1 to T_2 for the experimental group Ss. The results of the Combined Scale directly reflect the results of the Distance and FT measures from which it is composed with the experimental group Ss showing a significant decrease in fear at T_1 and a more rapid recovery of fear from T_1 to T_2 in comparison to the control group Ss.

The Post-Experiment questionnaire is not statistically evaluated. However, the results indicate a large reduction in fear as a result of nitrous oxide inhalation at both T_1 and T_2. The data also show that control group Ss clearly discriminated that they had received a relatively ineffective gas.

The results of the analyses of the Adjective Checklist data show that experimental group Ss describe themselves as significantly more relaxed and less inhibited than the control group Ss.

The analyses of the Semantic Differential categories show a significant difference between the experimental and control group Ss on three of the six categories, with experimental group Ss describing the peak effect as more positive in evaluation, more potent, and more novel.

The correlations between and within the various measures show a general trend toward independence. Of greatest importance is the fact that this independence is found for the correlations between the Distance and FT measures. Also of interest is that neither the S Attitudes and Expectations nor the Drug History measures correlate with the change in the Distance and FT indices.

Sample Size Variations: Due to extremely limited S availability it was not possible to fill all cells with Ss who had not touched the snake during the pre-test. However, since all Ss had indicated greater than zero fear on the FT, it was considered that while the Distance data for these Ss were not usable (no room for improvement), the FT and Combination measures, along with all other data remained valid. With the exception of group 2 (4 balloons of nitrous oxide) in which only one S touched the

snake during pre-test, there were 2 Ss per group who touched the snake during pre-test.

Accordingly, the following adjustments to N were necessary for the analyses: for the multi-level AoV-AoCV analyses the group n = 8 with one S randomly selected out of group 2; for all analyses involving pooled experimental groups compared to group 1 (control group), the experimental group n = 25 and the control group n = 8; for all correlations involving the Distance Change T_1 and T_2 scores (except when correlating to the Combined scores), N = 33; for all other correlations, N = 40.

Analyses

Distance: The results of a repeated-measures analysis of variance (Weiner, 1971) of the Pre and T_1 scores using the four dosage groups separately in the design (multi-level analysis) are presented in Table 1. Levels of significance are reached for the Time factor only ($F = 10.66$, $df = 1/28$, $p \leq .01$). No Dunnett comparisons of the experimental to the control groups (Weiner, 1971) show significant differences.

In order to test for a general gas effect where only zero versus greater than zero nitrous oxide inhalation is taken into account, the data from the experimental groups were combined and tested against the control group (pooled analysis). A repeated-measures unequal N analysis of variance (Weiner, 1971) of the Pre and T_1 scores yields essentially identical results with the multi-level analysis. The results (Table 1) also show only the Time factor to be significant ($F = 5.41$, $df = 1/31$, $p \leq .05$).

Table 1

Summary of the repeated measures multi-level and pooled analyses of variance for the Distance, Fear Thermometer, and Combined measures at Pre and T_1.

Source	Multi-level	Pooled
	Distance	
Dose	<1.00	1.14
Time	10.66**	5.41*
Dose X Time	<1.00	1.15
	Fear Thermometer	
Dose	<1.00	<1.00
Time	11.51**	4.42*
Dose X Time	1.46	1.08
	Combined	
Dose	<1.00	<1.00
Time	20.77**	10.19**
Dose X Time	1.44	2.29

Note--All Dunnett comparisons are N.S.

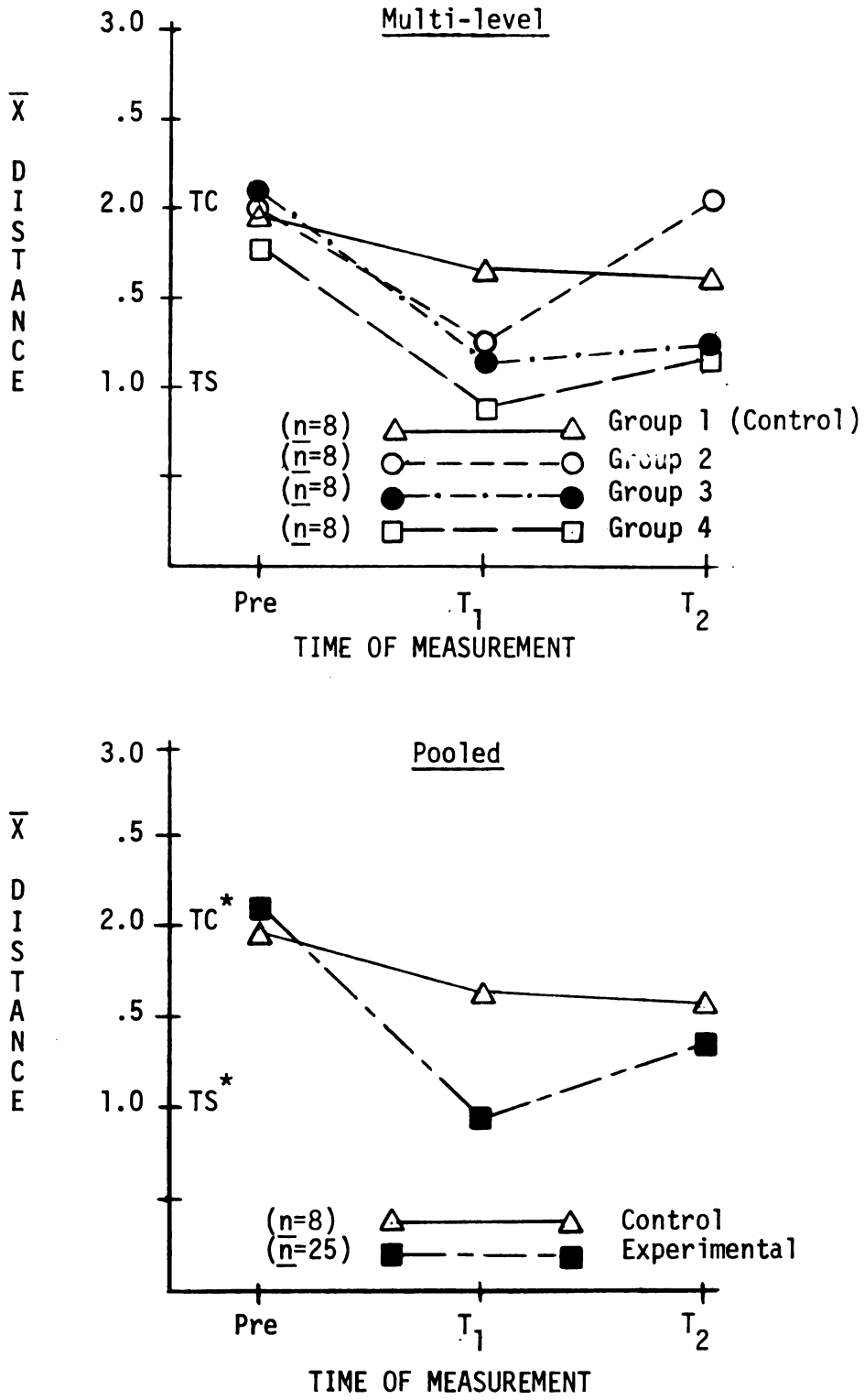
* $p \leq .05$
** $p \leq .01$

Graphs of the data in both the multi-level and the pooled forms (Figure 1) indicate that the significant Time factor is a result of all groups decreasing the distance between themselves and the snake from Pre to T_1. The failure of the Dose X Time interaction to reach significance combined with the significant Time factor indicates the operation of a strong placebo or procedural effect.

Since it is quite possible that scores obtained at T_1 and T_2 may vary as a function of the Pre-inhalation scores, the pre-test differences were statistically eliminated with the use of various analyses of variance-covariance with the Pre-inhalation scores serving as the covariate (Weiner, 1971).

The first of these, a repeated-measures variance-covariance analysis of the T_1 and T_2 data with the four groups kept separate (multi-level) indicates that there are no significant differences between the groups on all factors (Table 2). Similarly, Dunnett comparisons yield no significant differences.

The data were further analyzed by pooling the experimental group scores and comparing them to the control group data using an unequal N analysis of variance-covariance at T_1 with an identical analysis at T_2. The results (Table 3) show a significant difference between the two groups at T_1 ($F = 6.89$, df = 1/31, $p \leq .05$) in the analysis of variance, while the adjustment of the data on the covariate results in a level of significance at $p \leq .01$ ($F = 7.81$, df = 1/30). The graph of the data (Figure 1) illustrates the difference with the experimental groups showing a larger decrease in Distance from the pre-inhalation scores to T_1 than the control group.



*Note--A score of 1 is equivalent to touching the snake; a score of 2 is equivalent to touching the cage.

Figure 1. Group mean distance from the snake for all time periods.

Table 2

Summary of the repeated measures multi-level analyses of variance-covariance for the Distance, FT, and Combined measures at T_1 and T_2.

Source	AoV *F* Ratio	AoCV *F* Ratio
	Distance	
Dose	<1.00	1.31
Time	2.62	----
Dose X Time	1.14	----
	Fear Thermometer	
Dose	<1.00	1.22
Time	6.49*	----
Dose X Time	1.14	----
	Combined	
Dose	<1.00	1.55
Time	7.85**	----
Dose X Time	1.62	----

Note--All Dunnett comparisons are N.S.

* $p \leq .05$
** $p \leq .01$

Table 3

Summary of the pooled analyses of variance-covariance for the Distance, FT, and Combined measures at T_1 and T_2.

Source	AoV *F* Ratio	AoCV *F* Ratio
	Distance	
T_1 (one min. post)	6.89*	7.81**
T_2 (twenty min. post)	<1.00	<1.00
	Fear Thermometer	
T_1 (one min. post)	<1.00	1.02
T_2 (twenty min. post)	1.00	<1.00
	Combined	
T_1 (one min. post)	3.61	4.17*
T_2 (twenty min. post)	<1.00	<1.00

Note--All Dunnett comparisons are N.S.

* $p \leq .05$
** $p \leq .01$

The results of all these analyses indicate that while there is no effect that varies as a function of the nitrous oxide dosage level, there is a general gas effect, with Ss who received the nitrous oxide showing a significantly greater decrease in distance between themselves and the snake than the control Ss at one minute post-exhalation.

The absence of significant interaction terms in the preceding analyses support the conclusion that there is no difference in the rate at which the scores change from T_1 to T_2. However, the inability to adjust the Dose factor in the interaction term analysis, combined with the apparent slope discrepancies noted in the graphs of the mean scores, make it desirable to further analyze these curves. Accordingly, an analysis of the differences in regression slopes (Steele and Torrie, 1960) was employed, the results (Table 4) yield only one significant difference; the positive slope of group 4 (10 balloons of nitrous oxide) compared to the negative slope of the control group. However, there is no consistent difference between the experimental and control groups, and with only one of four tests reaching a level of significance, the effect seems to be very weak, and possibly a chance result.

In summary, the data analyses indicate the presence of a powerful placebo or procedural effect, with all groups (including the control group) showing a significant decrease in distance from Pre to T_1. The covariate analyses also indicate that Ss who received nitrous oxide maintain less distance between themselves and the snake at one minute post-exhalation than those Ss who inhaled the room air control gas.

Table 4

Summary of the analyses of regression slope differences from T_1 to T_2 for the Distance, FT, and Combined measures.

Group	b_{yx}: T_1 to T_2	Z
	Distance	
Control	- .397	-
2	-1.904	NS
3	- .766	NS
4	.649	2.26*
Pooled Experimental	- .612	NS
	Fear Thermometer	
Control	.063	-
2	4.042	9.45**
3	1.945	7.08**
4	1.059	3.30**
Pooled Experimental	2.590	7.54**
	Combined	
Control	- .358	-
2	7.020	9.19**
3	3.437	13.00**
4	1.306	5.96**
Pooled Experimental	3.351	8.08**

* $p \leq .05$
** $p \leq .01$

Fear Thermometer: The results of both the multi-level and the pooled analyses of variance of the Pre and T_1 scores (see Table 1) show identical results with the Distance analyses; only the Time factor reached significance (Multi-level; $F = 11.57$, df = 1/36, $p \leq .01$: Pooled; $F = 4.42$, df = 1/35, $p \leq .05$). Inspection of the data graphs (Figure 2) show all groups decreasing the extent of self-reported fear from Pre to T_1, indicating the action of a powerful placebo or procedural factor.

However, in contrast to the Distance analysis results, the multi-level repeated measures analysis of variance-covariance of the T_1 and T_2 scores (Table 2) yields a significant difference for the Time factor ($F = 6.49$, df = 1/35, $p \leq .05$), indicating that all groups tend to significantly increase the amount of indicated fear from T_1 to T_2.

A regression slope analysis (Table 4) shows that while the control group demonstrated a slight increase from T_1 to T_2, all experimental groups showed a significantly greater increase in fear for the same time period.

Variance-covariance analyses of the pooled experimental groups versus the control group at T_1 and T_2 fail to show any significant differences (Table 3). The data are graphed in Figure 2. The analysis of regression slope differences (Table 4) shows a significant contrast between the two groups on the rates of fear increase from T_1 to T_2 with the experimental groups increasing significantly more rapidly than the control group.

In summary, the significant decrease of self-reported fear from the pre-inhalation level to one minute post-exhalation for all groups illustrates, similar to the results of the Distance analysis, the action of a placebo or procedural effect. However, there is no indication that self-reported fear is affected by the inhalation of nitrous oxide at T_1,

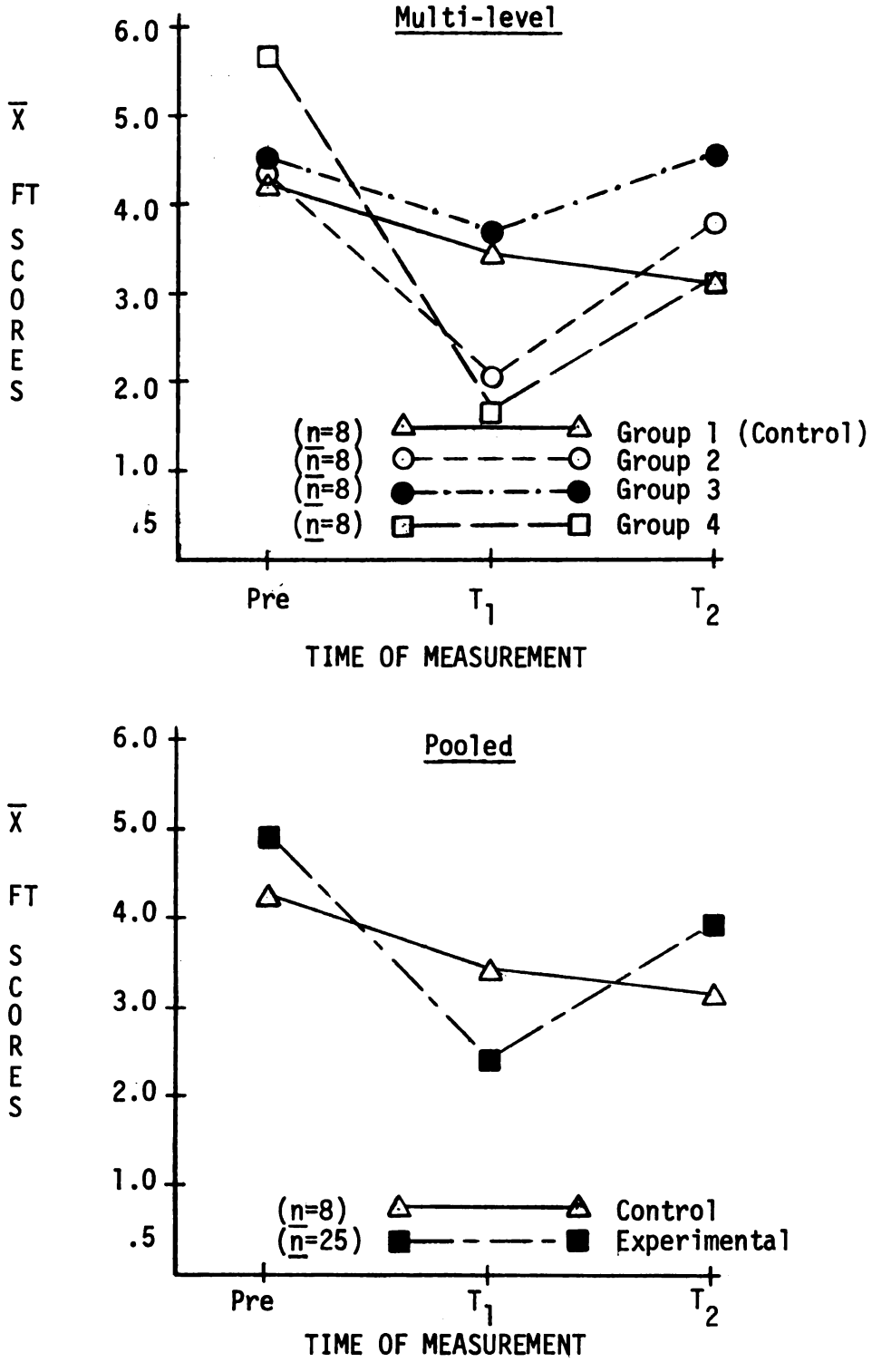


Figure 2. Group mean Fear Thermometer scores for all time periods.

contrary to the results of the Distance analyses. Also in contrast to the Distance analyses, the Fear Thermometer shows a sensitivity to the nitrous oxide in the rate of fear increase from T_1 to T_2. While the Distance data shows essentially the same rate of change for all groups from one to twenty minutes post-exhalation, the Fear Thermometer shows a significantly greater tendency to rebound (i.e., return to high levels of self-reported fear) for the experimental groups than for the control Ss. Therefore, while both measures reflect a placebo or procedural effect, the Distance data vary as a function of nitrous oxide at one minute post-exhalation, while the Fear Thermometer is sensitive to the effects of the gas at 20 minutes post-exhalation. Because of these contrasting results it seems appropriate to hypothesize that the two measures are quantifying two separate modes of adaptation or change.

Combined: The results of the multi-level and pooled analyses of variance (Table 1) of the Pre and T_1 scores show that all groups significantly decrease the fear and/or distance scores regardless of dosage levels or gas versus no gas (Multi-level; $F = 20.77$, df = 1/36, $p \leq .01$: Pooled; $F = 10.19$, df = 1/38, $p \leq .01$).

The multi-level repeated measures analysis of variance-covariance (Table 2) yields a significant difference in the Time Factor only ($F = 7.85$, df = 3/36, $p \leq .01$) while all Dunnett comparisons of the experimental to the control groups fail to reach levels of significance. The data, graphically represented in Figure 3, indicate that the significance of the Time factor is a function of the tendency for all experimental groups to increase from T_1 to T_2.

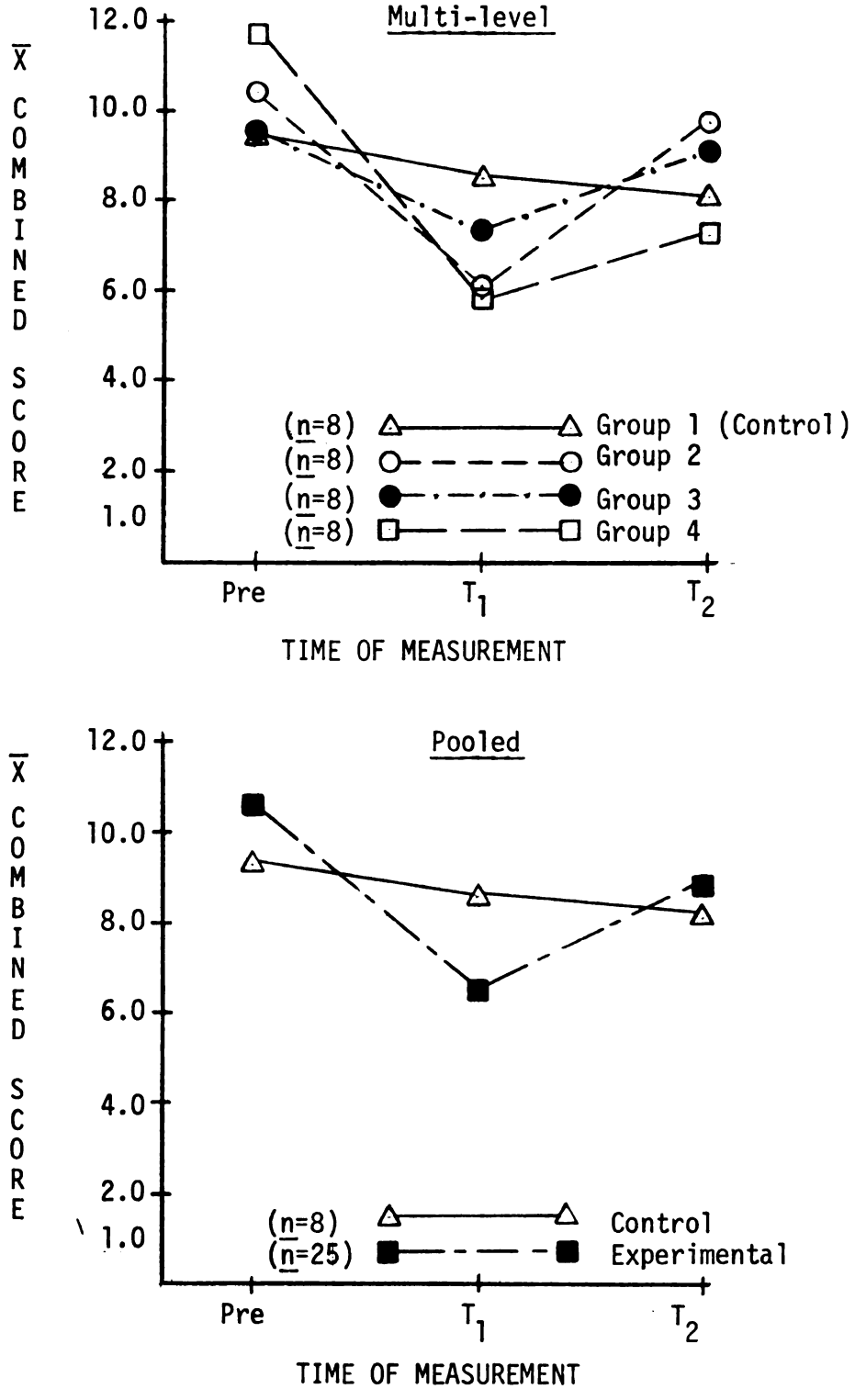


Figure 3. Group mean Combined measure scores for all time periods.

The results of the regression slope analyses (Table 4) indicate that all experimental groups show an increase from T_1 to T_2 which is significantly different from the slight decrease of the control group.

A pooled analysis of variance-covariance (Table 3) yields a significant difference between the two groups at T_1 when the data are adjusted on the pre-inhalation scores ($\underline{F} = 4.17$, df = 1/37, $\underline{p} \leq .05$). The data are graphically represented in Figure 3. The regression slope analysis shows the positive slope of the experimental groups to be significantly different than the negative slope of the control group (Table 4).

In summary, the Combined scale reflects a combination of the results of the Distance and Fear Thermometer analyses. The data show a powerful placebo or procedural effect at T_1, and a general gas effect at both one minute and 20 minutes post-exhalation, while failing to demonstrate any effects that vary as a function of dosage levels. If the Combined scale can be taken as an index of the total amount of the change in fear (Distance and/or FT), the effects of nitrous oxide are to significantly decrease fear immediately following gas administration, while increasing the amount of fear rebound, or return to high levels, from one minute to 20 minutes post-exhalation.

Questionnaire and Survey Data: Table 5 represents the results of the multi-level and pooled analyses of variance for all questionnaire and survey data excluding the Semantic Differential and the Post-Experiment questionnaire.

In the multi-level analyses a significant difference is found between the various groups on the S Attitude and Expectations Total Scale.

Table 5

Summary of the pooled and multi-level analyses of variance of the Drug History, Adjective Checklist, and S Attitudes and Expectations measures.

Source	Multi-level F	Pooled F
Drug History	<1.00	<1.00
ACL: IN-IM	2.63	7.55**
ACL: R-T	2.11	6.01*
ACL: H-S	<1.00	<1.00
S A&E: M	<1.00	<1.00
S A&E: UC	1.57	<1.00
S A&E: F	<1.00	<1.00
S A&E: Total	2.86*	<1.00

Note--All Dunnett comparisons are N.S.

* $p \leq .05$
** $p \leq .01$

Table 6

Group mean scores for the S Attitudes and Expectations Total scale.

Group	Mean Score
1 (Control)	10.0
2	7.3
3	5.7
4	14.1

The Total Scale represents a combination of the scores from the three subscales in such a way so that high scores reflect attitudes indicating a higher motivation for changing fear of snakes, a greater belief that a gas can alter fears and attitudes concerning snakes, and greater comfort with the experiment and experimental procedures. Table 6 gives the means for the various groups and shows a rank order (from highest to lowest) of group 4, group 1, group 2, and group 3. However, no Dunnett comparisons are significant and the comparison of the pooled experimental groups to the control group fails to reach a level of significance. There are two indications that these pre-test differences are of little significance: first, the results of the Distance, FT, and Combined scales show differences only in the pooled analyses whereas the pooled analysis of the S A&E Total scale does not show a significant difference; second, the results of correlations to be presented later in the text show a surprisingly low relationship between the S A&E scales and the Distance, FT, and Combined measures.

In the pooled analysis of variance (again, see Table 5), significant F ratios are found for the Adjective Checklist Inhibited-Impulsive subscale ($F = 7.55$, df = 1/38, $p \leq .01$) and the Relaxed-Tense subscale ($F = 6.01$, df = 1/38, $p \leq .05$). Figure 4 graphs the mean scores for the various groups of the ACL subscales. The graph demonstrates that at approximately 5 minutes post-gas administration (immediately following the T_1 Distance and FT test) the control group Ss who received room air described themselves as more inhibited and less relaxed than the experimental group Ss who received the nitrous oxide. Again, the results indicate a clear general gas effect in the absence of any dosage level effect.

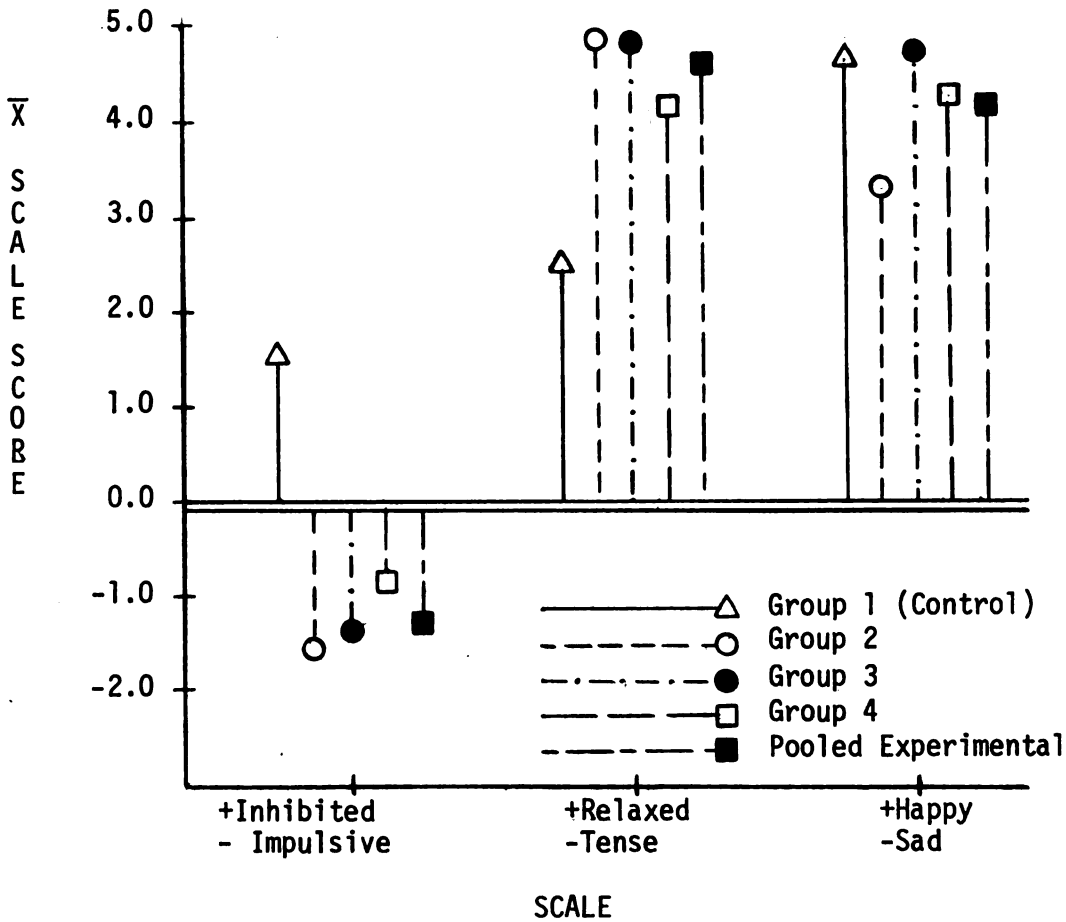


Figure 4. Group mean Adjective Checklist scale values.

The results of the multi-level and pooled analyses of variance of the Semantic Differential data are presented in Table 7. It is important to note that Osgood et al. (1957), voiced some concern in interpreting results of the Semantic Differential when the data are analyzed with standard statistical procedures such as the analysis of variance model employed in this research. The major problem is that involving the potential for violating the normality of distribution assumption. Although various authors (e.g., Weiner, 1971) have noted that this assumption can be violated to a considerable extent in an analysis of variance without affecting the results, it is a concern that must be taken into account, and interpretations concerning the results of the analyses of the Semantic Differential should be made with some caution. Another problem in interpreting the Semantic Differential data is that certain of the scales used here have not, in previous research, demonstrated particularly large factor loadings--indicating that these categories cannot be assumed to be necessarily stable within a given sample. Therefore, special care should be exercised in interpreting the results of these categories viz., Receptivity, Novelty, and Aggressiveness.

With these cautions in mind, the table of results of the analysis of variance of the Semantic Differential found in Table 7 show four significant differences in the multi-level analyses, with the Evaluation, Potency, Oriented Activity, and Novelty scales reaching a level of significance at $p \leq .01$. The results of the pooled analyses are similar, with the only change from the multi-level analyses being the failure of the Oriented Activity scale to reach significance.

Table 7

Summary of the pooled and multi-level analyses of variance for the Semantic Differential categories.

Source	Multi-level F	Pooled F
Evaluation	4.29**	8.87**
Potency	6.34**	10.97**
Oriented Activity	3.25**	1.23
Receptivity	1.35	< 1.00
Novelty	4.36**	5.45**
Aggressiveness	< 1.00	1.87

* $p \leq .05$
** $p \leq .01$

Table 8

Group mean deviations from neutral for the Semantic Differential categories

Category	Group				
	1 (Control	2	3	4	Pooled X_p
Evaluation	.50	.90	1.34**	1.40**	1.21
Potency	-.57	1.20**	.23	.33	.92
Oriented Activity	-.90	.40**	-.90	-.75	-.42
Receptivity	-.50	-.60	-1.05	-.30	-.65
Novelty	-.50	1.60*	.25	.25	.70
Aggressiveness	-.30	.10	.20	.40	.23

Note--Asterisks indicate significant Dunnett comparisons.

* $p \leq .05$
** $p \leq .01$

Table 8 (on the preceding page) presents the group mean differences from the scale midpoint of 4, the asterisks indicating significant Dunnett comparisons of the experimental groups to the control group.

For the Evaluation scale it can be seen that while all Ss tend to rate the peak experience as positive, Ss who received the nitrous oxide evaluate the experience as more positive than control Ss, with the differences becoming larger with increasing dosages of nitrous oxide. Also, groups 3 and 4 score significantly more positively than do the control group. Similarly, the results of the pooled analyses of variance demonstrate that the experimental groups as a whole rated the experience as significantly more positive than the control Ss.

The Potency scale data indicate that while the control group rated the peak experience in a negative, or impotent direction, all experimental groups ascribed potency to the peak effect. When Dunnett comparisons are calculated, only group 2 is significantly different from the control group. However, the pooled data analysis of variance indicates that when dosage level is disregarded, the experimental groups rate the peak effect as significantly more potent than the control group.

The means of the various groups show little difference on the Oriented Activity dimension (i.e., calming vs exciting, and simple vs complex) even though the multi-level analysis reaches significance. Inspection of the data indicates that the multi-level analysis of the Oriented Activity category reaches significance solely on the basis of the differences between group 2 and the remaining group scores. Therefore, it is difficult to ascribe these results to a general gas effect. There is no ready explanation for these findings.

The results of the Novelty scale show that while the control group rated the peak experience in a negative direction, all experimental groups tended to rate it in a positive, or novel, direction, although only group 2 showed a significant difference when compared to the control group. However, the analysis of the pooled experimental groups versus the control group reaches significance and as such indicates a general gas effect.

In summary, it would appear that the Evaluation, Potency, and Novelty scales reflect a general gas effect with the experimental groups describing the peak experience with the gas as more positive in evaluation, more potent, and more novel than the control group. Of these three categories, only the Evaluation scale results show differences as a function of increasing dosage levels. They also clearly show that the experimental group Ss perceive the action of the gas in a different way than do control group Ss.

In order to simplify the presentation of the Post-Experiment questionnaire data, the information is displayed in tabular form. Only those response categories of general interest to the conduct of the experiment are presented here (thus totals do not always equal 100%). For a complete summary of answering patterns see Appendix 14. The General-Experimental category represents those questions and answers that relate primarily to overall procedural concerns (Table 9). The Gas Effects category is presented in Table 10. Generally, only those results where there is a greater than 20% difference between the pooled experimental and the control group will be discussed.

1. General-Experimental: The most outstanding difference in the results of this category is the wide separation in the percentages of Ss who

Table 9

Summary of the Post-experiment questionnaire: General-Experimental questions.

Question	Response	Number of Ss and %	
		Experimental	Control
14 (Change in fear of snakes after the experiment)	A little	6 (20%)	1 (10%)
	More than a little	10 (33%)	0
15 (Hardest or most frightening part)	General procedures	0	2 (20%)
	Pre-gas approach test	7 (23%)	2 (20%)
	Gas effects	2 (7%)	0
16 (Easiest or most pleasant part)	General procedures	5 (17%)	2 (20%)
	T_1 approach test	3 (10%)	2 (20%)
	Gas effects	14 (47%)	1 (10%)
17 (Willing to participate in similar future research)	Yes	25 (83%)	8 (80%)
	No	2 (7%)	0
	Undecided or no answer	3 (10%)	2 (20%)

Note--Within question percentages do not always total 100%. See text and Appendix 14 for explanation and additional data.

Table 10

Summary of the Post-experiment questionnaire: Gas effects.

Question	Response	Number of Ss and % Experimental	Control
#2 and 3 (Expectations and whether the expectations were met or unmet)	Expected reduced fear--met	15 (50%)	2 (20%)
	Expected reduced fear--unmet	1 (3%)	2 (20%)
	Expected no reduced fear--met	5 (17%)	1 (10%)
	Expected no reduced fear--unmet	9 (30%)	2 (20%)
#1 (Immediate effects of the gas)	Psychological effects	30 (100%)	2 (20%)
	Sensory effects	13 (43%)	0
	Physical effects	29 (97%)	3 (30%)
	Not much or no effect	0	8 (80%)
#5 (Adverse reactions)	Queasiness or unpleasant dizzyness	6 (20%)	1 (10%)
	Anxious or restless	1 (3%)	3 (30%)
	Other	4 (13%)	0
#8 and 9 (Residual effects: 10-15 min. in duration unless noted otherwise)	Pleasant	2 (7%)	1 (10%)
	Unpleasant	2 (7%)	1 (10%)
	Other	7 (23%)	2 (20%)
	Effects lasting at least 20 min.	4 (13%)	1 (10%)
#10 (Any change in adverse feelings)	Psychological	4 (13%)	0
	Physical	0	2 (20%)
#11 (Feelings about responding at T_1)	Zero or reduced fear	23 (77%)	3 (30%)
	More hesitant or cautious	4 (13%)	0
#4 (Initial experience likened to:)	Alcohol	5 (17%)	0
	Marijuana	5 (17%)	1 (10%)
	Other drugs	7 (23%)	0
	Faint or dizzy state	5 (17%)	1 (10%)
#12 (guesses as to what the gas was)	Inactive agent (i.e., air, O^2)	3 (10%)	4 (40%)
	Active agent other than N_2O	2 (7%)	0
	N_2O	2 (7%)	1 (10%)

Note--Within question percentages do not always total 100%. See text and Appendix 14 for explanation and additional data.

felt that their fears and attitudes concerning the snake had been altered after the gas effect had passed. Overall, there were 53% of the experimental compared to only 10% of the control Ss who felt that their fears or attitudes had been altered, with 33% of those experimental group Ss signifying that the change was more than a little. These results disagree with the Distance, Fear Thermometer and Combined measures in indicating a reduction of fear in the experimental groups which lasts beyond the 20 minute delay of measurement at T_2. The discrepancy between these results and others will be discussed later.

A second difference between the control and the experimental groups is that 47% of the experimental Ss, compared to 10% of the control Ss noted that the gas effects were the easiest or most pleasant part of the experiment. These results agree with the analysis of the Semantic Differential Evaluation scale, where the nitrous oxide groups rate the experience with the gas in a more positive direction than do the control Ss.

2. Gas Effects: In response to questions 2 and 3, where Ss were asked to describe their expectations and the extent to which these expectations were or were not met, there is little difference between the experimental and the control groups in the percentage of Ss who expected their fear of snakes to be reduced (53% experimental, 40% control) or not to be reduced (47% experimental, 30% control). There is, however, a difference in the number of Ss who, regardless of what they expected, noted a reduction in fear (80% experimental, 40% control). These results indicate a fairly powerful effect of the gas with twice as many experimental than control Ss noting a lessening of fear. The data also tend to support the fairly extensive placebo or procedural effect noted in the analysis of the Distance,

FT, and Combined measures, with 40% of the control Ss noting a reduction in fear.

Another difference between the control and experimental groups appears in response to question 1. All of the experimental group Ss compared to only 20% of the control group Ss noted effects of a psychological nature (e.g., "pleasurable, felt like laughing"); only Ss who received nitrous oxide reported any sensory alterations (e.g., echos, increased auditory acuity); and 97% of the experimental and 30% of the control group Ss noted physical effects (e.g., numbness, tingling). The results of this question clearly indicate that Ss perceive the nitrous oxide in an entirely different fashion than the room air control substance. Also, since 80% of the control Ss noted "none" or "not much" effect of the gas, the results support the hypothesis that the significant improvement of the control group for the Distance, FT, and Combined measures from Pre to T_1 is most likely to have been caused by a procedural rather than a purely placebo drug effect. That is, while the control group Ss in fact showed a decrease in fear from Pre to T_1, their response to these questions clearly demonstrate that they attribute little or none of this change in fear to the effects of the gas. This issue will be discussed more fully in the next chapter.

It is interesting to note that an identical percentage of experimental and control Ss report residual effects of the gas (50%). Also, since all but 4 of the experimental and one of the control Ss indicated that the residual effects had passed by 15 minutes post-administration, the data strongly indicate that the difference in the rates of change from one to 20 minutes post-exhalation for the FT and Combined measures is more likely to

have been caused by the gas effects wearing off than the action of the gas itself.

Question 11 assesses S's feelings about responding to the snake test immediately following the gas administration (T_1). The results clearly show that the nitrous oxide reduces fear more frequently than room air (77% experimental, 30% control). It should be noted that these results tend to agree more with the significant gas effect at T_1 for the Distance measure than they do with the FT analyses. This aspect will be discussed later.

In response to question number 4, the experimental groups likened the effects of the gas to other drugs (e.g., alcohol, marijuana, Darvon) much more frequently than did the control group Ss (57% experimental, 10% control). These data coincide with the conclusion that Ss clearly perceive the nitrous oxide as having a greater effect than the room air. Further support is given in response to question 12 where 40% of the control compared to only 10% of the experimental Ss guessed that the gas given them was an inactive or relatively inactive agent, i.e., air or oxygen. That the experimental group Ss describe the nitrous oxide as having a greater effect than control gas also coincides with the results of the Semantic Differential Potency category, where experimental group Ss describe the peak experience as more potent than do the control Ss.

There are two sources of results from this questionnaire that do not tend to fit well with the data analysis of the Distance, FT, and Combined measures.

The results of the questions 2 and 3 concerning met and unmet expectations, and question 11 regarding response to T_1, indicate that there is a

large effect of the gas in reducing fear when measured at one minute post-exhalation. Thus, paradoxically, while the results of this verbal measure relate closely to those of the Distance behavioral measure, they do not correspond to more verbal FT data.

Furthermore, responses to question 14 show that 50% of the experimental group Ss experience a change in fear and/or attitudes after the effects have passed compared to only 10% of the control Ss. These retrospective answers are inconsistent with the results of the Distance, FT, and Combined measures where no significant differences between the groups were found at 20 minutes post-exhalation.

There are two alternative hypotheses that can explain the apparent discrepancies between these data: first, while the questionnaire taps verbal behavior, the FT measures a third, independent, source of data, quite possibly somatic activity; and second, the answers to these questions reflect a product of both S's subjective experience with the gas and the experimental situation and her retrospective interpretation of these events.

Correlational Results: All correlations involving the primary measures (Distance, FT, Combined) at T_1 and T_2 utilize change scores. The change scores have been derived by subtracting the individual pre-gas inhalation scores from the T_1 or T_2 values.

The correlations within and between the primary measures are presented in Table 11. As might be expected the within-measure correlations of the Pre, T_1, and T_2 change scores are statistically significant. Similarly, the results show the anticipated significant correlations involving the

Table 11

Correlations between and within the primary measures.
(N=40)

		Distance			Fear Thermometer			Combined	
		Pre	Change T_1	Change T_2	Pre	Change T_1	Change T_2	Pre	Change T_1	Change T_2
Distance	Pre		.90**	.32*	.22	.03	.03	.81**	.56**	.21
	Change T_1 (a)			.39*	.40*	.18	.10	.81**	.69**	.34*
	Change T_2 (a)				.10	.13	.21	.23	.27	.61**
Fear Therm.	Pre					.60**	.60**	.75**	.72**	.51**
	Change T_1						.61**	.38*	.61**	.53**
	Change T_2							.38*	.62**	.86**
Combined	Pre								.81**	.45**
	Change T_1									.65**
	Change T_2									

* $p \leq .05$
** $p \leq .01$

(a) Note--For all correlations in this row except those involving the Combined scores, N=33.

Distance and FT scales to the Combined measure. However, with the exception of a single, uninterpretable, significant correlation between the Distance change T_1 with FT pre scores there is very little correlation between the Distance and FT measures indicating a high degree of independence between the two. Since previous analyses have shown that the Distance and FT variables respond differently to the introduction of nitrous oxide, the present results lend further support to the hypothesis that the two scales measure fairly independent aspects of response to a fear stimulus.

Table 12 presents the between and within correlations for the remaining measures. There is a fairly high degree of within-measure relationship, with 8 out of a total of 24 correlations reaching levels of significance. The Evaluation scale from the Semantic Differential shows a positive relationship with the Relaxed-Tense and Happy-Sad scales from the Adjective Checklist indicating that a positive evaluation of the gas experience is closely related to the extent to which Ss describe themselves as relaxed and happy as a result of the gas inhalation. However, there is a general tendency toward low correlations between the various measures demonstrating a high degree of independence between them. Surprisingly, this finding holds true for the correlations involving the Drug History where the extent of previous drug experience shows very little relationship to the description of the nitrous oxide experience or the attitudes and expectations with which Ss enter a drug-related experiment.

Similarly, as shown in Table 13 (correlations between the primary and the paper and pencil measures), the Drug History shows little correlation with the Distance, FT, and Combined measures. The general failure of the Drug History to relate to any other measures would seem to indicate that

Table 12

Correlations within and between the paper and pencil measures. (N=40)

		Drug Hist	ACL IN-IM	ACL R-T	ACL H-S	S Att. & Expec. M	S Att. & Expec. UC	S Att. & Expec. F	S Att. & Expec. Tot.	Semantic Differential E	Semantic Differential P	Semantic Differential OA	Semantic Differential R	Semantic Differential N	Semantic Differential A
Drug History			-.11	-.04	.34*	.22	-.28	-.08	.25	.47**	.13	-.09	-.08	-.16	.02
ACL	IN-IM			-.22	-.17	.11	.16	.10	-.02	-.25	-.18	-.04	.09	-.13	.04
	R-T				.37*	-.10	-.33*	.13	.27	.52**	.48**	-.05	-.18	-.05	-.06
	H-S					.05	-.13	.08	.16	.42**	.01	-.29	-.17	-.31	-.12
S Att. & Expec.	M						.18	-.13	.19	-.12	-.09	.09	.32*	-.14	.09
	UC							-.16	-.74**	-.26	-.20	-.02	.02	.02	.32*
	F								.66**	.08	-.06	.02	.08	-.05	-.07
	Tot.									.19	.07	.06	.16	-.10	-.24
Semantic Diff.	E										.28	-.25	-.31	-.28	-.06
	P											.37*	-.12	.49**	.08
	OA												.33*	.54**	.11
	R													.01	.18
	N														.21
	A														

* $p \leq .05$
** $p \leq .01$

Table 13

Correlations between the primary and the paper and pencil measures. (N=40)

		Distance			Fear Thermometer			Combined		
		Pre	Change (a) T_1	Change (a) T_2	Pre	Change T_1	Change T_2	Pre	Change T_1	Change T_2
Drug History		.04	.10	.34*	.09	.13	.07	.08	.06	.23
ACL	IN-IM	.24	.14	.19	-.15	-.30	-.21	.08	-.13	-.08
	R-T	.06	.12	.01	.10	.30	.32*	.10	.36*	.25
	H-S	.05	.21	.12	.26	.38*	.40*	.19	.33*	.36*
S Att. & Expec.	M	.11	.06	.04	.21	.21	.07	.20	.09	.08
	UC	.09	.12	-.21	.04	-.02	-.11	.09	-.08	-.18
	F	-.14	.11	.24	.21	.14	.31	.03	.20	.33*
	Tot.	-.11	.00	.24	.18	.29	.26	.04	.22	.36*
Semantic Diff.	E	.02	.17	.28	.11	.30	.31	.08	.25	.38*
	P	.07	.09	-.06	-.12	.09	-.13	-.02	.17	-.11
	OA	.01	.03	-.16	-.25	-.27	-.14	-.15	-.28	-.09
	R	.09	.10	-.19	-.01	.17	-.18	.05	.09	-.22
	N	-.08	-.02	-.27	.12	-.04	-.19	.02	-.01	-.28
	A	.11	.16	-.26	-.13	-.19	-.25	.00	-.12	-.30

* $p \leq .05$

(a) Note--For all correlations in this column, $N = 33$.

either the drug, the setting, or the set (or a combination of these factors) was different enough from the "normal" to prevent prior drug usage from entering into the experience and the response to that experience to any significant degree. These results correspond to those of the Lynn et al. (1972) study, where no general differentiation of the objective gas effects was noted for Ss with an extensive drug history in comparison to Ss with an extremely limited drug history.

Although there is a tendency for the Relaxed-Tense and Happy-Sad ACL scales to correlate with the FT and Combined measures the correlations are minimal, with none reaching significance at $p \leq .01$. Overall, the correlations from Table 13 show essentially what the previous analyses have shown; namely, there is a high degree of independence between the various measures.

CHAPTER V

DISCUSSION

Hypotheses and Exploratory Questions: Within the framework of a strictly empirical interpretation of the results, the relationships of the data to the hypotheses are as follows: Hypothesis 1a is partially confirmed; i.e., nitrous oxide inhalation does in fact function to increase approach behavior. However, this effect does not correspond to increasing dosage levels. Hypothesis 1b is not confirmed; i.e., in comparison to a control population there is no effect of nitrous oxide inhalation in decreasing the level of self-reported fear on the Fear Thermometer. These negative results do not alter with increasing dosage levels.

Both of the exploratory questions are answered in the negative. The subjective set, as measured by the S Attitude and Expectations questionnaire does not correlate significantly with change on the Distance and Fear Thermometer measures. Similarly, the extent of S's previous drug-taking behavior does not correlate with the change measures.

Issues for Discussion: While the exploratory questions are limited in scope and can therefore be easily answered, the relationships of the results to the hypotheses are more complex and requires further consideration. Several important issues have already been raised regarding the results of the primary measures; these will be discussed in the following sequence:

1. The independence of the Distance and Fear Thermometer and the relationship of the Post-Experimental questionnaire to them;

2. The effects of nitrous oxide in changing fear response within the context of the previous issue;

3. The possible causes of the significant change in fear noted for the control group Ss, and the ramifications and relationship of these results to the broad issue of nitrous oxide effects;

4. Implications for further research.

Independence and Relationship of Measures: The analyses of the primary measures (Distance and FT) clearly do not support the assumption that fear is expressed in a unitary, cohesive fashion. Instead, the data support the hypothesis proposed by Lang (1968) that fear is more adequately treated as a response composed of separate behavior systems.

There are three sources of data in the present study that measure change in the status of fear as a result of gas inhalation; Distance, Fear Thermometer, and the Post-Experiment questionnaire. In comparing the results of the three measures it is clear that they do not agree with one another. Particular points of discrepancy are as follows: while both the Distance and Post-Experiment questionnaire reflect a general gas effect at one minute post-exhalation, the FT does not; although the data from the Distance measure reflect no effects of nitrous oxide at 20 minutes post-exhalation, the results of the FT indicate a significantly more rapid rise of fear from one to 20 minutes post-exhalation for the experimental group Ss, and the Post-Experiment questionnaire shows a continued reduction of fear in the experimental groups at 20 minutes post-exhalation; finally,

the correlations between the Distance and FT measures are very low, indicating a great deal of independence between the two indices of change.

Two alternative hypotheses have been proposed to explain these results. The first is that all three measures quantify an independent mode of response to a fearful situation. The second assumes that while the Distance and FT indices measure independent modes of fear response, the Post-Experiment questionnaire reflects a cognitive restructuring by S that does not measure any particular aspect of fear response but is rather a non-linear interpretation of the experiences and events that have occurred during the experiment.

In examining the two hypotheses the primary distinction between them illustrates a heuristic issue. The question here is whether three, only slightly related, sources of data should be examined as three distinct modes of fear response, or whether the behavioral (Distance) and self-reported fear (FT) measures should be considered the objective source of data while the verbal reports are relegated to the realm of subjectively determined behavior. In the first instance, all sources of data are considered equally important in reflecting fear change. The latter position argues that since the verbal behavior is a non-linear product of the experiences and behaviors already measured by the Distance and FT scales, it is not a valid source of data by itself; it is instead a mere reflection of subjective differences in perceptions of the past.

While either of the hypotheses may in fact be true, there is no empirical foundation in the literature upon which to build a convincing argument for one or the other. However, the absence of such data does not

indicate that neither hypothesis is preferable, for as noted by Lang (1968), to assume one or another index of behavior to be the "true" index of response is to automatically disregard the data from other indices as simply less accurate, and therefore relatively unimportant sources of information. Because this assumption risks overlooking important data due to a theoretical bias, it cannot be considered warranted. The author believes that the integration or differentiation of the various measures of behavior should be explored empirically. For the moment I will adopt the position that all three indices of fear response are equally valid and important aspects of behavior.

As noted by various authors (e.g., Lang, 1968; Schroeder and Craine, 1971) there are three readily apparent systems of response to a fearful situation: overt-motor; somatic or physiological; and verbal-cognitive. Extended research programs by Lang (1968) have repeatedly shown that while the FT and behavior approach tests correlate significantly with each other, the correlations are typically low, ranging around .40. Similarly, research by Schroeder and Craine (1971) showed only a .27 correlation between the FT and behavior approach tests. While the subject population was large enough that this correlation is statistically significant, it is clear that the two measures cannot be considered the same. Instead, the relationship of the self-reported fear index and the behavior approach test appears to be minimal, with independence rather than dependence being the rule. The results of the present study fit well with these experiments, thus lending further support to the choice of approaching the results of the experiment in a pragmatic fashion.

There is, however, a problem in the assignment of the three measures of change used in the present study to the three proposed categories of behavior. While the behavioral approach test has been considered the obvious index of the overt-motor category of behavior, the FT has traditionally been considered as the measure of verbal-cognitive behavior. If this historical schema is applied to the present experiment, the conflicts between the results of the Post-Experiment questionnaire and the FT lead the interpretations back to the original bind; one of the two measures must be discarded as an inaccurate index of behavior; in this case verbal-cognitive behavior. However, a review of the literature shows that the assumption which has led to the traditional assignment of the FT to the verbal-cognitive response category is not founded in data. Thus, while the assumption is a reasonable one, it is not dictated by experimental findings. It can be argued that since various research programs have shown that subjects can clearly discriminate their physiological state (e.g., Lang, Stroufe, and Hastings, 1967; Snyder and Nobel, 1966), it is certainly feasible to hypothesize that Ss may well be utilizing this discrimination in determining their reports of fearfulness on the FT. Since neither the assumption that the FT is an index of verbal-cognitive behavior nor the assignment of it as a physiological index is confirmed by data, the acceptance of one hypothesis over the other remains a purely heuristic one. If the assumption regarding the FT as a verbal-cognitive index of response is taken to be true, the discrepancies between it and the Post-Experiment questionnaire must be assumed to be a result of deficiencies in the questionnaire. Therefore, in order to insure that no data are arbitrarily disregarded, the FT will be tentatively considered to be an index of the

somatic or physiological category of fear response. Furthermore, there are certain aspects of the data that would lead one to adopt the same position (see page 70).

Effects of Nitrous Oxide: The greatest effect of nitrous oxide in reducing fear is reflected in the verbal-cognitive data. The results of the Post-Experiment questionnaire indicate that not only does nitrous oxide inhalation reduce verbally reported fear during the acute effects of the gas (T_1), but for 53% of the experimental group Ss the fear reduction continues for at least 20 minutes. Furthermore, at both T_1 and post-experimentally, approximately four times the number of experimental compared to control group Ss indicate a reduction of fear. These data would seem to indicate that the verbal fear reduction resulting from nitrous oxide inhalation must be considered to be at least as stable as the non-drug related change reflected by the control data. The stability of this effect cannot be explained in terms of the single consistent cognitive effect reported in the literature; that of cognitive disruption (e.g., Lynn et al., 1972; Summerfield and Steinberg, 1957). This is true because, as noted in the Lynn et al. study, the cognitive disruption disappears by 5 minutes post-inhalation. A more reasonable hypothesis is that because of the reduction of verbal-cognitive fear at T_1, a single trial of in vivo desensitization occurred (Wolpe, 1966), which in turn resulted in a lessening of fear that lasted beyond the acute effects of the gas.

The second greatest effect of nitrous oxide in reducing fear is noted for the overt-motor category of response. While no effect of dosage level

manipulation is found for the Distance measure, the data indicate that inhalation of nitrous oxide results in the reduction of fear measured at one minute post-exhalation. While the analyses fail to distinguish the experimental and control groups at 20 minutes post-exhalation, the absence of a significant F ratio for the Time factor in the analysis of the T_1 and T_2 data, combined with the generally non-significant results of the regression slope analyses, indicate that neither the experimental nor the control groups return to the original high levels of overt-motor fear. Therefore, although the distinction between the groups is gone by T_2, the results indicate some stability of the change noted at T_1. Again, the most reasonable hypothesis for this stability would seem to be the effects of *in vivo* desensitization. However, the data analyses indicate that the hypothesized desensitization is not as strong for the overt-motor fear response as it is for the verbal-cognitive measure.

Of the three indices of fear response, the results of the Fear Thermometer present the most complex problem for interpretation. While no apparent effect of nitrous oxide inhalation is found at one minute post-exhalation, the regression slope analyses indicate differential rates of fear change from one to twenty minutes post-exhalation for the experimental versus the control group Ss. To explain the more rapid fear recovery of the experimental groups as a result of a simple gas effect is not reasonable since to do so would be to insist that the gas effect on the FT measure does not begin until after the acute effects of the gas have passed. Not only does this postulate fail to make logical sense, it also does not fit well with interview data that indicate a nearly complete absence of general gas-related effects lasting 20 minutes post-exhalation (T_2). However, given the

tentative assumption that the FT is a measure of physiological responsivity, the data do fit well with the typical findings of experiments designed to measure the effects of drugs on physiological processes. As noted by Lang (1968), the usual results of such studies show a drug-related change in physiological processes only when the drug effects are being exerted. Once the acute effects of the drug have dissipated, the reinstatement of the stimulus conditions results in physiological reactions identical to the pre-drug state.

While this interpretation may explain the differential rates of fear recovery it fails to account for the lack of difference between the experimental and control groups at T_1. While the previous hypothesis states that the different rates of recovery are caused by the dissipation of the effects of nitrous oxide, the non-significant results noted at T_1 indicate that there are no effects present to dissipate. A possible explanation for this apparent dilemma lies in the effects of demand characteristics.

Demand characteristics is the label given by Orne (1962) to identify those aspects of an experiment that in some way indicate to S what the outcome of the experiment is hypothesized to be, and that, therefore, communicate to S what behaviors they are expected to exhibit. A study by Jaffe (1969) showed that when demand characteristics are experimentally manipulated, a significantly greater effect of the demand characteristics will be found when measured by self-reports of fear than when measured by an overt-motor index of fear. If it is hypothesized that the less the effect of the experimental variable, the more S will respond to demand characteristics, then it is possible to explain the negative results of the FT at one-minute post-exhalation as a result of the selective deflation of the control

group scores (less reported fear) rather than the absence of the effect of nitrous oxide in reducing self-reported fear. A more thorough discussion of this hypothesis and the further ramifications of the concept of demand characteristics in relation to this study will be presented at the end of this chapter.

There is, however, some evidence that the negative results of the FT analyses at T_1 may be related to a selective effect of nitrous oxide. As previously noted, while the correlations of the behavioral and FT measures are typically low, indicating independence between them, these correlations are generally significantly greater than zero. Since this is not the case for the present results, the failure of the two measures to correlate significantly lends some support to the notion that while nitrous oxide acts to reduce verbal and motor responses of fear, a gas-specific exclusion of effect is noted for the self-reported fear index. Thus, if nitrous oxide exerts a differential effect on the Distance and FT measures the correlations between them would be predictably lower than is normally found. While this finding cannot explain the onset of differential effects for the control and experimental group Ss after the acute effects of the gas have passed, it does open the possibility that the effects of nitrous oxide on self-reported fear are different and perhaps considerably more complex than its effects on overt-motor and verbal-cognitive responses. Thus, the results indicate two possibilities: first, while nitrous oxide does act to lower self-reported fear, the selective activity of demand characteristics on the FT in the control population make it impossible to statistically distinguish the effects; and second, the selective effect of

nitrous oxide on the FT is sufficiently complex that data from the present experiment do not suggest its true mode of action.

The results of the Combined Scale essentially reflect the results of the measures from which it is composed; Distance and FT. While these data do not lead to any new conclusions regarding the effect of nitrous oxide on fear, they do indicate that the Distance and FT data do not disagree. That is, in order for the results of both measures to appear in the analyses of the Combined Scale, the Distance and FT data sources can not contradict one another.

Overview--Demand Characteristics and Control: On the Post-Experiment questionnaire 80% of the control Ss noted that there was either not much, or no effect at all of breathing the control gas. In light of this fact it does not seem reasonable to assume that the control Ss responded to what they believed the effects of the gas to be. If this is true, the significant improvement of the control Ss cannot be appropriately termed a placebo response. A placebo response is typically defined as ". . . The physiologic and psychologic reaction to the administration and acceptance of the placebo . . ." (Fisher and Olin, 1956). Therefore, the description of a placebo response must include some reference to the acceptance of the placebo drug as a drug that can effect change. In contrast to this, 80% of the control Ss in the present experiment indicated that the gas resulted in little or no physiological or psychological alteration. In order to explain the significant reduction of fear noted for the control group on all three change measures, two additional alternatives will be considered.

The first alternative is that the significant reduction in fear shown by the control group reflects a measurement problem. That is, the significant changes in the control data may be a function of inherent unreliability of the measures or desensitization in the absence of intervention, or both. Other research findings on this question are conflicting. While a study by Lang and Lazovick (1963) indicates that without effective intervention no significant change occurs in the behavioral approach or self-reported fear measures, another study, utilizing essentially the same methodology (Barkover and Craighead, 1971) resulted in significant changes over trials for both the behavioral and FT measures. While the conclusion could be made that the significant improvement shown by the control group in the present study is in fact a measurement artifact, this would preclude any further dissection of the issues. Instead, the problems of measurement will be left as an alternative explanation, and a discussion involving the effects and ramifications of demand characteristics will be undertaken.

Orne (1961) presents a complete and penetrating discussion of what he terms "demand characteristics." As a preface to that discussion, Orne reviews a fact well-known by researchers who utilize human subjects; namely, that humans in an experiment are not simply passive organisms, reacting unintelligently and automatically to the stimuli impinging upon them, but are in truth active, thinking, integrating beings that will consistently examine and interpret their environment. Because of this fact, the overt and subtle cues in any experiment that relate to the hypothesized outcome of the experiment, and consequently the expected behavior of the subject, are utilized and responded to by the subject. There are obviously three

ways in which a subject can respond to this input; positively (do what is expected), negatively (don't do what is expected), or faithfully (forget what you know). Unfortunately research in this area is minimal, and what factors contribute to which kind of response are generally unknown.

However, a study by Orne and Scheibe (1964) demonstrates the effectiveness of demand characteristics in controlling behavior. In this experiment two different demand characteristics were given two groups of Ss in the same experimental situation. Both groups of Ss were placed in an environment which had been carefully designed to avoid stimulus deprivation. One group of Ss were told that they were in a stimulus deprivation experiment while the second group of Ss were told that they were the control group for a stimulus deprivation experiment. The dependent variable was a battery of 14 tests commonly used to evaluate the effect and extent of stimulus deprivation. The results showed that the "experimental" group in fact scored significantly higher in stimulus deprivation on 13 of the 14 tests than the "control" group. Thus, the experiment demonstrated that what a subject thinks should happen may be a more significant determinant of behavior than the actual effects of the independent variable. This is an example of a response by the subject to the demand characteristics of the experiment.

One method for dealing with the ubiquitous demand characteristic is to deliberately establish the demands in line with the experimental question. For example, in a study by Kälin (1964) the question asked by the research involved the alteration of certain measures as a result of alcohol consumption in the typical drinking environment. Thus, instead of arranging a laboratory study in which the set and setting (and therefore many of the

demand characteristics) were scientifically sterile, the research was accomplished in a party atmosphere. In this way, it was hoped that the demand characteristics of the experiment would more accurately reflect those of the typical setting in which alcohol is consumed. An obvious shortcoming in this method is the fact that Ss know their responses are being studied. This in itself will produce other, unwanted, demand characteristics. However, this procedure clearly avoids a great many of the problems encountered in more traditional research approaches where demand characteristics are largely ignored.

In the present experiment the intuitive attempt at preventing demand characteristics was done in the more traditional fashion--the introduction to the experiment attempted to conceal the true hypothesis by presenting another. Thus, Ss were informed that the experiment was designed to assess the effect of a gas on their fear of snakes, and that the gas might make them more or less afraid of snakes, or it might not alter their fear of snakes at all. Furthermore, Ss were told that the effects of the gas range from not much at all to a great deal of effect. While these instructions are not exactly libelous, they are also not exactly true. In addition, they tend to sound somewhat vague and evasive which by itself might well arouse suspicion. In any case, as Orne notes, psychologists have been in the habit of concealing the hypothesis for so long that Ss expect to be lied to. It is, therefore, reasonable to hypothesize that no matter what the subjects are told, the main source of information for them in their interpretation of the experiment is likely to be the actual procedure of the experiment, and the introduction to the purpose of the experiment

will be respected only as much as it agrees with common sense, experimental procedure, and S bias. In the present research the process of the experiment essentially involved a test, followed by gas inhalation, followed in turn by two more tests. As Orne notes ". . . if a test is given twice with some intervening treatment, even the dullest college student is aware that some change is expected. . . ."

There are two additional factors that enter into the consideration of the demand characteristics present in this experiment. First, while the Post-Experiment questionnaire indicates that some Ss expected a decrease in fear as a result of the gas effects and others expected no change in fear, there was no S that indicated she expected her fear to increase as a result of inhaling the gas. In fact, it is doubtful that mere introductory remarks could convince a reasonably intelligent subject that a psychologist would give them a drug that might make them even more afraid than they were before. One of the clearest characteristics of any experiment is that it is not designed to get the experimentor in trouble with irrate parents and officials

Second, research by Mederios (1971) indicates that Ss will respond opposite to a clearly stated demand characteristic if by doing so they believe that they will appear more ". . . skilled or competent in the eyes of E." In the question from the S Attitudes and Expectations questionnaire that assessed the extent to which S would like to get rid of her fear of snakes (M scale), a score of one equals "not at all" while 10 equals "very much." The results of this question show that 3 of the 4 groups score higher than mid-scale, thus indicating that Ss were generally motivated to

be rid of the snake phobia. Therefore, not only do societal norms type the subjects fear as abnormal (phobia), but the subjects themselves are motivated to be rid of their fear of snakes.

Put together, the various sources of demand characteristics in the present study make it no great surprise that Ss changed in the direction of lessened fear, even in the absence of nitrous oxide.

To this point in the discussion no distinction concerning the differential effects of demand characteristics on experimental versus control group data has been made. As was earlier discussed, the data strongly indicate that the room air gas was easily discriminated by the control Ss as being ineffective and innane. Therefore, a critical experiential distinction between the experimental and control conditions is the effectiveness of the nitrous oxide in producing immediate, clear feedback that something has happened as a result of the drug, compared to the absence of effect from the inhalation of the control gas. Given this distinction between the experiences of a control versus an experimental S, it is possible to explain the results of both the Distance and Post-Experiment questionnaire data at T_1 simply on the basis of demand characteristics. A hypothetical situation is as follows: the control S, having experienced little effect from the gas concludes that she is not expected to change her behavior to any great extent, or at the very least she does not get any feedback from the gas effects that demand any great change in behavior. She is, however, left with the motivation to change her fear (the most socially and intrapersonally desirable behavior) along with the demand characteristics inherent in the experimental design. Compare this with the

experience of the experimental S who has just experienced nitrous oxide and is feeling massive effects from the gas. This S has the added demand characteristic of great effect equals great change. In this hypothetical comparison, differential fear reduction would be predicted at T_1 between the experimental and control Ss. Significant reduction of fear in the control group would not be at all surprising, and no specific effect of nitrous oxide on fear would have to be postulated.

Some support for this hypothesis of non-specific gas effects is found in the results. With only one possible exception (Evaluation scale from the Semantic Differential) there is a conspicuous absense of dosage level effects. These results fit well with the hypothesis that only the experience is important, not the extent of the experience. Of course, the more S experiences the effects, the more the demand for change will be, but the increase in the demand as a result of increasing dosages would be hypothesized as insignificant compared to the effect of the experience.

While this hypothesis seems to adequately explain the results at T_1 for the Distance and Post-Experiment questionnaire data, it does not fit well with the results of the FT measure. While the hypothesis inflexibly predicts a significant difference between the experimental and control groups, the data for the FT show non-significant results at T_1. Furthermore, since the demand characteristics previously outlined all seem to be situation specific (a change of fear as tested by the snake approach and FT measures) there is no basis from which to predict the results of the Adjective Checklist Relaxed-Tense category. Thus, while the experimental Ss describe themselves as significantly more relaxed than the control Ss in

the apparent absence of any demand to do so, it would seem that nitrous oxide acts to specifically induce relaxation. Since relaxation is an incompatible response with anxiety (Wolpe, 1966), the effects of relaxation would be predicted as a reduction in fear as measured by the primary change indices.

If it is assumed that nitrous oxide, in fact, specifically induces relaxation, the data can be more adequately explained. The experimental S does not require contextual cues (demand characteristics) in order to respond--they are simply more relaxed as a result of the drug. However, the control S does need the direction offered by the demand characteristics and utilizes them in responding to the snake. Thus, it is argued that the significant change of the experimental group in all 3 measures is due to the specific effects of the nitrous oxide, while the control group change is a result of the effects of demand characteristics. The non-significant results of the FT at T_1 are hypothesized as being caused by the previously described differential effect of demand characteristics on self-reported fear measures, which results in greater than normal reduction of scores for the control Ss.

While there is some support for either the non-specific or specific nitrous oxide effects hypothesis, the specific effects postulate seems to most adequately describe the results. It should be clear, however, that support for one hypothesis above the other is extremely tentative. One or the other hypothesis may in fact be true, or a combination of the two may be closest to the actual psychological and physiological effects of nitrous oxide. The present experiment is exploratory in nature and is not expected to answer this crucial question.

However, the original question concerning the use of nitrous oxide as a therapeutic tool has been clearly answered in the affirmative. Certainly therapy involves much more intense and clear demand characteristics than an experiment, and the data readily show that in the presence of demand characteristics for positive change, nitrous oxide will facilitate this change for the overt-motor and verbal-cognitive responses. In addition, although the somatic-physiological (FT) response does not appear to be altered more than would occur in the absence of the drug, the response does decrease a significant amount. However, in the data regarding the rates of change from T_1 to T_2 lies a note of caution. While the experiment was not designed to investigate the results of repeated dosage followed by exposure to the feared object, the fact that the nitrous oxide Ss return to high levels of self-reported fear indicates the possibility that the somatic-physiological fear response in particular may not be alterable with the use of nitrous oxide.

Implications for Further Research: The most critical issue regarding further research is that involving the use of control drugs. It has been hypothesized that the inadequacy of the control gas (compressed room air) in serving as a placebo control leads to differential effects of demand characteristics on the experimental versus the control Ss. If this is true it is not possible to simply subtract the data of the control Ss from the experimental group results thus obtaining the effects due to the independent variable. Yet this comparison of control and experimental data is the core of all scientific research. It is, therefore, argued that the traditional methodology of drug research involving human subjects is totally

inadequate if the experimental S can readily discriminate that something has happened as a result of ingesting a drug while the control S cannot make such a discrimination. It should be clear that this problem does not simply apply to nitrous oxide research, but to any drug (e.g., alcohol) where this discrimination can be readily made by the subject. The problem concerning adequate controls is recognized by Carpenter (1968) in his review of the literature concerning drinking and driving. He concludes that "In many situations (e.g., moderate to high doses, subjects measured alone, subjects used as their own controls) there is probably no way to devise a satisfactory control which leaves the active agent indistinguishable from the inactive agent." However, Carpenter's discussion of the problem largely ignores the issue of differential effects on Ss who discriminate that they have received a control substance. Therefore, the problem of dissecting the specific from the non-specific effects of a drug is not pursued.

With the recognition of the methodological deficiencies, corrective procedures become an immediate concern. One such procedure would obviously be the use of active placebo controls; i.e., the use of control substances which have effects readily discernible by S but are not hypothesized to have the same effects as the experimental drug. Clearly this method involves other problems and issues. For instance, exploratory research would be hazardous since an a priori hypothesis concerning the effects of the drug must be used to determine the control substance. Furthermore, it can be argued that with the use of such a methodology, all drug research is comparative and no determination of an absolute baseline of effect can ever be

made. However uncomfortable the latter problem may be, it may be a fact of life that cannot be altered.

Another, less obvious, and certainly more painstaking method of correcting for the hypothesized problem of control, is to directly investigate the relationship of the effect-no effect discrimination to the demand characteristics engendered by the experimental design and procedure. It would seem that any drug research program where such a problem is evident should include a minimum of one group of Ss in which the demand characteristics are deliberately altered in such a way that data will be presented that will allow E to parcel out some of the results caused by the demand characteristics alone. Using the present research as an example it would have been preferable to explain to half of the experimental Ss that they were members of the control population, and that while the gas they were to be given would have some clear effects on their thinking, it was expected that no change in their snake fear would be evidenced.

Certainly many such pleas for alterations in traditional experimental design have been made, many of them substantiated by hard and clear data. That the majority of such pleas will remain unheeded is certain; conducting an experiment involving those thinking, interpreting, discriminating, and even scheming organisms known as human beings is complication enough.

What was the phrase--"Hope springs eternal?"

CHAPTER VI

SUMMARY

Nitrous oxide has recently been employed by a few therapists as an adjunct in the treatment of phobic states and other pathologies that involve chronic anxiety (Lynn, 1971). In addition, the "street" use of nitrous oxide is apparently increasing (Lynn, Walter, Harris, Dendy, and James, 1972). However, research on the effects of nitrous oxide has been largely confined to its use as an analgesic and anesthetic agent. The majority of the remaining research involving nitrous oxide has used the gas as a cognitive disruptor in learning and recall experiments (e.g., Steinberg and Russell, 1957). Only one experiment has been recently conducted with the intent to investigate the effects of nitrous oxide per se (Lynn et al., 1972). The same experiment has been the only one to utilize the acute method of gas administration which reflects the street usage of the gas. In general, experiments using nitrous oxide have shown that the gas disrupts cognitive performance during the acute effects, the disruption ceasing within five minutes after the cessation of gas inhalation. In addition, various anecdotal reports have indicated that nitrous oxide may induce relatively long-lasting relaxation.

The present study was designed to measure the effects of nitrous oxide on fear when the gas is administered in an acute, rather than the typical chronic fashion. The Ss consisted of 40 female undergraduate students

who indicated a high degree of fear of snakes during an administration of a Fear Survey Schedule. The Ss were randomly assigned to one of four dose level groups: control (4 balloons of compressed room air); 4 balloons of nitrous oxide; 7 balloons of nitrous oxide; and 10 balloons of nitrous oxide. The primary measures of fear change were the snake approach test (Distance), the Fear Thermometer (FT), and a Post-Experiment questionnaire. A live tame snake served as a fear stimulus. The design consisted of Distance and FT tests at pre-gas inhalation, one minute post gas-exhalation (T_1), and 20 minutes post-gas-exhalation (T_2). The Post-Experiment questionnaire was administered immediately following T_2. It was hypothesized that a reduction in fear corresponding to nitrous oxide dosage levels would be found for the Distance measure (Hypothesis 1a) and the FT scale (Hypothesis 1b).

The results of the analyses of all sources of data indicate a general lack of effect corresponding to nitrous oxide dosage levels. Furthermore, all change in fear measures show a significant reduction in fear for control Ss at T_1. The Distance measure reflects a significant reduction in fear as a result of nitrous oxide inhalation at T_1, but not at T_2. While the FT does not show a significant reduction in fear for the experimental compared to the control Ss, the results of regression slope analyses indicate a significantly more rapid increase in fear from T_1 to T_2 for the experimental group Ss. The Post-Experiment questionnaire is not statistically evaluated. However, the results indicate a large reduction in fear as a result of nitrous oxide inhalation at both T_1 and T_2. The data also show that control Ss clearly discriminated that they had received a relatively ineffective gas. Correlations between the Distance and FT measures

show them to be independent of one another.

The independence of the measures fits well with the hypothesis proposed by Lang (1968) that fear is not a unitary response, but is composed of three independent categories of response. Although there are certain issues in the designation of the three measures of fear change used in this study, the following assignments are made: Distance measures the overt-motor response category; the Post-Experiment questionnaire measures the verbal-cognitive category; and the FT measures the somatic-physiological response category. In this way the effects of nitrous oxide in reducing fear can be considered greatest for the verbal-cognitive response. The next greatest effect is noted for the overt-motor response, and the least effect is reflected in the somatic-physiological response category.

The significant reduction in fear noted for control Ss on all change measures can be attributed to measurement artifact. An alternative hypothesis involves the effects of demand characteristics (Orne, 1962). It is possible that the significant effects of nitrous oxide inhalation are due simply to the fact that while the experimental Ss discriminated that something had happened as a result of breathing a gas, the control Ss felt little or nothing. Although the effects of the demand characteristics inherent in the experiment might well lead to a significant improvement for the control Ss, the added demand for change produced by a drug experience would result in an even greater reduction in fear for the experimental group Ss. Given this hypothesis it is possible to explain the results of this experiment without postulating any specific effects of nitrous oxide on fear.

However, the results of the ACL show a significant effect of nitrous oxide inhalation with experimental group Ss describing themselves as significantly more relaxed and less inhibited at 5 minutes post-exhalation. Since this differentiation of the control versus the experimental group Ss was possible in the absence of any apparent demand characteristics for such data, it is possible that nitrous oxide in fact exerts a specific effect on fear, leading to greater relaxation. Because an active control drug was not used, it is only possible to speculate concerning the specific versus the non-specific effects of nitrous oxide inhalation.

Hypothesis 1a is only partially confirmed, while Hypothesis 1b is not confirmed. However, although the control and experimental group Ss are indistinguishable at T_1 for the FT, a significant reduction in scores is noted. Therefore, the question concerning the efficacy of nitrous oxide as a therapeutic adjunct seems to be answered affirmatively. It is concluded that because of the critical problem of adequate control in drug effects research, data specifically concerned with the action of demand characteristics on drug responses are needed. Without such research it would seem to be impossible to separate the specific from the non-specific effects of drugs.

REFERENCES

Barber, T. X., LDS, Marijuana, Yoga and Hypnosis. Chicago: Adline, 1970.

Barkovec, T. D., and Craighead, W. E., The comparison of two methods of assessing fear and avoidance behavior. Beh. Res. Ther., 1971, 9, 285-291.

Bourne, J. G., Studies in Anesthetics. London: Lloyd-Luke, 1967.

Brown, W. E., Lucas, C. H., and Henderson, V. E., Anesthetic value of nitrous oxide under pressure. J. Pharmacol. Exp. Ther., 1927, 31, 269-289.

Carpenter, J. A., Contributions from psychology to the study of drinking and driving. Quart. J. Studies Alch., 1968, Supplement No. 4, 234-251.

Christiansen, B. Notes concerning the use of nitrous oxide in psychiatric treatment and psychological research. Unpublished, 1971: The Menninger Foundation.

Claussen, G. W. Making Reality More Real. Los Angeles: Turn-Ons Unlimited, 1971.

Clement, F. W., Nitrous Oxide-Oxygen Anesthesia. Phil.: Lea and Febiger, 1945.

Davis, W. N. Drinking: A search for power or for nurturance? Ph. D. dissertation, Harvard Univ., 1969.

Eastwood, D. W., The pharmacology of nitrous oxide. In Eastwood, D. W. (Ed.) Clinical Anesthesia: Nitrous Oxide. Phil.: Davis, 1964.

Eger, E. I., Uptake, distribution and elimination of nitrous oxide. In Eastwood, D. W. (Ed.) Clinical Anesthesia: Nitrous Oxide. Phil.: Davis, 1964.

Faulconer, A., Pender, J. W., and Bickford, R. G., The influence of partial pressure of nitrous oxide on the depth of anesthesia and the electroencephalogram in man. Anesth., 1949, 10, 601-604.

Fischer, H. K., and Dlin, B. M., The dynamics of placebo therapy: A clinical study. Amer. J. Med. Sci., 1956, 232, 502-512.

Fletcher, D. E., Personality disintegration incident to anoxia with nitrous oxide anesthesia. J. Nerv. Ment. Dis., 1945, 102, 392-403.

Fogel, E. J., and Gray, L. P., Nitrous oxide anoxia in the treatment of schizophrenia: Report of 24 cases. Amer. J. Psychiat., 1940, 97, 677-685.

Goodman, L. S., and Gilman, A., The Pharmacological Basis of Therapeutics. New York: Macmillan, 1970.

Gould, R. B., Nitrous oxide anesthesia: A critical evaluation. Brit. Med. J., 1943, 2, 607-608.

Greer, J. H., The development of a scale to measure fear. Beh. Res. Ther., 1965, 3, 45-53.

Heironimus, T. W., History of nitrous oxide. In Eastwood, D. W. (Ed.) Clinical Anesthesia: Nitrous Oxide. Phil.: Davis, 1964.

Jaffe, L., Non-specific treatment factors and deconditioning in fear reduction. Diss. Abst. Inter., 1969, 29, (9-B), 3485-3486.

Kälin, R., Alcohol, sentience, and inhibition: An experimental study. Ph. D. dissertation, Harvard Univ., 1964.

Lang, P. J., Fear reduction and fear behavior: Problems in treating a construct. In Shlien, J. M. (Ed.) Research in Psychotherapy, Vol. III. Washington: Amer. Psychol. Assoc., 1968.

Lang, P. J., and Lazovik, A. D., Experimental desensitization of a phobia. J. Abnorm. Soc. Psychol., 1963, 66, 519-525.

Lang, P. J., Lazovik, A. D., and Reynolds, D. J., Desensitization, suggestibility and psuedotherapy. In Stollak, G. E., Guerney, B. G. Jr., and Rothberg, M. (Eds.), Psychotherapy Research. Chicago: Rand McNally, 1966.

Lang, P. J., Stroufe, L. A., and Hastings, J., Effects of feedback and instructional set on the control of cardiac rate variability. J. Exp. Psychol., 1967, 75, 425-431.

Lehmann, H., and Bos, C., The advantages of nitrous oxide in psychiatric treatment. Amer. J. Psychiat., 1947, 104, 164-170.

Lynn, E. J., Personal communication, 1971.

Lynn, E. J., Walter, R. G., Harris, L. A., Dendy, R., and James, M., Nitrous oxide: It's a gas. J. Psychedelic Drugs, 1972, 5, 1-7.

McKinney, F., Nitrous oxide anesthesia as an experimental technique in psychology. J. Gen. Psychol., 1932, 6, 195-199.

Medeiros, D. C., Demand characteristics and the effects of alcohol placebo ingestion upon reaction time. Diss. Abst. Inter., 1971, 32, (6-B), 3644-3645.

Orne, M. T., On the social psychology of the psychological experiment: With particular reference to demand characteristics and their implications. Amer. Psychologist, 1962, 17, 776-783.

Orne, M. T., and Scheibe, K. E., The contribution of non-deprivation factors in the production of sensory deprivation effects: The psychology of the "panic button." J. Abnorm. Soc. Psychol., 1964, 68, 3-12.

Osgood, C. E., Suci, G. J., and Tannenbaum, P. H., The Measurement of Meaning, Univ. of Ill. Press, Urbana, 1957.

Parkhouse, J., Henrie, J. R., Duncan, G. M., and Rome, H. P., Nitrous oxide analgesia in relation to mental performance. J. Pharm. Exp. Ther., 1960, 128, 44-54.

Rogerson, C. H., Narco-analysis with nitrous oxide. Brit. Med. J., 1944, VI, 811-812.

Russell, R. W., and Steinberg, H., Effects of nitrous oxide on reactions to "stress." Quart. J. Exp. Psychol., 1955, 7, 67-73.

Schroeder, H., and Craine, L., Relationships among measures of fear and anxiety for snake phobics., J. Cons. Clin. Psychol., 1971, 36, 443.

Seldin, H. M., Complications attending and following nitrous oxide-oxygen anesthesia: Cause and effect. J. Amer. Dent. Assoc., 1943, 30, 421-424.

Snyder, C., and Nobel, M., Operant conditioning of vasoconstriction. Paper presented at the meeting of the Midwestern Psychological Association, Chicago, April-May, 1966.

Steel, R. G. D., and Torrie, J. H., Principles and Procedures of Statistics. McGraw-Hill, N. Y., 1960.

Steinberg, H., Selective effects of an anesthetic drug on cognitive behavior. Quart. J. Exp. Psychol., 1954, 6, 170-180.

Steinberg, H., Changes in time perception induced by an anesthetic drug. Brit. J. Psychol., 1955, 46, 273-279.

Steinberg, H., "Abnormal behavior" induced by nitrous oxide. Brit. J. Psychol., 1956, 47, 183-194.

Steinberg, H., and Russell, R. W., Transfer effects in reaction to "stress." Quart. J. Exp. Psychol., 1957, 9, 215-220.

Steinberg, H., and Summerfield, A., Influence of a depressant drug on acquisition in rote learning. Quart. J. Exp. Psychol., 1957, 9, 138-145.

Steinberg, H., and Tomkiewicz, M., Psychopharmacology, A review of progress 1957 to 1967. In Efron, D. H. (Ed.), The Proceedings of the Sixth Ann. Meeting of the American Coll. of Neuropsychopharmacology. San Juan, 1967, 879-884.

Summerfield, A., and Steinberg, H., Reducing interference in forgetting. Quart. J. Exp. Psychol., 1957, 9, 146-154.

Summerfield, A., and Steinberg, H., Using drugs to alter memory experimentally in man. In Efron, D. H. (Ed.), The Proceedings of the Sixth Ann. Meeting of the American Coll. of Neuropsychopharmacology. San Juan, 1967, 879-884.

Walk, R. D., Self ratings of fear in a fear-invoking situation. J. Abnorm. Soc. Psychol., 1956, 52, 171-178.

Westerlund, R. L., Pittinger, C. B., and Reger, S. N., The effects of nitrous oxide on responses to hearing. Anesth. Analg., 1971, 40, 238-241.

Wilson, A., Crockett, G. S., Exton-Smith, A. N., and Steinberg, H., Clinical evaluation of effects of drugs on medical students as a teaching method. Brit. Med. J., 1950, VII, 484-488.

Winer, B. J., Statistical Principles in Experimental Design. McGraw-Hill, N. Y., 1971.

Wolpe, J., The Practice of Behavior Therapy. New York: Pergamon, 1969.

Wolpe, J., and Lazarus, A. A., Behavior Therapy Techniques. New York: Pergamon, 1966.

APPENDICES

APPENDIX 1

TELEPHONE BLURB

Hello, this is Lance Harris and you filled out a survey of fears form for me . . . (do you remember that?) . . . What I was primarily looking for on that survey was people who are very afraid of snakes. . . . The reason I'm calling you now is to ask you to participate in an experiment that I am doing to look at the effects of a gas on your fear of snakes. . . . (I can't give you the name of the gas until the experiment is completely done because I'm afraid that it will alter the results). . . . The experiment will involve some questionnaires and tests--one of which will be a test of how close you can go to a harmless snake but you will not in any way be forced to go any closer than you want to. It will also involve breathing a gas that has been used in a great deal of previous research and has been proven to be completely harmless, safe, and cannot produce a loss of consciousness when it is used as we will use it. The effects that people report typically range from not much effect at all to extremely pleasurable. I think that it will be a very interesting experiment for you and it will certainly help me out since there is a limited number of people who are very afraid of snakes. I also really believe that this study has a lot of potential for improving health care in the future so I have some real commitment to completing the experiment as soon as I can. You will get three experimental credits and I can pay you $3.00 as well for volunteering. Will you participate? (If Yes) Good. We will be running the experiment on (give options of times and dates). When would you be able to make it? (Schedule the volunteer). I will be sending you

a health survey form in the mail and you should get it in the next couple of days. It's standard procedure for an experiment of this nature and it's only one of a number of precautions that I have taken, and that any good experiment of this kind always includes, to insure your safety and rights as a subject. As soon as you return the survey I'll have it screened by the consulting physician to make sure that there is no reason to be concerned about the general nature of your health and then I'll recontact you. It will help if you'll fill out the form and return it as soon as you can, but I'll have to have it back by (give date) so that I have time to have it properly screened. The survey will include a stamped and addressed envelope for returning it. Do you have any questions at this point? O.K. Thanks a lot.

(If no) O.K. I won't try to coerce you but I'm keeping a record of phone calls and if it's O.K. I would like to know the reasons for your refusal.

Note: After the medical survey form has been completed and returned it will be given to Dr. Edward Lynn for screening. If the survey is satisfactory to the physician it will be signed and returned to E. The subject will then be recontacted and informed that the medical survey was completely satisfactory and the appointment time for the experiment will be reconfirmed. They will also be asked to refrain from all unnecessary drug use for 48 hours prior to the experiment time. If the medical survey is questionable to the physician, S will be contacted and informed of the concern. They will be told that we are unwilling to take any risks whatsoever with their safety and we regretably cannot allow them to participate. They will, however, receive one experimental credit for their time in completing the survey.

APPENDIX 2

FEAR SURVEY SCHEDULE

Instructions

For each item circle the word that most nearly describes the amount of fear you feel toward the object or situation noted in the item.

1. Sharp objects	None	Very little	A little	Some	Much	Very much	Terror
2. Being in a passenger car	None	Very little	A little	Some	Much	Very much	Terror
3. Dead bodies	None	Very little	A little	Some	Much	Very much	Terror
4. Suffocating	None	Very little	A little	Some	Much	Very much	Terror
5. Failing a test	None	Very little	A little	Some	Much	Very much	Terror
6. Looking foolish	None	Very little	A little	Some	Much	Very much	Terror
7. Being a passenger in an airplane	None	Very little	A little	Some	Much	Very much	Terror
8. Worms	None	Very little	A little	Some	Much	Very much	Terror
9. Arguing with parents	None	Very little	A little	Some	Much	Very much	Terror
10. Rats and mice	None	Very little	A little	Some	Much	Very much	Terror
11. Life after death	None	Very little	A little	Some	Much	Very much	Terror
12. Hypodermic needles	None	Very little	A little	Some	Much	Very much	Terror
13. Being criticized	None	Very little	A little	Some	Much	Very much	Terror
14. Meeting someone for the first time	None	Very little	A little	Some	Much	Very much	Terror
15. Roller coasters	None	Very little	A little	Some	Much	Very much	Terror

16. Being alone	None	Very little	A little	Some	Much	Very much	Terror
17. Making mistakes	None	Very little	A little	Some	Much	Very much	Terror
18. Being misunderstood	None	Very little	A little	Some	Much	Very much	Terror
19. Death	None	Very little	A little	Some	Much	Very much	Terror
20. Being in a fight	None	Very little	A little	Some	Much	Very much	Terror
21. Crowded places	None	Very little	A little	Some	Much	Very much	Terror
22. Blood	None	Very little	A little	Some	Much	Very much	Terror
23. Heights	None	Very little	A little	Some	Much	Very much	Terror
24. Being a leader	None	Very little	A little	Some	Much	Very much	Terror
25. Swimming alone	None	Very little	A little	Some	Much	Very much	Terror
26. Illness	None	Very little	A little	Some	Much	Very much	Terror
27. Being with drunks	None	Very little	A little	Some	Much	Very much	Terror
28. Illness or injury to loved ones	None	Very little	A little	Some	Much	Very much	Terror
29. Being self-conscious	None	Very little	A little	Some	Much	Very much	Terror
30. Driving a car	None	Very little	A little	Some	Much	Very much	Terror
31. Meeting authority	None	Very little	A little	Some	Much	Very much	Terror
32. Mental illness	None	Very little	A little	Some	Much	Very much	Terror
33. Closed places	None	Very little	A little	Some	Much	Very much	Terror
34. Boating	None	Very little	A little	Some	Much	Very much	Terror
35. Spiders	None	Very little	A little	Some	Much	Very much	Terror
36. Thunderstorms	None	Very little	A little	Some	Much	Very much	Terror
37. Not being a success	None	Very little	A little	Some	Much	Very much	Terror

38. God	None	Very little	A little	Some	Much	Very much	Terror
39. Snakes	None	Very little	A little	Some	Much	Very much	Terror
40. Cemeteries	None	Very little	A little	Some	Much	Very much	Terror
41. Speaking before a group	None	Very little	A little	Some	Much	Very much	Terror
42. Seeing a fight	None	Very little	A little	Some	Much	Very much	Terror
43. Death of a loved one	None	Very little	A little	Some	Much	Very much	Terror
44. Dark places	None	Very little	A little	Some	Much	Very much	Terror
45. Strange dogs	None	Very little	A little	Some	Much	Very much	Terror
46. Deep water	None	Very little	A little	Some	Much	Very much	Terror
47. Being with a member of the opposite sex	None	Very little	A little	Some	Much	Very much	Terror
48. Stinging insects	None	Very little	A little	Some	Much	Very much	Terror
49. Untimely or early death	None	Very little	A little	Some	Much	Very much	Terror
50. Losing a job	None	Very little	A little	Some	Much	Very much	Terror

Please list 3 magazines that you would prefer to use to "kill time" for a half an hour.

1. _____

2. _____

3. _____

Name: _____

Address: _____

_____

Telephone Number: _____

Age: _____

APPENDIX 3

HEALTH SURVEY

If there are any questions about the survey or any experiment-related issues, please feel free to call me at home. I should be there from 5:00 p.m. on in most cases, or if I'm not you should be able to give a message to my wife so I can call you back. The phone number is 489-6949. If you need to call during the day you can try the Counseling Center (355-8270) and ask for me.

Date by which the survey MUST be returned_____

Lance Harris

(Note: Please discard this cover sheet before returning the survey.)

HEALTH SURVEY

Prepared by: Lance Harris

Edward Lynn, M.D.

Name_____ Date of Birth _____

Todays date _____

Although there are virtually no contraindications (medically dictated restrictions) to the use of the gas in this experiment, the questions below concerning your state of physical well-being and the possibility of pregnancy are necessary for your protection. Let me reiterate that this form is but one of a number of precautions that are being taken, and are taken in any good experiment of this nature, to insure your complete safety.

Physical health (Excellent, Good, Fair, Poor) _____

Last physical examination (date)_____

Medical diseases (types and dates) _____

_____

Have you ever lost consciousness (give reason and date)_____

_____

Allergies _____

Surgery (types and dates)_____

Psychological treatment (hospitalization, counseling, etc.; give dates of treatment) _____

_____

_____

Have you ever had any adverse reactions, either physical or psychological, to pain killers, anesthetics, amphetamines, minor tranquilizers (such as miltown or equinol), alcohol, or barbiturates? If so give type of drug, nature of reaction, and dates.

_____

_____

Do you now, or have you ever had respiratory problems (excluding common colds) such as emphysema, tuberculosis, bronchitis, etc.? If so specify the disease and date. _____

_____

Do you have any type of circulatory system or heart problems? (type) ____

_____

Have you ever had rheumatic fever (date) _____

Do you now have a cold? _____

Are you now taking any prescription or over the counter drugs? If so please specify the drug and the illness involved._____

_____

Date of the start of your last menstrual period._____

What form, if any, of contraception do you employ? _____

Is there any possibility that you are now pregnant? _____

APPENDIX 4

GENERAL EXPERIMENT OUTLINE

(Begin by introducing the assistant)

I would like to begin by giving you an overview of what the experiment is all about and the steps that we will go through during the experiment. Some of it I already briefly described when I first called you. First let me tell you that the reason I am reading this now and why all of the instructions will be either read to you or printed for you to read is so that I do not say different things to different people. It is just a way of keeping the experiment as consistent as I can.

As I said before, the purpose of the medical history form was just one of a number of precautions that I have taken to insure your complete safety. In fact, I can clearly state that we are taking many more precautions than the typical study using this gas so that the experiment can be conducted with complete ease of mind.

The experiment has been designed to test your reactions to a snake before and after inhaling some gas. What I am trying to find out is whether the gas will change how close you will come to a live snake in a cage. There may be an increase or a decrease in the distance you will keep between you and the snake, or there may be no change at all, but this is what I am trying to find out. At no time will you be forced to go closer to the snake than you want to. When you get as close to the snake as you can, I will ask you to indicate the amount of fear you are feeling on this form called a fear thermometer. All you do is draw a line representing how afraid you are at that distance from the snake.

You can expect to be pretty nervous before you inhale the first balloonful of gas--most people are--but once you have had the gas your nervousness will dissipate quickly. I can't tell you the name of the gas until the experiment is finished but I can tell you something about some of the initial effects you might feel. First of all, the range of action is like most other drugs in that it is very wide--and there is a great deal of variation between individuals. Some people feel almost nothing while others feel some very definite pleasant effects. Examples of what you might feel, if you feel anything, are light-headedness, a sense of sounds being greatly amplified, and a ringing or buzzing sound that seems to originate from inside your head. If you do feel some effects you will probably notice their onset quickly--usually within 15 seconds or so and these immediate effects will disappear quickly--within less than a minute. People sometimes describe the effects as weird or strange but not unpleasant. Do you have any questions about the gas?

One additional comment; the gas will be scented with some liquid extract so don't be surprised at the taste and smell of it.

I would like now to briefly describe the procedure of the experiment. First, I will give you a brief questionnaire and a couple other forms. Then, I will test you to see how close you can go to the snake located in another room. After that we will practice breathing air from a balloon since it's not as easy as it looks at first. Then, you will get a "trial" balloon of the gas so that you will have a good idea what its effects are like before the testing begins. Following this we will start the actual testing. You will first receive a number of balloonsful of the gas, then

another test of how close you can go to the snake will be given. Following this you will be ushered back to this room to fill out a couple more questionnaires. For another 15 minutes or so you can just relax or read the magazines provided. After this a final test of how close you can go to the snake will be administered and a final questionnaire will be filled out. More complete instructions will be given at each step of the experiment so you don't have to remember any of it. I am reading this for you only to give you some kind of overview of what will be happening so that the various phases of the experiment are not a complete surprise to you. I would like you to know that all data will be coded with a subject number so that I cannot unconsciously bias the results. This will also assure you of complete privacy since there will be no way of decoding the individual results to match with anyones name. Finally, you may discontinue the experiment at any point if you wish. However, I very much need your help so I hope that you will be willing to do the entire experiment. Are there any questions at this point?

(Note: A record will be kept concerning any questions asked.)

APPENDIX 5

CONSENT FORM

I have been told of the effects of the gas to be used and the procedures to be followed in this research and I agree to participate. I understand that I can terminate my participation in this experiment at any time if I so desire and that I will receive full experimental credit. In the event that I do not complete the experiment the amount of money that I receive will be negotiated between myself and Lance Harris; the amount not to exceed $3.00.

_____

Sign Full Name

_____

Witness

_____

Date

APPENDIX 6

RECENT DRUG USE CHECKLIST ANSWER SHEET

Date:_____ S# _____

To be orally administered.

Instructions: The purpose of this questionnaire is to survey your use of drugs within the last 48 hours so that any possible interactions between these drugs and the gas can be anticipated prior to your use of the gas.

Within the last 2 days have you used any of the following drugs:

Drug Category	Yes-No	Type	When Taken	Amount
Alcohol	_____	____	_____	_____
Marijuana and derivatives	_____	____	_____	_____
Psychedelics	_____	____	_____	_____
Barbiturates and Tranquilizers	_____	____	_____	_____
Amphetamines	_____	____	_____	_____
Over-the-counter drugs	_____	____	_____	_____
Other (specify) _____	_____	____	_____	_____

APPENDIX 7

S ATTITUDES AND EXPECTATIONS

(To be orally administered)

This questionnaire is designed to measure some of your attitudes and thoughts concerning yourself and the experiment. The questions have no relevance to your eligibility for the experiment nor do they refer in any way to your capabilities or personality traits. However, since certain characteristic attitudes or ideas about an experiment can in some ways alter your activities in the experiment I would like to survey your attitudes and ideas before the actual experiment begins. In answering the questions you are best advised to just give the first answer that comes to you rather than spending time thinking about the question. I will read the questions to you and record your answers. Are there any questions?

1. Why did you volunteer for this experiment:
   A. It sounded interesting.
   B. You need the experimental credit.
   C. You need the money.
   D. You would like to learn more about your fear of snakes.
   E. Or something else (please specify)
2. On a scale from 1 to 10 how comfortable or uncomfortable are you about breathing the gas I told you about? 1 equals very comfortable, 10 equals very uncomfortable.
3. Do you think that it will make you feel silly or foolish to breath the gas from a baloon?
   A. Yes
   B. No

4. On a scale from 1 to 10 how much would you like to get rid of your fear of snakes? 1 equals not at all, 10 equals very much.
5. On a scale from 1 to 10 how comfortable or uncomfortable are you about participating in this experiment? 1 equals very comfortable, 10 equals very uncomfortable.
6. On a scale from 1 to 10 how likely do you think it is that breathing a gas can make you either more or less afraid of snakes? 1 equals not at all likely, 10 equals very likely.
7. On a scale from 1 to 10 how likely do you think it is that breathing a gas can make you generally less anxious? 1 equals not at all likely, 10 equals very likely.
8. On a scale from 1 to 10 how likely do you think it is that this experiment will alter your attitudes toward snakes? 1 equals not at all likely, 10 equals very likely.

ANSWER SHEET

S ATTITUDE AND EXPECTATIONS

Date _____ S# _____

1. A B C D E _____

_____

_____

2. Very comf. 1 2 3 4 5 6 7 8 9 10 very uncomf.

3. Yes No

4. Not at all 1 2 3 4 5 6 7 8 9 10 very much

5. Very comf. 1 2 3 4 5 6 7 8 9 10 very uncomf.

6. Not likely 1 2 3 4 5 6 7 8 9 10 very likely

7. Not likely 1 2 3 4 5 6 7 8 9 10 very likely

8. Not likely 1 2 3 4 5 6 7 8 9 10 very likely

APPENDIX 8

INSTRUCTIONS FOR DISTANCE AND FT TEST

Against the far wall of this room is a cage containing a live, harmless snake. I want you to go as close to the snake as you possibly can. If you are able, I want you to open the top of the cage and touch the snake; I can guarantee that there is absolutely no chance that the snake will bite you.

If you find that you cannot touch the snake, try to lay both hands on top of the closed cage.

If it is not possible to do either of the preceding, go as close to the cage as you can.

Remember, the object of this test is to see how close you can come to a live, harmless snake, so I want you to try very hard to go all the way and touch the snake. When you are as close to the snake as you can be I will give you this form to complete (FT).

APPENDIX 9

ANSWER SHEET

Approach Test and FT

Date _____ S# _____

A.T.: Measured by number of floor tiles between front of foot and cage.

TS = touch snake; TC = touch cage top.

Pre-Test

AT _____

FT _____

Post 1 minute

AT _____

FT _____

Post 20 minutes

AT _____

FT _____

APPENDIX 10

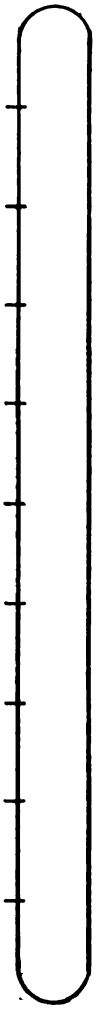
S# _____

Date _____

Instructions

Draw a line across the scale below to indicate the amount of fear you now feel.

Extreme Fear



No Fear

APPENDIX 11

Date _____

S# _____

ADJECTIVE CHECKLIST

Instructions: Listed below is a series of adjectives that may or may not describe how you are feeling. Circle or underline the extent to which you feel the adjective in question describes the way you are feeling at the present time. Please work quickly and do not spend much time thinking about your answer.

Attentive	a lot	a little	not at all
Calm	a lot	a little	not at all
Careless	a lot	a little	not at all
Cautious	a lot	a little	not at all
Cheerful	a lot	a little	not at all
Contented	a lot	a little	not at all
Cool	a lot	a little	not at all
Dissatisfied	a lot	a little	not at all
Gloomy	a lot	a little	not at all
Happy-go-lucky	a lot	a little	not at all
Hasty	a lot	a little	not at all
Impatient	a lot	a little	not at all
Inhibited	a lot	a little	not at all
Leisurely	a lot	a little	not at all
Nervous	a lot	a little	not at all
Optimistic	a lot	a little	not at all
Pessimistic	a lot	a little	not at all
Quiet	a lot	a little	not at all
Relaxed	a lot	a little	not at all
Restless	a lot	a little	not at all
Serious	a lot	a little	not at all
Spontaneous	a lot	a little	not at all
Tense	a lot	a little	not at all
Warm	a lot	a little	not at all

APPENDIX 12

DRUG HISTORY FORM

Sub. # _____

Because the extent of experience with other drugs can affect the way in which an individual responds to a new drug, it is very important for me to know your previous drug-taking history. As is true with all other aspects of the experiment the information is coded in a way that will prevent anyone, including the experimentors, from being able to attach a name to the data. This is strictly confidential.

Please describe the frequency (times per day, week, month, or year); the type (such as beer as opposed to wine, or LSD as opposed to DOM); the dose (such as number of beers, number of "hits" of LSD, number of pills); and the approximate length of time (weeks, months, years) you have used the following drugs.

Alcohol: Frequency _____

Type (beer, wine, whiskey, etc.) _____

Amount on a typical occasion _____

How long have you used alcohol? _____

Marijuana and derivitives: Frequency _____

Type (pot, hash, etc.) _____

Amount on a typical occasion _____

How long have you used this drug? _____

Psychedelics: Frequency _____

Type (LSD, DOM, Mescaline, etc.) _____

Amount on a typical occasion _____

How long have you used psychedelics? _____

Barbiturates and Tranquilizers: Frequency _____

Type (if you know specifically: such as Meprobamate, phenobarbatol, thorazine, etc.) If you do not know specifically list the major category: Barbiturate or Tranquilizer._____

Amount on a typical occasion _____

How long have you used this drug? _____

Amphetemines ("Speed, pep-pills, bennies")

Frequency _____

Type (If you know: such as methaphetemine, dexedrine, benzedrine, etc.) _____

Amount on a typical occasion _____

How long have you used amphetemines? _____

Others: Frequency _____

Type _____

Amount on a typical occasion _____

How long have you used this drug?_____

APPENDIX 13

Sub. # _____

Date _____

POST-EXPERIMENT QUESTIONNAIRE AND SEMANTIC DIFFERENTIAL

In your own words, how would you describe your experiences with the gas?

_____

_____

_____

_____

_____

_____

After I read you the introduction to the experiment what did you anticipate would happen, both in terms of the experiment itself and the effects of the gas?

_____

_____

_____

_____

_____

_____

Were any of these expectations realized? _____

_____

_____

_____

_____

Sub. # _____

Were the initial effects like any other experience? (Please describe)

_____

_____

_____

_____

_____

_____

Have you ever been hypnotized? _____

Do you now, or have you ever, practiced yoga, transendental meditation, alpha brain wave, or other meditational states? (Please specify)_____

_____

After the initial effects of the gas were over did you notice any residual effect (any feelings or sensations that differed from your pre-inhalation state)? Please describe. _____

_____

_____

_____

How long would you estimate that these effects lasted? _____

_____

If you had any adverse feelings (such as headache, cramps, fatigue, boredom, depression, anxiety not related to the experiment) before the experiment began, did you notice any change in them after breathing the gas? Please specify the original feelings and the change, if any._____

_____

_____

Sub. # _____

How did you feel about responding to the snake approach test after breathing the gas? _____

_____

_____

Do you have any guesses as to what the gas you inhaled was?_____

_____

What do you think the purpose of this experiment is?_____

_____

_____

Do you think that the gas in any way altered your fear of snakes? (Please specify) _____

_____

_____

Was there any part of the experiment that was particularly difficult or frightening? (Please describe)_____

_____

_____

Was there any part of the experiment that was particularly easy or pleasant? (Please describe) _____

_____

_____

Would you be willing to participate in similar research in the future?

_____

Sub. # _____

Instructions

The purpose of this questionnaire is to measure the meaning of your experience with the gas used in this experiment. The questionnaire consists of a list of 15 polar opposite words (such as "hot" vs "cold") that have been placed on either end of a 7 point scale. Your task is to place an X at the point on the scale that most nearly describes your experience with the gas at the peak effect. For example, if you feel that the word "hot" is very closely related to your experience you would place an X as shown below:

cold ___: ___: ___: ___: ___: X : ___ hot

or if, on the other hand, you felt that the word "cold" slightly describes your experience you would place an X as shown below:

cold ___: ___: X : ___: ___: ___: ___ hot

The mid-point of the scale should be used when you feel that both of the words equally describe the meaning of your experience or when you feel that neither word is at all descriptive of your experience.

Please work rapidly and do not worry or puzzle over individual items. It is your first impression, the immediate "feelings" about the items, that we want. Please complete all items; do not omit any.

If there are any questions about the questionnaire feel free to ask the experimentor.

Remember, this form is designed to measure the meaning of your experience with the gas at the peak effect.

1. Pleasant ___: ___: ___: ___: ___: ___: ___ unpleasant
2. Smooth ___: ___: ___: ___: ___: ___: ___ rough
3. Powerful ___: ___: ___: ___: ___: ___: ___ weak

4.	Pushing	____:	____:	____:	____:	____:	____:	____	pulling
5.	Calming	____:	____:	____:	____:	____:	____:	____	exciting
6.	Deep	____:	____:	____:	____:	____:	____:	____	shallow
7.	Familiar	____:	____:	____:	____:	____:	____:	____	strange
8.	Soft	____:	____:	____:	____:	____:	____:	____	hard
9.	Safe	____:	____:	____:	____:	____:	____:	____	dangerous
10.	Dark	____:	____:	____:	____:	____:	____:	____	bright
11.	Colorful	____:	____:	____:	____:	____:	____:	____	colorless
12.	Simple	____:	____:	____:	____:	____:	____:	____	complex
13.	Chaotic	____:	____:	____:	____:	____:	____:	____	ordered
14.	Meaningless	____:	____:	____:	____:	____:	____:	____	meaningful
15.	Bad	____:	____:	____:	____:	____:	____:	____	good

If you would like to be notified of the preliminary results of this experiment as well as the name of the gas involved please put your name and address below, it will be separated from the rest of the experiment materials to preserve the confidentiality of all data.

_____

_____

_____

If I have forgotten, remind me to sign your experimental credit card.

THANK YOU VERY MUCH FOR YOUR HELP.

APPENDIX 14

COMPLETE SUMMARY OF THE POST-EXPERIMENT QUESTIONNAIRE

Question	Response	Number of Ss and %	
		Experimental	Control
1 (Immediate effects of the gas)	Psychological effects	30 (100%)	2 (20%)
	Sensory effects	13 (43%)	0
	Physical effects	29 (97%)	3 (30%)
	Not much or no effect	0	8 (80%)
2 and 3 (Expectations and whether the expectations were met or unmet)	Expected reduced fear--met	15 (50%)	2 (20%)
	Expected reduced fear--unmet	1 (3%)	2 (20%)
	Expected no reduced fear-met	5 (17%)	1 (10%)
	Expected no reduced fear-unmet	9 (30%)	2 (20%)
	No answer or no expectations	0	3 (30%)
4 (Initial experience likened to:)	Alcohol	5 (17%)	0
	Marijuana	5 (17%)	1 (10%)
	Other drugs	7 (23%)	0
	Dizzy or faint state	5 (17%)	1 (10%)
	No initial effects	0	1 (10%)
	Not like anything else	8 (26%)	4 (40%)
	No answer	0	3 (30%)
5 (Adverse reactions)	Queasiness or unpleasant dizzyness	6 (20%)	1 (10%)
	Anxious or restless	1 (3%)	3 (30%)
	Other	4 (13%)	0
	No adverse reactions	19 (64%)	6 (60%)
6 (Ever been hypnotized)	Yes	2 (7%)	0
	No	28 (93%)	10 (100%)
7 (Ever practiced yoga, etc.)	Yes	1 (3%)	1 (10%)
	No	29 (97%)	9 (90%)
8 and 9 (Residual effects: 10-15 min. in duration unless noted otherwise.)	Pleasant	2 (7%)	1 (10%)
	Unpleasant	2 (7%)	1 (10%)
	Other	7 (23%)	2 (20%)
	No residual effects	8 (27%)	5 (50%)
	Effects lasting 5 min. or less	7 (23%)	0
	Effects lasting at least 20 min.	4 (13%)	1 (10%)
10 (Any change in adverse feelings)	Psychological	4 (13%)	0
	Physical	0	2 (20%)
	No	26 (87%)	8 (80%)
11 (Feelings about responding at T_1)	Zero or reduced fear	23 (77%)	3 (30%)
	More cautious	4 (13%)	0
	Same as Pre-test	3 (10%)	7 (70%)

Question	Response	Number of Ss and %	
		Experimental	Control
12 (Guesses as to what the gas was)	Inactive agent (i.e., air, O^2)	3 (10%)	4 (40%)
	Active agent other than N_2O	2 (7%)	0
	N_2O	2 (7%)	1 (10%)
	No guesses	23 (76%)	5 (50%)
13 (What was the purpose of the experiment)	As stated in the introduction	21 (70%)	5 (50%)
	Suggestibility test	2 (7%)	1 (10%)
	Motivation test	1 (3%)	1 (10%)
	Test of snake fear: gas irrelevant	1 (3%)	2 (20%)
	Test of gas effects: snake irrelevant	2 (7%)	0
	Substitution of fear with gas	1 (3%)	0
	Some combination of above answers	1 (3%)	0
	Don't know	1 (3%)	1 (10%)
14 (Change in fear altered after the experiment)	A little	6 (20%)	1 (10%)
	More than a little	10 (33%)	0
	No, or only during the gas effects	14 (47%)	9 (90%)
15 (Hardest or most difficult part)	General procedures	0	2 (20%)
	Pre-gas approach test	7 (23%)	2 (20%)
	Gas effects	2 (7%)	0
	None, or no answer	21 (70%)	6 (60%)
16 (Easiest or most pleasant part)	General procedures	5 (17%)	2 (20%)
	T_1 approach test	3 (10%)	2 (20%)
	Gas effects	14 (47%)	1 (10%)
	None, or no answer	8 (26%)	5 (50%)
17 (Willing to participate in similar future research)	Yes	25 (83%)	8 (80%)
	No	2 (7%)	0
	Undecided or no answer	3 (10%)	2 (20%)