A comparison of taped versus live biofeedback assisted relaxation training employing audio or audio and video instruction presentation

Michael Jay Craw

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A COMPARISON OF TAPED VERSUS LIVE BIOFEEDBACK ASSISTED
RELAXATION TRAINING EMPLOYING AUDIO OR AUDIO AND VIDEO
INSTRUCTION PRESENTATION

A Thesis
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Psychology

by
Michael Jay Craw
September 1992
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Approved by:

Frederick Newton PhD (Chair)
Sanders McDougall PhD
Gloria Cowan PhD
Richard Newman MA
ABSTRACT

The current study compared the effects of taped versus live biofeedback assisted relaxation training using an audio only presentation format, or an audio/video presentation format. Fifty subjects were assigned to either a taped training group with audio presentation, a taped training group with audio/video presentation, a live group with audio presentation, a live group with audio/video presentation, or a no treatment control group. The four groups that received training showed significant reductions on measures of heart rate, galvanic skin response, state anxiety, and significant increases in peripheral finger temperature. The control group showed no reductions on measures of arousal. No differences were found between groups for taped or live relaxation training. No differences were found between groups for audio only or audio/video presentation. The results are discussed in terms of cognitive preparation and expectancy effects.
ACKNOWLEDGMENTS

The present study was conducted with the support of the Jerry L Pettis Veterans Administration Hospital to which the author is indebted. A special thanks are also due to the thesis committee members, Frederick Newton PhD, Sanders McDougall PhD, Gloria Cowan PhD, and Richard Newman MA.
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INTRODUCTION

Historically, biofeedback emerged from human and animal studies in which it was shown that the autonomic nervous system could be brought under voluntary control following the application of instrumental conditioning procedures. At this early stage, "biofeedback" as a term had not yet been coined and researchers such as Neal Miller titled such learning studies as visceral training, instrumental training, and augmented sensory feedback (Fuller, 1980). At approximately the same time, other researchers were reporting studies that taught human subjects to bring involuntary physiological responses under voluntary control. Such responses included activity of single motor units (Basmajian, 1983), heart rate, and alpha brain waves (Kamiya, Barber, DiCara, Miller, Shapiro, Stoyva, 1971). The principle unifying these early human studies was that subjects were fed back information about their own physiological activities of which they were normally unaware. Techniques based on this principle constitute the field now generally known as biofeedback (Fuller 1980). Brown gave legitimacy to
the field and also increased public attention to biofeedback by writing two books, *New Mind, New Body* (1974), and *Stress and the Art of Biofeedback* (1977). Since its inception, biofeedback has been shown to be a useful and important technique for many applications and has impacted many related fields.

In a broad sense, biofeedback represents the converging interests of psychosomatic medicine, health psychology, and behavioral medicine. Within these disciplines, biofeedback aims to help an individual produce and maintain a general state of relaxation and increase self awareness of bodily processes. This has been shown to be an effective approach for tension headaches, hypertension, migraines, and chronic anxiety (Fuller, 1980). Biofeedback therapies have also been applied with successful results to bruxism, essential hypertension, spasmodic torticollis, and disorders involving peripheral nervous system damage (Schwartz & Olson, 1987).

In applied settings, biofeedback is most often used in conjunction with relaxation therapies, such as Jacobson's progressive relaxation (Jacobson, 1970), autogenic training (Luthe, 1969), or systematic
desensitization (Wolpe, 1966). Progressive relaxation involves the tensing and relaxing of various muscle groups to induce relaxation, while autogenic training involves focusing on the heaviness and warmth of the extremities that is felt during relaxation. Systematic desensitization involves teaching a phobic patient to inhibit emotional arousal in the presence of the feared stimulus which is presented in increasing intensity.

Biofeedback and relaxation techniques developed separately but now often comprise a unitary approach in clinical and hospital settings. An important consideration in the use of biofeedback assisted relaxation training is whether live relaxation training is superior to taped relaxation training. This question is of considerable importance, since therapists using biofeedback will either use therapist made and commercial tapes or live instruction when teaching patients relaxation training. However, research investigating the physiological effects of taped versus live relaxation training are equivocal.

Reviews of the literature comparing taped relaxation and live relaxation have generally found that live relaxation training is favorable (Borkovec &
Sides, 1979; Lehrer 1982). In analyzing 25 studies that employed progressive muscle relaxation training, Borkovec and Sides found that 73% of the studies finding progressive relaxation superior to a control group used live administration of the procedures. Of the remaining studies that found progressive relaxation equivalent to control procedures, 70% used taped administration of the procedures. It is important to note that this is indirect evidence for the superiority of live training, since out of the 25 articles cited, only two articles (Paul & Trimble, 1970; Paul, 1969; Israel & Bieman, 1977) specifically manipulated live and taped conditions.

Lehrer (1982) also examined the physiological effects of progressive relaxation and concluded that live instruction is superior to taped instruction, especially when the effects of relaxation are measured outside the training session. Lehrer concluded that studies specifically comparing the effects of live versus taped training generally found that live relaxation was more effective.

However, in reviewing studies that specifically manipulated live and taped conditions, it is apparent
that more recent studies have not always favored live training over taped training. Moreover, there have been differences across studies in how live training was operationalized, and disagreement exists regarding the salient components that may make live training preferable. Finally, several studies contain methodological problems and confounding variables. A detailed analysis of these methodological problems in the literature is warranted, as is a discussion of the operational definition of live training.

Response Contingent Feedback

Several researchers defined live training as including a response contingent component so that the subject could control the instructions by signaling the experimenter. Paul (1969) and Paul and Trimble (1970) compared the effects of taped versus live relaxation in two separate studies. In the first study, 60 female students were assigned to either a live abbreviated relaxation condition, a live hypnotically suggested relaxation condition, or a self relaxation condition control group. In the abbreviated relaxation condition, subjects were instructed to focus attention on certain muscle groups and systematically tense and
release each muscle group. In the hypnotically suggested condition, subjects received instructions emphasizing heaviness, relaxation and warmth. Subjects in the control condition were instructed to get as comfortable as possible and rest quietly without going to sleep. The group receiving abbreviated relaxation training showed the greatest reduction in physiological arousal.

To assess the effects of taped versus live relaxation training, data from the previous live relaxation study were compared to a second study where 50 subjects were assigned to either a taped abbreviated relaxation training condition, a taped hypnotically suggested relaxation condition, or a self relaxation control condition. The procedures for this study were identical to the first study, except instructions were presented via recorded tapes in the experimenter's absence. The primary difference between taped and live instruction was that progression to the next muscle group or hypnotic suggestion, in the live condition, was contingent upon the subject's report that relaxation had occurred.
The live instructions were superior in reducing arousal, although no differences were found on subject self report measures. Paul and Trimble (1970) suggested that the presence of response contingent feedback, where the experimenter did not proceed to the next muscle group until the current muscles were relaxed, explains why the live group was superior in reducing physiological arousal.

Riddick and Meyer (1973) included a response contingent component in an automated relaxation condition and found that the automated group performed as well as a live group on measures of heart rate and gross motor activity. This study differs from the other studies in that a loud speaker was used to present the relaxation instructions instead of a tape recording in the automated condition. The automated condition was response contingent in that motion detectors provided auditory feedback for gross motor activity, and the subject could signal for additional tense release cycles.

The above research (Paul & Trimble, 1970; Riddick & Meyer, 1973) which tested the effects of taped versus live relaxation training generally found that response
contingent feedback was the salient component in live training that explained its superiority over taped training. Generally, these researchers allowed the subjects in the live condition to signal for more tension release cycles if the current muscle group was not relaxed. Hamberger and Schuldt (1986) suggested that defining response contingent feedback in this way represents a confound since subjects in the live condition could receive up to four additional tense release cycles compared to the taped conditions. The superiority of the live training could then be due to the subject's increased opportunity to practice. Defined in this way, response contingent feedback represented differential amounts of training between groups and not subject control.

Hamberger and Schuldt (1986) manipulated response contingent conditions in which subjects in the live group could signal for increased time to explore the current instruction which controlled for differential amounts of training between groups. Therefore, response contingent feedback referred to subject pacing of the procedures. However, when response contingent feedback was defined in this way, no differences were
found between groups. Since research testing live versus taped relaxation training has yielded no consistent findings with regard to response contingent feedback and subject control components, it is important to study the effect of the therapists role in the live condition in terms of timing of instruction delivery.

**Active Versus Passive Therapist**

While there have been no studies manipulating timing of delivery, several studies varied the presence of an active therapist who provided positive expectancy and suggestions to facilitate relaxation. Borgeat, Hade, Larouche, and Bedwani (1980) manipulated the presence of a passive versus active therapist in this manner and found no differences between groups. Wolfe (1977) compared therapist administered versus patient administered EMG biofeedback training and found no differences between groups. However, these two studies did not have the therapist administer relaxation exercises. Instead, the therapist in the active condition gave suggestions to facilitate relaxation and provided positive expectancy.
No research to date has varied the presence of an active therapist who delivers instructions live, versus a passive therapist who delivers the instructions via audio cassette. The salient component of live training would be an active therapist who varies the timing of the instructions to match the subject's progress. For example, during progressive relaxation, the therapist might instruct the subject to tense the shoulder muscles. The active therapist would not proceed to the next instruction until the therapist observed the gross motor activity of the subject and determined that the subject had complied with the last instruction. Defined in this way, live training would allow the greatest flexibility and accuracy in administration of the instructions. This condition could be compared to a passive therapist who delivers the instructions via audio cassette, where the pacing of instruction is standardized.

The rationale for this approach in relaxation training can be extrapolated from literature on interviewing techniques and procedure explanation. It has been found that live interviews provide optimal flexibility in the administration of questionnaires and
procedures compared to other approaches such as paper and pencil or telephone interview (Tilden, Beckman, & Murray, 1989). Furthermore, live training would allow the experimenter to detect subtle movements and gross motor activity from the subject so that a determination could be made as to whether the instructions are being followed. The experimenter would then be able to vary the timing of the instructions to match the subject's pace. In a taped condition where the delivery is constant, subjects may fall behind or be less inclined to comply with the instructions.

Another topic pertinent to taped and live training is the placebo effect and how it may operate differentially in these procedures. In a biofeedback assisted relaxation training situation there may be two sources of placebo, from the cognitive preparation, and from the delivery procedures themselves. The importance of balancing placebo effects by providing the same cognitive preparation and expectancy between groups was demonstrated by Stefanek and Hodes (1986) and will be discussed in detail in a later section. The second source of placebo in the current study is from the taped and live procedures themselves. Greater
placebo effects would be expected in the live group compared to the taped group because of the differences in amount of interpersonal contact. This difference in placebo may provide a further rationale for live training compared to taped training.

Furthermore, research on physiological changes occurring during psychotherapy may also provide a rationale for live relaxation training. Borgeat and Elie (1991) discuss non specific factors related to psychotherapy such as positive therapeutic relationship, and favorable expectancies toward the therapist and treatment. These factors are also presumed to operate in the biofeedback situation, and may be enhanced through live training compared to taped training. It has also been found that a positive therapeutic relationship is associated with lower physiological arousal (Glucksman, 1985; Kirtz & Moos, 1974). Borgeat and Elie (1991) found that low levels of frontal EMG with response to a live therapist were positively correlated with headache improvement on follow-up.
Experimenter Presence Versus Absence

Israel and Bieman (1977) also directly tested the effects of taped versus live relaxation training, but experimenter presence was confounded with the taped and live conditions, according to Hamberger and Schuldt (1986). Israel and Bieman (1977) trained three groups: a live relaxation group, a taped relaxation group, and a self relaxation group, across three sessions of abbreviated progressive relaxation training. All conditions experienced significant reductions in arousal, but no differences were found between groups in terms of physiological variables.

Bieman, Israel, and Johnson (1978), in a second study, examined the effects of live versus taped relaxation instructions using four groups; a live relaxation condition, a taped relaxation condition, a self relaxation condition, and an electromyograph biofeedback condition. Live relaxation training resulted in greater reductions on measures of heart rate and galvanic skin response (GSR) compared to taped relaxation training. In addition, the live relaxation group reported greater relaxation on subjective measures of tension on all but the fifth session.
Russell, Sipich, and Knipe (1976) ran two sessions of training with undergraduate females and found live instruction superior to taped instruction. Specifics regarding cognitive preparation of subjects was not reported in the study. Additionally, the experimenter was present in the live condition but not in the taped condition. The reasons for such an arrangement are not explained.

In examining the above studies i.e., (Paul & Trimble 1970; Russell et al., 1976) Hamberger and Schuldt (1986) suggested that taped and live instructions had been confounded with experimenter presence. In several other studies (Bieman et al., 1978; Israel & Bieman, 1977; Riddick & Meyer, 1973) it was not reported whether or not experimenter presence was controlled for, suggesting that subjects had generally been left alone in taped conditions. The interpretation of these studies is problematic since the group differences could be due to either live versus taped training, or experimenter presence versus absence.

Hamberger and Schuldt (1986) conducted an experiment manipulating experimenter presence versus
absence. Subjects were assigned to either a taped progressive relaxation condition with experimenter present, a taped progressive relaxation condition with experimenter absent, a taped didactic condition with experimenter present, or a taped didactic condition with experimenter absent. The taped didactic conditions provided discussion of relaxation with no practice and served as a control. Both relaxation groups performed significantly better on both EMG measures and subjective report compared to the control condition. Experimenter presence did not affect amount of relaxation.

While Hamberger and Schuldt (1986) were unable to reliably show that experimenter presence versus absence affects arousal in a relaxation training situation, social facilitation has shown that the presence of even a single observer can affect performance of many tasks (Zajonc, 1965). Beckman, Murray, and Pavlov (1987) argued that it is not mere presence, but the amount of interpersonal contact that can affect response styles. Guerin (1986) found that the presence of an observer can have an effect on the performance of a motor task, while Social Influence Theory has shown that subjects
look to observers in ambiguous situations to determine reality or degree of social desirability (Aronson, 1972).

Borgeat, Bernard, Larouche, and Bedwani (1980) varied therapist presence versus absence and found that therapist presence led to higher EMG levels in a population of headache sufferers. However, both conditions resulted in reductions on subjective headache intensity and the authors concluded that there may be a desirable balance between therapist presence and absence. Experimenter presence may facilitate placebo effects, thus enhancing performance for some subjects, while having an experimenter present could be disturbing for other subjects. Until further research has specifically determined the effect of experimenter presence versus absence on relaxation and biofeedback training situations, it would be prudent to either manipulate presence versus absence or hold the variable constant.

Cognitive Preparation

Another procedural variable that has not been given appropriate attention is cognitive preparation of subjects. Differences in effectiveness between taped
and live relaxation training might be the result of differences in expectancy for success (Stefanek & Hodes, 1986). Therefore, cognitive preparation should be standardized between groups throughout the training to balance expectancy effects. Typically, details about how subjects were cognitively prepared were not reported in previous studies (Bieman et al., 1978; Hamberger & Schuldt, 1986; Israel & Bieman, 1977; Paul, 1969; Paul & Trimble, 1970; Riddick & Meyer, 1973; Russell, Sipich, & Knipe, 1976) making it difficult to determine if this variable was held constant between conditions.

Research indicates that when positive expectancy is varied between groups, the group given a higher initial level of expectation will evidence lower arousal (Shaw & Blanchard, 1983). Stefanek and Hodes (1986) manipulated high and low levels of expectancy and found that relaxation was greatest when conducted in a context of high expectancy for change. Stefanek and Hodes further assert that previous research comparing live and taped procedures are confounded by varying expectancy levels inherent in these procedures.
Audio and Video Relaxation Formats

In addition to testing the effects of taped versus live relaxation using audio instruction, the effects of visual stimuli presented on videocassette used in conjunction with audio relaxation was tested. At the time of this study there were no experiments investigating the effects of relaxation exercises presented on video cassette that include relaxing nature scenes. However, such video tapes are available commercially, as is a computer based biofeedback system that presents nature scenes in a multimedia format. The rationale for developing relaxation display formats that present nature scenes is that most people learn new skills more effectively through an audiovisual environment (Bittman, 1992). A corollary purpose of the present study was to compare this newer video relaxation format with the more common audio cassette format.

The current study was conducted in order to resolve the apparent conflict in the literature regarding the effects of taped versus live relaxation training and how it is operationalized. The salient component of live training was the presence of an
active therapist who delivers instructions and varies the timing of delivery contingent upon the subjects' performance. This condition was compared to a taped condition that received the same instructions with a therapist present, where the pacing of delivery is standardized by the audio cassette. To ensure that taped and live conditions were not confounded with experimenter presence or absence, the experimenter was present in all conditions. All groups received the same cognitive preparation on the first session which was presented live by the experimenter.

The present study measured five dependent variables: Frontalis electromyograph (EMG), peripheral finger temperature, heart rate, galvanic skin response (GSR), and self-report responses to the State portion of the State Trait Anxiety Inventory (Spielberger, Gorus, Lushene, Vagg and Jacobs, 1983). Frontalis EMG biofeedback has been found to be effective in treating muscle tension headaches, and for generalized body relaxation (Budzynski, 1973). Peripheral finger temperature has been used for general relaxation and the control of migraine headaches (Fuller, 1980), while high levels of galvanic skin response have been
positively correlated with arousal (Schwartz, 1987). Increased heart rate is also strongly associated with anxiety and arousal (Basmajian, 1983) and therefore provides an accurate measure of the effectiveness of a relaxation program.

In addition to these physiological dependent variables, self report anxiety will also be measured with the State portion of the State Trait Anxiety Inventory (Spielberger, et al., 1983). The State Trait Anxiety Inventory has been widely used in research and clinical practice to assess anxiety in medical, surgical, and psychiatric patients. State anxiety refers to how a person perceives an immediate situation in terms of apprehension, tension, nervousness, and worry (Spielberger et. al., 1983). Scores on State anxiety typically decrease as a result of effective relaxation training. Trait Anxiety refers to more enduring individual differences in proneness to anxiety, which would not be expected to change as the result of a short term relaxation program.

The current study was conducted to test the following hypotheses: 1.) Subjects receiving biofeedback assisted relaxation training would evidence
greater relaxation than subjects in a control condition as measured by decreases in frontalis EMG, galvanic skin response, heart rate, and increases in peripheral finger temperature. 2.) Subjects receiving biofeedback assisted relaxation training would evidence greater decreases in self report anxiety than subjects in a control condition as measured by the State portion of the State Trait Anxiety Inventory. 3.) Subjects receiving live relaxation training would evidence greater relaxation than subjects receiving taped relaxation training as measured by decreases in frontalis EMG, galvanic skin response, heart rate, and increases in peripheral finger temperature. 4.) Subjects receiving live relaxation training would evidence greater decreases in self report anxiety than subjects receiving taped relaxation training as measured by the State portion of the State Trait Anxiety Inventory. 5.) Subjects receiving audio plus video relaxation training would evidence greater relaxation than subjects receiving audio relaxation training, as measured by frontalis EMG, galvanic skin response, heart rate and increases in peripheral finger temperature. 6.) Subjects receiving audio plus video
relaxation training would evidence greater decreases in self report anxiety than subjects receiving audio relaxation training as measured by the State portion of the State Trait Anxiety Inventory.
METHODS

Subjects

Fifty male subjects from an in-patient addiction treatment unit in a Veterans Administration Hospital participated in the study. Subjects were randomly assigned to one of five experimental groups (n=10). As necessary, consent was obtained from the human subjects and research committee at the Jerry L Pettis Veterans Hospital, and from the human subjects committee at California State University San Bernardino. All subjects were treated in accordance with the ethical guidelines of the American Psychological Association.

Apparatus

The physiological variables were measured by a J&J I-330 computerized biofeedback system connected to a 286 IBM compatible microcomputer. A J&J M-301 electromyogram module measured EMG from the frontalis muscle and was set on a narrow band pass filter width of 100-200 HZ, with a range setting of 0-100 microvolts. A J&J P401 plethysmograph module (heart rate) measured the pulse waveform between peaks and converted the time interval to a voltage representing
heart rate with a range of 0 to 200 beats per minute. A J&J T-601 module was used to measure electrodermal gram (EDG) using a voltage constant of 0.166 VDC within a range of 0 to 50 micromhos. A second J&J T-601 module was used to measure peripheral finger temperature within a range of 60 to 100°F. To provide the subjects with feedback, signals were displayed on a 13 inch Enhanced Graphics Adapter (EGA) color monitor. The feedback display consisted of four horizontal bars that moved to the right as physiological measures increased and to the left as the measures decreased. To the right of the screen were digital readouts of each measure. No auditory feedback was used.

Sessions were conducted in a room measuring 4x5 meters. There was a vinyl covered recliner and a table that contained the biofeedback apparatus in the center of the room. Also contained in the room was a chair in which the experimenter sat. During sessions, the experimenter sat 0.5 meter away on the subject's right side. Other items used during sessions were relaxation tapes on audio cassette and VHS video cassette, electrode gel, silver/silver chloride EMG electrodes, porous tape, a Panasonic VCR with a 20 inch TV monitor,
and a Realistic SCT-100 cassette deck. Connected to the cassette deck were two Radio Shack amplified speakers.

**Procedure**

Subjects were assigned by randomization to one of five groups: A live biofeedback training group with audio instruction presentation, a live biofeedback training group with audio and video instruction presentation, a taped biofeedback training group with audio instruction presentation, and a taped biofeedback training group with audio and video instruction presentation, and a no treatment control group. All groups had an experimenter present during the sessions.

In the first treatment session, the experimenter first randomly assigned the subject to one of the five groups, then cognitive preparation was delivered to the subject from the audio cassette, *Introducing Patients to Biofeedback Assisted Relaxation* by Schwartz (1978). This audio cassette was dictated to manuscript and was presented live to each subject on the first session by the experimenter.

The experimenter then cleaned the forehead with rubbing alcohol and applied electrode gel, followed by
a surface adhesive electrode placement on the frontalis muscle approximately 2 cm above the eyebrow. A photoplethysmograph was connected to the left index finger to measure heart rate, and a temperature sensor was attached to the left middle digit with porous tape to measure peripheral finger temperature. Galvanic skin response (GSR) sensors were placed on the middle pads of the index finger and the middle finger of the right hand using silver/silver chloride electrodes with a small amount of electrode gel.

Subjects were then introduced to the feedback display with explanation as to the meaning of the bar graphs and number displays (see appendix 1). Subjects then received a three min prebaseline session with feedback (the screen was left on and physiological variables were recorded). The following relaxation exercises were used in the following order for audio conditions and were either presented live or taped: 1. Breathing, The Basic Elements of the Quieting Response (Stroebel, 1979), 2. Tense Slow Relax (Budzynski, 1974), 3. Arms and Legs Heavy and Warm (Budzynski, 1978), and 4. Stress Control (Budzynski, 1978). To enhance the effects of the relaxation exercises, the
above order was chosen so that the exercises progressed in complexity across the sessions rather than presenting the sessions in counterbalanced order.

For the video taped condition, the same relaxation exercises were presented and the following video stimuli accompanied the instructions: sessions 1 and 2, *Sierra Spring* (Halpern, 1984) and sessions 3 and 4, *Loon Country by Canoe* (Gibson, 1987). In the live condition for video and audio, instructions were read out loud by the experimenter. In the taped condition for video and audio, instruction were presented on audio cassette. For the control condition, subjects were measured on pre and post baseline sessions five days apart and received no relaxation training. Subjects in the control condition were instructed to sit quietly with their eyes open.

Following each session, a three minute post-baseline was recorded with feedback. The difference between live and taped conditions, is that in the live conditions, the experimenter was actively involved in presenting the instructions and varied the timing of the instructions to match the subject's needs. For example, if the instruction involved tensing the neck
by pushing the head back into the chair, the
experimenter would observe gross motor activity of the
subject to ensure that the instruction was followed
before proceeding to the next instruction. This
component was in place in both live groups for both
audio cassette and video cassette conditions.

Subjects were instructed not to talk during the
training sessions to avoid artifact in the frontalis
EMG recording site. In addition, subjects in the taped
and live condition receiving audio training may have
had a tendency to close their eyes compared to subjects
in the video taped condition, which could have lead to
a possible confound in the interpretation of the
results. Therefore, subjects in all groups were
instructed to keep their eyes open.
RESULTS

To determine whether there were differences between groups, means were computed for each dependent variable across the four training sessions. This data was further analyzed in a 2(taped or live) X 2(audio or audio plus video) multivariate analysis of variance. No differences were found between groups on measures of frontalis EMG, galvanic skin response, heart rate, or state anxiety, F(1,12) = .628, p > .05. There was also no interaction. In analyzing temperature data using univariate analysis of variance between groups, there was a significant difference between the live conditions (M = 91.08, SD = 1.71, M = 90.26, SD = 1.88) and the taped conditions (M = 86.93, SD = 3.61, M = 86.94, SD = 5.15), F(1,12) = 4.11, p < .01.

However, in analyzing baseline data, it appeared that these differences in temperature were present before training and represented a sampling error, or a failure in randomization. A covariate was calculated using baseline data for temperature to partial out the variation between groups present at the beginning of treatment. When the temperature data was re-analyzed,
Table 1. Means and Standard Deviation EMG in microvolts.

<table>
<thead>
<tr>
<th>Training Gr</th>
<th>Ses</th>
<th>Pre M</th>
<th>SD</th>
<th>Trt M</th>
<th>SD</th>
<th>Post M</th>
<th>SD</th>
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<tbody>
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<td>Taped/Audio</td>
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<td>2.96</td>
<td>1.74</td>
<td>3.07</td>
<td>1.33</td>
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<tr>
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<td>3.58</td>
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</table>

no differences were found between groups, $F(3,35) = 2.05$, $p > .05$. Table 1 presents means and standard deviations for EMG. Means for heart rate are presented in Table 2, and means for GSR and temperature are presented in Tables 3 and 4, respectively.

To test whether the treatment groups experienced significant reductions in physiological arousal, means were calculated for each physiological dependent
variable across each pre and post baseline for the four sessions and analyzed using repeated measures analyses of variance. The four treatment groups showed significant reductions in galvanic skin response, \( F(1,36) = 177.88, p < .01 \), heart rate, \( F(1,36) = 29.69, p < .01 \), and an increase in temperature, \( F(1,36) = 54.40, p < .01 \). No changes were found pre and post on measures of EMG, \( F(1,36) = 3.17, p > .05 \). A Repeated measures analysis of variance was also calculated on pre and post self report anxiety. All four groups showed significant decreases in State anxiety, \( F(1,36) = 50.13, p < .01 \).

The no treatment control group was also tested on pre and post baselines with repeated measures analysis of variance on the physiological dependent variables and self report anxiety. No changes were found on pre and post baselines for EMG, \( F(1,9) = 1.11, p > .05 \), peripheral finger temperature, \( F(1,9) = .00, p > .05 \), galvanic skin response, \( F(1,9) = .20, p > .05 \), heart rate, \( F(1,9) = .62, p > .05 \), or state anxiety, \( F(1,9) = .13, p > .05 \). Table 5, presents means and standard deviations for state anxiety for the experimental and control group.
To assess whether there were group differences following each session, means were calculated across the four post baselines and analyzed between groups using multiple analyses of variance. No differences were found between groups on post baseline data for the experimental groups, $F(4,33) = .99$, $p > .05$.

Table 2. Means and Standard Deviations for HR in BPM.

<table>
<thead>
<tr>
<th>Training Gr</th>
<th>Ses</th>
<th>Pre M</th>
<th>Pre SD</th>
<th>Trt M</th>
<th>Trt SD</th>
<th>Post M</th>
<th>Post SD</th>
</tr>
</thead>
<tbody>
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</table>

To assess whether the control group differed from the experimental groups on measures of arousal, multiple analyses of variance was performed using data
from the post baselines. No differences were found between the experimental groups and the control group on post baseline measures of EMG, $F(4,45) = .640$, $p > .05$, or galvanic skin response, $F(4,45) = 1.70$, $p > .05$, or temperature, $F(4,45) = 1.24$, $p > .05$. There was a significant difference between groups on measures of heart rate, $F(4,45) = 3.68$, $p < .01$, and State.

Table 3, Means and Standard Deviations for GSR in micromhos.

<table>
<thead>
<tr>
<th>Training Gr Ses</th>
<th>Pre M</th>
<th>SD</th>
<th>Trt M</th>
<th>SD</th>
<th>Post M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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anxiety, $F(4,45) = 3.46$, $p < .05$. Post hoc comparisons were performed using one way analyses of variance and
the least significant difference procedure at the .05 level. The control group scored significantly higher on measures of State anxiety compared to the taped/audio group, the live/audio group, and the live/video group. There were no differences on State anxiety between the control group and the taped/video group. For heart rate the control group was significantly higher on measures of heart rate compared to the live/video group and the taped/video group.
There were no differences between the control group and the live/audio group or the taped/audio group.

Figures one through 4 present graphs for each physiological dependent variable across four sessions of training. Figures 5 through 9 present graphs on pre and post baselines for each dependent variable for the experimental and control conditions.

Table 5, Means and Standard Deviations for State Anxiety.

<table>
<thead>
<tr>
<th>Training Group</th>
<th>Pre M SD</th>
<th>Post M SD</th>
</tr>
</thead>
<tbody>
<tr>
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<td>29.7 6.81</td>
</tr>
<tr>
<td>Live/Audio</td>
<td>40.70 6.18</td>
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<td>37.5 11.81</td>
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</tr>
<tr>
<td>Control</td>
<td>42.7 13.76</td>
<td>44.0 13.7</td>
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</tbody>
</table>

35
Figure 1, EMG By Trials
Figure 2, GSR by Trials

GSR in micromhos

---

TAPED/AUDIO  LIVE/AUDIO  TAPED/VIDEO  LIVE/VIDEO
Figure 3, HR by Trials
Figure 4, Temp by Trials

Temp in degrees F

- TAPED/AUDIO
- LIVE/AUDIO
- TAPED/VIDEO
- LIVE/VIDEO
Figure 5, EMG Pre Post Baseline
Figure 6, GSR Pre Post Baseline

![Graph showing GSR Pre and Post data with different conditions: Taped/Audio, Live/Audio, Taped/Video, Live/Video, and Control. The graph indicates a decrease in GSR (in micromhos) from Pre to Post.](image)
Figure 7, Heart Rate Pre Post

heart rate in beats per minute

HR PRE  HR POST

--- TAPED/AUDIO  --- LIVE/AUDIO  --- TAPED/VIDEO  --- LIVE/VIDEO

CONTROL
Figure 8, Temp Pre Post
Figure 9, State Pre Post
DISCUSSION

The present study was conducted to determine the effect of several relaxation presentation techniques on physiological arousal and self report of anxiety. Hypothesis 1, that subjects receiving biofeedback assisted relaxation training would evidence greater relaxation than subjects in a control condition, was supported. Subjects in the four training conditions evidenced significant reductions in heart rate and GSR, and significant increases in peripheral finger temperature while the control condition, showed no significant decrease in physiological arousal. Hypothesis 2, that subjects receiving biofeedback assisted relaxation training would evidence greater decreases in self report anxiety compared to a control condition was also supported. The subjects receiving biofeedback assisted relaxation training showed significant decreases on the State portion of the State Trait Anxiety Inventory, whereas the control group actually showed a slight increase in State anxiety.

Hypothesis 3, that subjects receiving live biofeedback assisted relaxation training would evidence
greater relaxation than subjects receiving taped biofeedback assisted relaxation training was not supported. In addition, no differences were found between groups receiving live and taped instruction on subjective measures of tension, lending no support to hypothesis 4. These findings agree with Hamberger and Schuldt (1986) who also found no differences between taped and live relaxation training conditions on physiological arousal and self report tension. The present study differs from Hamberger and Schuldt in the manner in which live training was operationalized. The present study defined live training as having an active therapist present who varied the timing of the instruction. Hamberger and Schuldt, on the other hand, allowed the subject to signal for more time to explore the current instruction. The two studies are similar in that therapist presence was controlled for by maintaining presence in taped and live conditions.

The present study disagrees with the rather consistent finding (Bieman et al., 1978; Israel & Bieman, 1977; Paul & Trimble, 1970) that live training is superior to taped training. The methodological differences between these studies and the present study
include how live training was defined, and the fact that many previous studies confounded taped and live conditions with experimenter presence. The above studies focused on subject control of the procedures in defining live training, whereas the current study focused on the experimenters ability to facilitate relaxation in live training.

In attempting to explain the above results, it is important to discuss the therapeutic relationship and expectancy as it relates to relaxation training. Research has indicated that a positive therapeutic relationship is associated with lower autonomic arousal (Glucksman, 1985). Based on the increased amount of interaction between the experimenter and subject in live training, it was expected that the therapeutic relationship would be enhanced, thus leading to greater relaxation in the live groups. Contrary to this assumption, it appears that the degree of rapport between experimenter and subject is more a function of cognitive preparation and expectancy during the initial sessions of treatment, than is mode of instruction delivery. Indeed, Borgeat et al., (1991) found that low levels of frontal EMG in response to the
therapist's presence on the first session of training, was the best predictor of favorable symptom improvement. To further support this position, Stefanek and Hodes (1986) found that subjects receiving either high or low expectancy for improvement on the first session of relaxation training affected treatment outcome, while taped and live procedures had no differential effects on arousal.

These two studies taken together suggest that non-specific factors leading to an enhanced therapeutic relationship and increased expectant faith (placebo) are closely tied to the interaction between the therapist and client on the initial stages of treatment. While this seems to be a consistent finding in the literature on psychotherapy and biofeedback, there is less evidence that treatment outcome is determined by mode of instruction delivery.

If this conclusion is acceptable, that amount of placebo and therapeutic rapport are the result of early contact and cognitive preparation, it should be noted that the current study stringently controlled for differences in cognitive preparation between groups so that the effect of mode of instruction delivery could
be observed. In a discussion of the placebo effect in biofeedback, Frank (1982) asserts that elimination of the placebo component of any technique would lead to an underestimation of its clinical value, since the placebo response operates synergistically with biofeedback techniques. It was this strict control over the placebo effect, related to cognitive preparation, that led to the results of the present study.

A drawback of the present study is that subjective ratings regarding the therapeutic relationship and instruction delivery procedures were not taken. It is therefore not possible to determine if perceptions regarding the experimenter or mode of instruction delivery were related to physiological response patterns. One of the most accurate predictors of therapeutic change in psychotherapy is the clients perceptions of the therapeutic relationship (Hartley and Strupp, 1983). Since biofeedback can be referred to as instrument aided psychotherapy (Frank, 1982) future research should assess the subject's perceptions of the therapeutic alliance and relaxation procedures.
Hypothesis 5, that subjects receiving audio and video instruction presentation would relax more than subjects receiving audio only instruction presentation, was not supported. No differences were found between audio/video instructions and audio only instructions on measures of physiological arousal. There were also no differences between these conditions on self report anxiety, lending no support to hypothesis 6. These results disagree with Bittman (1992) who suggested that learning relaxation should be more effective in an audio/visual presentation.

The groups receiving audio/video presentation actually evidenced greater frontalis EMG compared to the audio only conditions. While these differences were not significant, it can be asserted that the audio/video conditions experienced greater frontalis muscle tension because of the increased eye movements necessary to attend to both the biofeedback display and nature scene display. Future research should attempt to integrate the biofeedback display with the nature scenes on the same display so that eye movements are kept to a minimum.
As the PC becomes more common, the new multimedia based system known as Mindscope, which allows a subject's physiology to actually control the progression of nature scenes, may prove to be a more natural way to learn relaxation. While the current study does not support the audio/video relaxation format, it should be pointed out that the differences between mindscope and videocassette format are many. Future research should empirically test the new multimedia format as a viable method for teaching relaxation.
Appendix 1, Supplement to cognitive preparation regarding biofeedback display.

I would like to introduce you to the biofeedback display. The bar graph on the top of the screen is your muscle tension. Your goal during the training is to keep the bar below the threshold, which is marked by a "T" on the screen. The next bar graph is measuring sweat activity, and again your goal is to keep the bar below the "T". Next is your heart rate. There is no threshold set for your heart rate, but try to see if you can get it to decrease during the training. This will indicate that you are relaxing. The last bar at the bottom is your skin temperature. Remember, the warmer your hands are the more relaxed you are. As you can see, there is a threshold set at 90 °F. Your goal is to keep the bar above the threshold during the training for temperature.
REFERENCES


