INFORMATION TO USERS

While the most advanced technology has been used to photograph and reproduce this manuscript, the quality of the reproduction is heavily dependent upon the quality of the material submitted. For example:

- Manuscript pages may have indistinct print. In such cases, the best available copy has been filmed.
- Manuscripts may not always be complete. In such cases, a note will indicate that it is not possible to obtain missing pages.
- Copyrighted material may have been removed from the manuscript. In such cases, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, and charts) are photographed by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each oversize page is also filmed as one exposure and is available, for an additional charge, as a standard 35mm slide or as a 17”x 23” black and white photographic print.

Most photographs reproduce acceptably on positive microfilm or microfiche but lack the clarity on xerographic copies made from the microfilm. For an additional charge, 35mm slides of 6”x 9” black and white photographic prints are available for any photographs or illustrations that cannot be reproduced satisfactorily by xerography.
Progressive relaxation: A meta-analysis

Paterson, Chris Edward, Ph.D.

The Ohio State University, 1987

Copyright ©1987 by Paterson, Chris Edward. All rights reserved.
PROGRESSIVE RELAXATION: A META-ANALYSIS

Dissertation

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of the Ohio State University

By

Chris Edward Paterson, A.A., B.S., M.A.

* * * * *

The Ohio State University
1987

Dissertation Committee:
P. S. Highlen
R. K. Russell
W. B. Walsh

Approved by

Adviser

Department of Psychology
To My Father And Mother
ACKNOWLEDGEMENTS

I would first like to express sincere appreciation to Dr. Richard K. Russell who has been my greatest asset and an excellent mentor throughout my graduate career at Ohio State University. Similarly, Committee Members Dr. Pamela S. Highlen and Dr. W. Bruce Walsh provided thoughtful guidance and support during the last five years and throughout the dissertation process. I would also like to recognize Dr. Terry F. Pettijohn as the individual who brought me into the field of psychology and excited me about pursuing graduate work. The staff at University of Florida Psychological and Vocational Counseling Center provided an atmosphere during my internship conducive to personal and professional development and the completion of my degree.

My parents, William and Betty Paterson, provided all of the inspiration, faith, love, and support necessary for the completion of a Ph.D. The rest of my immediate family, Jane, Roger, Lori, and Erin Ruth, and Dick, Mary, Susanna, and Amy Paterson have been beside me with the same level of devotion. Finally, supportive friends make all the difference during challenging times. Among those I would thank are Mark Harris, Peg Mortensen, Elmer Schulz, Mike Murphy, Steve Gravenkemper, Fran Davis, and Robin August. Go Buckeyes.
VITA

July 21, 1960 .................. Born – Marion, Ohio

1981 .................. A.A., Ohio State University, Marion, Ohio

1982 .................. B.S., Ohio State University, Columbus, Ohio

1984 .................. M.A., Ohio State University, Columbus, Ohio, Counseling Psychology

1982-1986 .................. Graduate Administrative/Teaching Assistant, Ohio State University, Columbus, Ohio

1985-1986 .................. Adjunct Lecturer, Capital University, Columbus, Ohio

1986-1987 .................. Predoctoral Intern, Psychological and Vocational Counseling Center, University of Florida, Gainesville, Florida

1987- .................. Assistant Professor, Department of Educational and Psychological Studies, University of Miami, Coral Gables, Florida
PUBLICATIONS


FIELDS OF STUDY

Major Field: Counseling Psychology
Other Coursework Emphasis: Quantitative Psychology
# TABLE OF CONTENTS

**DEDICATION** ........................................................................................................... ii

**ACKNOWLEDGMENTS** ............................................................................................. iii

**VITA** .......................................................................................................................... iv

**LIST OF TABLES** ........................................................................................................ ix

**CHAPTER** ..................................................................................................................

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>II. LITERATURE REVIEW</td>
<td>4</td>
</tr>
</tbody>
</table>

**Progressive Relaxation** ......................................................................................... 4
**Definition** ............................................................................................................... 5
**Brief Description** .................................................................................................... 5
**Physiological and Psychological Systems** .................................................................. 6
**Clientele** .................................................................................................................. 6
**Treatment Providers** ................................................................................................ 8
**History** ....................................................................................................................... 8
**Procedure** ................................................................................................................ 10
**Jacobson** ................................................................................................................ 10
**Wolpe** ...................................................................................................................... 12
**Bernstein and Borkovec** .......................................................................................... 13
**Other Adaptations** .................................................................................................... 15
**Alternative Procedures** ............................................................................................ 15
**Progressive Relaxation as a Procedural Enhancement** .............................................. 15
**Progressive Relaxation Enhanced by Other Procedures** ........................................... 16
**Cue-controlled relaxation** ........................................................................................ 16
**Biofeedback** ............................................................................................................. 17
**Imagery** ..................................................................................................................... 18
**Effectiveness** .............................................................................................................. 19
**Results of Other Reviews** ........................................................................................ 19
**Systematic desensitization** ....................................................................................... 19
**Progressive relaxation** .............................................................................................. 20
**Cue-controlled relaxation** ........................................................................................ 21
**Biofeedback** ............................................................................................................. 24

vi
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progressive relaxation with biofeedback</td>
<td>25</td>
</tr>
<tr>
<td>Summary</td>
<td>27</td>
</tr>
<tr>
<td>Theory</td>
<td>27</td>
</tr>
<tr>
<td>Jacobson</td>
<td>27</td>
</tr>
<tr>
<td>Mathews and Gelder</td>
<td>28</td>
</tr>
<tr>
<td>Davidson and Schwartz</td>
<td>29</td>
</tr>
<tr>
<td>Other theories</td>
<td>31</td>
</tr>
<tr>
<td>Summary</td>
<td>32</td>
</tr>
<tr>
<td>Components Analysis</td>
<td>32</td>
</tr>
<tr>
<td>Moderating Variables</td>
<td>34</td>
</tr>
<tr>
<td>Live Versus Taped Administration</td>
<td>35</td>
</tr>
<tr>
<td>Individual Versus Group Instruction</td>
<td>37</td>
</tr>
<tr>
<td>Therapist Experience</td>
<td>38</td>
</tr>
<tr>
<td>Duration of Training</td>
<td>38</td>
</tr>
<tr>
<td>Home Practice</td>
<td>39</td>
</tr>
<tr>
<td>Population</td>
<td>40</td>
</tr>
<tr>
<td>Client Position</td>
<td>41</td>
</tr>
<tr>
<td>Treatment Rationale</td>
<td>41</td>
</tr>
<tr>
<td>Summary</td>
<td>41</td>
</tr>
<tr>
<td>Meta-Analysis</td>
<td>42</td>
</tr>
<tr>
<td>Definition</td>
<td>42</td>
</tr>
<tr>
<td>History</td>
<td>42</td>
</tr>
<tr>
<td>Procedural Synopsis</td>
<td>45</td>
</tr>
<tr>
<td>Limitations and Strengths</td>
<td>45</td>
</tr>
<tr>
<td>Purpose</td>
<td>51</td>
</tr>
<tr>
<td>III. METHOD</td>
<td>52</td>
</tr>
<tr>
<td>Literature Search</td>
<td>52</td>
</tr>
<tr>
<td>Moderator Variables</td>
<td>56</td>
</tr>
<tr>
<td>The Analyses</td>
<td>75</td>
</tr>
<tr>
<td>IV. RESULTS</td>
<td>80</td>
</tr>
<tr>
<td>Preliminary Analysis</td>
<td>80</td>
</tr>
<tr>
<td>Meta-Analysis</td>
<td>85</td>
</tr>
<tr>
<td>Selected Comparisons</td>
<td>89</td>
</tr>
<tr>
<td>V. DISCUSSION</td>
<td>96</td>
</tr>
<tr>
<td>General Results</td>
<td>96</td>
</tr>
<tr>
<td>Debilitating Influences on G</td>
<td>98</td>
</tr>
<tr>
<td>Selected Comparisons</td>
<td>100</td>
</tr>
<tr>
<td>Limitations</td>
<td>102</td>
</tr>
<tr>
<td>Summary Statement</td>
<td>104</td>
</tr>
</tbody>
</table>
# List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Binomial effect size display for a weighted mean effect size of 0.68</td>
</tr>
<tr>
<td>2.</td>
<td>Results of an analysis of variance on type of measure X publication status</td>
</tr>
<tr>
<td>3.</td>
<td>Weighted mean effect sizes for types of measures</td>
</tr>
<tr>
<td>4.</td>
<td>Weighted mean effect sizes for publications and dissertations</td>
</tr>
<tr>
<td>5.</td>
<td>Binomial effect size display for a weighted mean effect size of 0.337</td>
</tr>
<tr>
<td>6.</td>
<td>Weighted mean effect sizes for progressive relaxation variations</td>
</tr>
<tr>
<td>7.</td>
<td>Weighted mean effect sizes for live and taped relaxation training</td>
</tr>
<tr>
<td>8.</td>
<td>Weighted mean effect sizes for individual and group administration</td>
</tr>
<tr>
<td>9.</td>
<td>Weighted mean effect sizes for types of treatment</td>
</tr>
<tr>
<td>10.</td>
<td>Weighted mean effect sizes for live, individual, Bernstein and Borkovec treatment versus other studies</td>
</tr>
<tr>
<td>11.</td>
<td>Weighted mean effect sizes for insomnia versus noninsomnia studies</td>
</tr>
<tr>
<td>12.</td>
<td>Weighted mean effect sizes for general anxiety studies versus other studies</td>
</tr>
<tr>
<td>13.</td>
<td>Weighted mean effect sizes for alcoholism studies versus nonalcoholism studies</td>
</tr>
</tbody>
</table>
14. Weighted mean effect sizes for subject classifications

15. Weighted mean effect sizes for complication classifications

16. Weighted mean effect sizes for types of control
CHAPTER I
INTRODUCTION

Progressive relaxation is a therapeutic technique originally developed by Jacobson (1938) for the relief of muscle tension. Simply stated, progressive relaxation involves tensing and relaxing a series of muscle groups in order to become more physiologically and/or psychologically relaxed. This tension-release cycle and physiological attention focusing are proposed as active ingredients in these relaxation procedures (Borkovec & Hennings, 1978). As a treatment strategy, progressive relaxation has been used to address a variety of concerns in a multitude of settings. Psychologists, nurses, physicians, and others have treated participants with such difficulties as insomnia, general tension, performance anxiety, and hypertension. Progressive relaxation also has been employed as a procedural enhancement in treatment techniques such as systematic desensitization, and it has been used in conjunction with other procedures such as biofeedback.

As will be more thoroughly presented in Chapter II, there are many theories which attempt to account for the
efficacy of progressive relaxation. Jacobson believes that becoming somatically relaxed necessarily inhibits any feeling of anxiety as well. Davidson and Schwartz (1976) take issue with this supposition, proposing instead that cognitive and somatic anxiety can function rather independently. Other theorists have speculated about the attention-focusing nature of the treatment.

Since the 1973 publication of the progressive relaxation training manual by Bernstein and Borkovec, a plethora of research on this therapeutic technique has been published in a variety of journals and has appeared before numerous dissertation committees. Various individual investigations have supported the treatment's efficacy. Reviews of the literature, however, have been fairly restrictive, limiting themselves to particular subsets of studies. For example, Turner (1986) reviewed progressive relaxation's effectiveness in the treatment of insomnia, and Luiselli (1980) evaluated the effectiveness of relaxation training with developmentally disabled persons. Snyder (1984) reviewed 13 studies of progressive relaxation primarily related to the nursing profession. While it seems that research in this area has reached its peak and is actually on the downswing, a comprehensive, inclusive review with some quantitative synthesis of the literature is still sorely lacking.
The growth of progressive relaxation as a treatment technique has been paralleled by the development of meta-analysis as a set of statistical techniques for the quantitative synthesis of collections of studies. Thus, the timing seems ideal to submit the empirical investigations of the effectiveness of progressive relaxation to the statistical tests offered by meta-analysis in hopes of, at the very least, making some statement about how useful this treatment has been to study participants. It may also be possible to specify the conditions under which progressive relaxation appears to be most effective.

In the present investigation, 71 published studies comparing a progressive relaxation group to a control group were located and their results were standardized through the use of effect sizes. Each publication also was coded on 58 different moderator variables—dimensions along which the investigations differed. These data were then subjected to contemporary meta-analytic techniques.

Chapter II of this dissertation renders a comprehensive review of progressive relaxation and presents background information on meta-analysis. Chapter III describes the literature search, list of moderator variables, and the analyses. The results of these analyses and discussion of the findings are presented in Chapters IV and V, respectively.
CHAPTER II
LITERATURE REVIEW

Progressive Relaxation

The following background information on progressive relaxation will include (a) a definition section which will briefly describe the procedure, pertinent physiological and psychological systems potentially under its influence, the clientele, and the treatment providers; (b) the history of the technique discussing the contributions of Edmund Jacobson and others; (c) alternative procedures which make use of progressive relaxation or which are incorporated into progressive relaxation; (d) effectiveness - focusing on the results of other literature reviews and theoretical explanations for the treatment's efficacy; and finally, (e) an examination of potentially important moderating variables such as live versus taped administration, individual versus group instruction, therapist experience, duration of training, home practice, population, and client position.
Definition

Brief Description

Progressive relaxation is a behavioral technique used for the purpose of anxiety reduction. Sometimes referred to as progressive muscle relaxation or systematic muscle relaxation, progressive relaxation is a skill taught to clients who learn to operate on their own skeletal musculature in order to create feelings of relaxation. In essence, progressive relaxation involves tensing and relaxing a series of muscle groups while focusing attention inward on the contrasting feelings of tension and relaxation.

According to Edmund Jacobson (1957), who originally developed the technique, progressive relaxation is "progressive" in three ways: (a) a group of muscles is relaxed further and further with each passing minute in a training session, (b) "patients" progressively learn to relax principle groups of muscles by adding new groups as sessions progress while simultaneously relaxing previously practiced groups, and (c) daily practice leads to progress toward a state of automatically maintained quiet. Jacobson's original version of progressive relaxation has undergone metamorphosis since the early 1900's, and adaptations to his technique will be noted in a subsequent section.
Physiological and Psychological Systems

According to Pender (1982), progressive relaxation is believed to: (a) lower the body's oxygen consumption, (b) decrease metabolism, (c) lower respiration rate, (d) reduce heart rate, (e) decrease muscle tension, (f) lower premature ventricular contractions, (g) decrease systolic and diastolic blood pressures, and (h) increase alpha brain waves. Obviously, these are physiological systems that might be expected to be indirectly or directly (in the case of muscle tension) influenced by relaxation of the skeletal muscles.

Psychologically speaking, progressive relaxation is believed to reduce or eliminate the experience of anxiety, thus leaving the client more mentally or emotionally relaxed. Resultant of psychological and physiological relaxation should be a reduction in behavioral indices of anxiety, as well as an increase in performance of tasks previously inhibited by anxiety. The latter supposition is supported by the Yerkes-Dodson Law which posits an optimal level of arousal for maximum performance, above or below which performance begins to falter.

Clientele

Progressive relaxation has been taught to individuals experiencing insomnia (e.g. Borkovec & Fowles, 1982), chemotherapy patients (e.g. Burish & Lyles, 1981), speech anxious students (e.g. Goldfried & Trier, 1974), asthma
sufferers (e.g. Alexander, Miklich, & Hershkoff, 1972), persons experiencing generalized anxiety (e.g. Mathews & Gelder, 1969), alcoholics (e.g. Parker, Gilbert, & Thoreson, 1978), hypertensives (e.g. Pender, 1984), Parkinsons patients (e.g. Shumaker, 1980), headache patients (e.g. Janssen, 1983), hyperactive children (e.g. Klein & Deffenbacher, 1977), tinnitus patients (e.g. Ireland, Wilson, Tonkin, & Platt-Hepworth, 1985), musicians experiencing performance anxiety (e.g. Sweeney & Horan, 1982), test anxious students (e.g. Russell & Lent, 1982), pain sufferers (e.g. Turner, 1982), individuals without any particular presenting concern (e.g. Boswell & Murray, 1979), and a host of other populations.

Bernstein and Borkovec (1973) propose that progressive relaxation training is most useful with clients who have high tension levels and responses (e.g. insomnia, tension headaches, "general tenseness") which are interfering with the performance of some behavior. Jacobson (1977) views progressive relaxation as crucial in the treatment of diseases related to the cardiovascular system. While Bernstein and Borkovec acknowledge the "placebo value" of these relaxation procedures and point out that clients with low levels of tension may later find use for relaxation skills, they caution that unwarranted relaxation training can negatively affect client cooperation and motivation. It is notable that Jacobson
(1938) views willingness and cooperation as essential to the process.

Snyder (1984) outlines specific populations for which progressive relaxation may not be appropriate. For example, depressed persons may experience further withdrawal, "loss-of-reality-contact reactions" may occur in hallucinogenic or delusional clients, medications may become more toxic, and perception of pain may be increased because of the internal focus of attention. Snyder also advises that cardiac patients must be cautious in tensing muscles.

Treatment Providers

Progressive relaxation procedures have been administered by a variety of health service providers including counseling and clinical psychologists, psychiatrists, physicians, nurses, and other types of counselors. Settings range from university counseling or laboratory facilities to hospitals, clinics, and treatment homes.

History

Jacobson first became interested in relaxation therapy when he experienced his father becoming very "excitable" following a fire at a building the family owned in Chicago (Jacobson, 1977). He was able to pursue this interest several years later (1908) as a graduate student at Harvard University where he trained his first
subjects to relax in order to alleviate a startle response. Jacobson went on to invent the neurovoltmeter at Bell Laboratories, which provided for fine measurements of muscle action potentials. This enabled him to demonstrate that mental activity was not strictly limited to the brain.

In 1938 Jacobson formally outlined his relaxation procedures in his book *Progressive Relaxation*, which would become the anchor for later applications and modifications of the technique. Unfortunately, Jacobson's book did not have the significant impact that might have been expected, possibly because of the prohibitively large number of training sessions prescribed (Goldfried & Trier, 1983). American interest in the area of relaxation subsequently declined during the 1940s and early 1950s (Davidson & Schwartz, 1976), and it was not until 1958 that these procedures were revived through the writings of Joseph Wolpe. Wolpe introduced a drastically abbreviated version of the Jacobsonian procedures to be used with a behavioral technique he termed systematic desensitization.

In 1973, Douglas Bernstein and Thomas Borkovec published a training manual called *Progressive Relaxation Training: A Manual for the Helping Professions* which specifically details abbreviated progressive relaxation procedures, and discusses targets for relaxation training, presentation of the rationale, variations on the basic
procedures, troubleshooting, and measurement of progress. Thus, with a more standardized formula for administration in place, a plethora of progressive relaxation research began to appear in a variety of journals as well as in front of dissertation committees in the late 1970's and early 1980's.

Procedure

Jacobson

As previously mentioned, in 1933 Edmund Jacobson introduced a set of therapeutic procedures which he termed "progressive relaxation." Not unlike contemporary relaxation methods, Jacobson advocated tensing a group of muscles such that the "patient" is trained in the "negative of doing" so that he/she learns what not to do. The individual develops a "muscle sense" such that tension can be located in the body.

Laying on her/his back with the arms at the sides and the legs not crossed, the patient works through a series of muscle groups, tensing and subsequently relaxing each several times, and perhaps does only one group in a single session (Jacobson, 1938). As a single muscle group is contracted, the "physician" may impede the movement with his/her own hand, and eventually, individuals are instructed to relax without contraction. Tensing occurs only in the first portion of a session and no more than three acts of tension can occur per hour because: "If you
continue to tense one part after another (as many have done wrongly), you will fail to learn to relax because your hour will be devoted instead chiefly to physical exercises" (Jacobson, 1957, p. 106). Subsequently, the session's focus is exclusively on relaxation, and as a given part of the body is relaxed, previously relaxed groups of muscles are simultaneously relaxed.

Between three and seven sessions per week of one half to one hour's duration are required, and one to two hours of home practice per day are expected. According to Wolpe and Lazarus (1966), Jacobson's procedures as outlined demand between 50 and 200 sessions. In fact, if the counselor followed the prescribed minimum number of sessions per muscle group (Jacobson, 1957) and had one session each day, it would take fully 68 days to complete the course of treatment. Thus, it is not surprising that modifications of the technique frequently were aimed at improving efficiency and expediting the process.

There are several other ways that Jacobson's progressive relaxation is different than more contemporary procedures, despite the fact that the basic principles are the same. For example, in more current treatment regimens, the client is typically reclining in a chair instead of lying flat, the number of muscle groups is reduced, the sequence of muscle groups is changed, and the methods for tensing various muscle groups are somewhat
different. Presently, several and probably all groups of muscles are likely to be attended to in a single session, with the tension-release cycle continuing throughout. Relatively speaking, more emphasis is placed upon tension than Jacobson would probably condone, and attention is verbally directed by the therapist toward contrasting feelings of tension and relaxation (Lehrer, 1982). According to Lehrer, it is even common practice to use tapes with current procedures. Conversely, Jacobsonian procedures specify that few words are to be spoken during the training, and that it is to be completely devoid of suggestion (Jacobson, 1938).

Furthermore, reading of Jacobson (1957) leads one to believe that he viewed progressive relaxation training as more of an art than a technique, in that he apparently oriented his approach more toward fine tuning, and emphasized a seemingly slower and more gentle tension-release cycle. His approach also seems more holistic, as he suggested for example that techniques such as progressive relaxation can be used in conjunction with diet, drugs, surgery, and other therapies (Jacobson, 1938), and he in fact may have provided some of these services (Lehrer, 1982).

Wolpe

Wolpe (1958) provided the first significant modification of the progressive relaxation treatment
regimen, which he then incorporated into his development of systematic desensitization. Wolpe’s relaxation sessions were fewer in number, with most individuals requiring between five and seven periods of training. Not unlike Jacobsonian methods, Wolpe instructed "patients" to tense a group of muscles for 30 seconds, followed by 10 minutes of "untensing." Patients worked their way through a sequence of muscle groups (e.g. arms; forehead; jaw, tongue, and eyeball; neck and shoulders; back, abdomen, and thorax; and legs), focusing on one group per session as advocated by Jacobson (Wolpe & Lazarus, 1966). The procedures begin to sound more forceful though, as (for example) tension in the lower arm is created by making a fist instead of by turning the hand.

**Bernstein and Borkovec**

As previously eluded to, Bernstein and Borkovec (1973) have written the most recent and perhaps most authoritative manual on progressive relaxation. While the relaxation procedures have remained quite similar to those originally proposed by Jacobson, the entire intervention has become much more time efficient. Bernstein and Borkovec advise that the client be instructed to tense and relax a series of muscle groups (16 initially) while in a comfortable (usually reclining) position. During periods of tension (10 seconds) and relaxation (30-40 seconds), the therapist draws the client’s attention to these...
contrasting feelings, and thus it is thought that the client will be better able to recognize feelings of tension and anxiety when they later occur. (Recall that Jacobson's original version was completely devoid of therapist "patter.") It is also believed that the procedure itself will be relaxing in that, aside from instructions to relax, creating tension should be followed by even greater feelings of relaxation. (The analogy is that in order to swing a pendulum a good distance in one direction, it must first be swung a good distance in the exact opposite direction.) With practice, the number of muscle groups may be reduced to 7 or 4, and then it may become possible to simply recall the feelings of relaxation without any actual tension being employed.

Bernstein and Borkovec's (1973) progressive relaxation procedures are actually quite similar to those outlined by Paul (1966). Paul's regimen, though even more abbreviated, introduced the idea of running through the entire sequence of muscle groups within each session. This is the stance of Bernstein and Borkovec, who advocate that two successive tension-release cycles occur for each muscle group, and that more than two should occur if the client indicates continued tension through the use of a hand signal.
Other Adaptations

Bernstein and Borkovec's (1973) procedures have occasionally been modified in more minor ways by recent researchers. For example, Turner (1986) specifies a 20-second tension phase and a 30-second relaxation phase, and three to four repetitions for each muscle group. Pender (1982) employs 15 muscle groups, moves more quickly toward fewer groups, and provides tapes for home practice. Essentially, contemporary progressive relaxation procedures seem to be most closely based on the ideas of Bernstein and Borkovec. One criticism of current procedures, though, is that they teach people "how" but not "when" to use the skills they develop (Goldfried & Trier, 1974).

In summary, progressive relaxation has undergone some notable modifications. Interestingly, since the bulk of the research followed the Bernstein and Borkovec (1973) manual, it is the effectiveness of the contemporary procedures which has been most closely examined.

Alternative Procedures

Progressive Relaxation as a Procedural Enhancement

Progressive relaxation training has served as a foundation upon which other techniques employed to enhance relaxation or performance of a behavior are added. Systematic desensitization, perhaps the most elaborate procedure building upon progressive relaxation, involves
first learning progressive relaxation and constructing an anxiety hierarchy. The hierarchy is arranged such that the most anxiety-producing stimulus situations for the patient are at the top of the list, and the least upsetting situations are at the bottom. While relaxed and hypnotized, the individual is asked to visualize scenes from the very bottom of the list. Movement up the hierarchy occurs when no tension is signaled for the ongoing scene, and between 10 and 25 sessions are usually required according to Wolpe (1958).

Contemporary systematic desensitization methods often omit the use of hypnosis, and alternatives to progressive relaxation have been proposed (Greenwood & Benson, 1977). Wolpe (1958) employed progressive relaxation because he believed it to produce one of three responses antagonistic to anxiety (i.e. relaxation, assertive, and sexual responses). His now-famous principle reads: "If a response antagonistic to anxiety can be made to occur in the presence of anxiety-provoking stimuli so that it is accompanied by a complete or partial suppression of the anxiety responses, the bond between these stimuli and the anxiety responses will be weakened (p. 71)."

**Progressive Relaxation Enhanced by Other Procedures**

**Cue-controlled relaxation.** Cue-controlled relaxation was introduced by Russell and Sipich (1973) as an alternative to systematic desensitization in the treatment
of anxiety. They proposed that while the effectiveness of systematic desensitization was well documented, it may not be the treatment of choice when time is of a premium, imagery is a problem, or anxiety is experienced in a variety of situations. These authors proposed an alternative treatment - cue-controlled or conditioned relaxation - where the client comes to associate a relaxed state with a cue word such as "calm," thereby allowing him or her to bring on the feelings of relaxation simply by reciting the cue word. This is essentially a classical conditioning paradigm with the cue word being the conditioned stimulus.

Biofeedback. Biofeedback, another procedure related to progressive relaxation, involves giving the client information on the level of tension in a specific area of the body so that the client might learn to gain some control over activity in the autonomic nervous system (Turner, 1986). According to Pender (1982), the four basic operations involved are: (a) detection and subsequent amplification of bioelectric signals, (b) conversion of those signals to information that can be processed easily, (c) feedback of this information to the client, and (d) using feedback to gain voluntary control of the target response. It is not uncommon to see progressive relaxation enhanced by providing clients with physiological information through biofeedback on how
relaxed their muscles are becoming.

In electromyographic (EMG) biofeedback, electrodes are usually attached to the skin at the forehead (frontalis muscle) and jaw area or the forearm, such that the biofeedback mechanism can detect the amount of electrical discharge in the corresponding muscle fibers. The frontalis muscle is believed to be a reliable indicator of overall tension in the body (Pender, 1982). Detection of electrical discharge results in the activation of a light or tone signaling to the client that it is time to change behavior in order to moderate arousal (Turner, 1986). Other methods of feedback are also possible. For example, in skin temperature feedback, decreased skin (finger) temperature reflects smooth muscle contraction around peripheral blood vessels caused by activation of the sympathetic nervous system (Pender).

Imagery. Imagery has also been a component of progressive relaxation programs, particularly in work with athletes. An example is Dick Suinn's development of visuo-motor behavior rehearsal through his work with U.S. Olympic athletes. Visuo-motor behavior rehearsal involves training the participant in progressive relaxation, followed by mental rehearsal of practice and game situations (Titley, 1976). It is believed that performance of motor behavior will become more automatic as a result of this activity. In other treatment
Programs, relaxing images following progressive relaxation are thought to further enhance feelings of relaxation (e.g. Lyles, Burish, Krozely, & Oldham, 1982).

Progressive muscle relaxation has also combined forces with such diverse interventions as music, exercise, cognitive approaches, assertiveness, and multimodal therapy. Although novel pursuits, these strategies are employed in only a handful of studies.

**Effectiveness**

Recalling his own early skepticism related to progressive relaxation, Jacobson (1977) now believes the research supports its efficacy. A meta-analysis examining the effectiveness of progressive relaxation in general could not be located. However, a few published meta-analyses and literature reviews related to progressive relaxation training are of interest. Following a discussion of these reviews will be a presentation of theoretical perspectives on how progressive relaxation operates to reduce anxiety.

**Results of Other Reviews**

**Systematic desensitization.** In their landmark meta-analysis of 400 controlled studies of psychotherapeutic outcome, Smith and Glass (1977) found an average effect size (where effect size was the "mean difference between the treated and control subjects divided by the standard deviation of the control group. (p.
753)" of 0.68 for all therapies. Systematic desensitization (100 studies) had the highest average effect size (0.91) of any of the specific types of therapy they explored, although their final conclusions rejected any major outcome differences between behavioral and nonbehavioral approaches. Concerning the latter, Smith and Glass are criticized for grouping different therapies into what they termed "superclasses" because of the diversity of the interventions (Strube, Gardner, & Hartmann, 1985). In any case, a later expansion of this original meta-analysis (Smith, Glass, and Miller, 1980) adjusted the average effect size for systematic desensitization up to 1.05 (1.21 on fear/anxiety outcome measures).

Also worth mentioning in regard to systematic desensitization is the well-known study by Paul (1966) which found systematic desensitization to be superior to insight treatment and attention-placebo and wait-list control for speech-anxious students. Paul reported a 100% success rate for systematic desensitization subjects, while the success rate for insight and placebo subjects was just 47%.

**Progressive relaxation.** Snyder (1984) reviewed 13 studies of progressive relaxation as applied primarily to patients receiving medical treatment. She found positive results in all but one of the studies, proclaiming
progressive relaxation to be widely applicable in nursing based on the varied populations that were represented in this review. Furthermore, Turner's (1986) literature review contended that 20 well-designed experiments lend support to progressive relaxation as a treatment for insomnia. Many of these studies employed control groups, and some of them used measures other than self-report. Neither of these reviews, however, outlined the criteria for designating a piece of research as support for the treatment.

Cue-controlled relaxation. Grimm (1980) reviewed cue-controlled relaxation research published prior to 1979. He classified relevant studies into one of five categories: case reports, uncontrolled group designs, group designs with untreated controls, group designs with attention-placebo controls, and psycho-physiological aspects of cue-controlled relaxation. Grimm proposed that while the case reports, uncontrolled group designs, and group designs with untreated controls demonstrate the positive therapeutic effects of cue-controlled relaxation, its superiority over a treatment that is therapeutically inert (employed in attention-placebo control designs) has not been demonstrated. Thus, it may be that the effectiveness of cue-controlled relaxation might be attributed to nonspecific factors, and the experimental design may have a significant influence over the size of
the therapeutic effect.

In what was, in retrospect, a pilot study for this proposed dissertation, 16 noncase cue-controlled relaxation studies were located and meta-analyzed. In this study it was concluded that cue-controlled relaxation has a uniformly positive and significant effect upon anxiety. The final weighted mean effect size (a standardized difference between means which is discussed in Chapter III) of 0.68 was highly significant, and Cohen (1977) would describe it as being in the "medium" to "large" range. A weighted mean effect size of 0.63 is not inconsistent with Smith and Glass's (1977) mean effect size of 0.91 for the related anxiety treatment systematic desensitization, or 0.63 for all forms of psychotherapy. However, Smith and Glass used a somewhat different definition of effect size.

Furthermore, although the nature of the cue-controlled relaxation studies reviewed does not restrict this discussion to correlational conclusions, it can be said that participation in the cue-controlled relaxation treatment is related to reduced anxiety ($r = .32$) and associated with an increase in "success rate" from 34% to 66%. The binomial effect size display below (Rosenthal, 1984) shows this change in success rate.
Table 1

Binomial Effect Size Display for a Weighted Mean Effect Size of 0.68

<table>
<thead>
<tr>
<th>Condition</th>
<th>Less Anxious</th>
<th>More Anxious</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cue-Controlled Relaxation</td>
<td>66%</td>
<td>34%</td>
</tr>
<tr>
<td>No Cue-Controlled</td>
<td>34%</td>
<td>66%</td>
</tr>
</tbody>
</table>

Generally good methodological quality among these cue-controlled relaxation investigations, uniformly strict adherence to the treatment regimen, and the apparently small influence of most of the coded moderator variables (e.g. source of anxiety, author) added further support for the effectiveness and generality of these procedures as outlined by Russell and Sipich (1973). One obvious limitation on generalizability, however, would be the nearly exclusive use of undergraduates as subjects in these studies.

While self-report measures did appear to be more sensitive to reductions in anxiety than behavioral or psychophysiological measures, the differences were not significant. Thus, it was possible to do one meta-analysis on the collapsed effect sizes associated with different measures within each study. Later communication with a specialist in the area of meta-analysis (C. F. Bond, personal communication, June,
1986), however, pointed to a more appropriate analysis which may or may not have justified this aggregation.

Different types of comparisons/designs did produce different effect sizes, with attention-placebo control studies demonstrating the smallest gains (followed by no-treatment control) as predicted based on Grimm's (1980) narrative review. However, when two studies with seemingly "active" placebo treatments were removed from the meta-analysis, there was insignificant variance among the effect sizes. The two discordant studies were actually discovered indirectly, in that they were originally grouped as a subset because they did not report standard deviations which then had to be estimated. Since these investigations shared a common author, perhaps they also shared a common data reporting format and bias towards a more powerful "placebo" treatment.

**Biofeedback.** Sharpley and Rogers (1984) meta-analyzed 20 studies and found a mean effect size of 0.43 for the application of biofeedback procedures to frontalis EMG levels. Effect size here was the difference between pre- and posttreatment scores, divided by the standard deviation of the preintervention scores. This mean effect size was found to be significantly greater than the mean effect size for control procedures (0.21), while the mean effect size for "alternative relaxation procedures" (0.33) was not superior to the control
procedures. Alternative relaxation procedures included a wide range of interventions such as progressive relaxation by itself, progressive relaxation with autogenic instructions, meditation, and hypnosis.

**Progressive relaxation with biofeedback.** Some treatment programs have combined progressive relaxation and biofeedback procedures. While it would seem that biofeedback would enhance the reduction of arousal, Turner (1986) points out that no study has shown the superiority of a combined program over progressive relaxation alone in the treatment of insomnia. Lehrer's (1982) review of relevant literature led him to believe that EMG biofeedback is a favorable addition to the treatment regimen when progressive relaxation training is weak, such as when taped instruction is employed. When training is live and "carefully administered," Lehrer does not view EMG biofeedback as an integral or particularly useful part of the procedure.

Bhatara, Arnold, Lorance, and Gupta (1979) reviewed eight studies employing EMG-biofeedback, progressive relaxation, or both in the treatment of hyperkinesis in children. Despite the inconsistency among the samples (which they attributed to heterogeneity of subjects and varied methodologies), Bhatara et al. concluded that EMG biofeedback may not be particularly useful with hyperkinetic children by itself or as an accessory. They
propose that progressive relaxation may offer better generalization to the classroom. Thus, from these reviews, it would not seem that the addition of EMG biofeedback would significantly improve outcome.

Consistent with these reviews, Chesney and Shelton's (1976) primary research shows that biofeedback by itself was not significantly better than no treatment among sufferers of muscle contraction headaches. Furthermore, they postulate that while biofeedback may be a useful addition to progressive relaxation training, it is the progressive relaxation itself that is the essential component in the treatment of such headaches. Other authors (Braud, 1973; Taylor, Farquhar, Nelson, & Agras, 1977) point out that progressive relaxation is the treatment of choice when considering practical matters such as ease of application and equipment costs.

Despite this seemingly overwhelming support for progressive relaxation without this adjunct, there have been somewhat conflicting findings. Reinking and Kohl (1975) found biofeedback and biofeedback-assisted relaxation training to be superior to progressive relaxation training in reducing EMG levels. These authors, however, employed the less contemporary Jacobson-Wolpe relaxation instructions. Similarly, Davis, Saunders, Creer, and Chai (1973) found abbreviated Jacobsonian relaxation training to be inferior to that
same training assisted by biofeedback among asthmatic children. Perhaps then biofeedback has a facilitating effect upon the more classic relaxation procedures.

**Summary.** It would seem that while systematic desensitization has garnered support through quantitative reviews of the literature, progressive relaxation has received support only through more qualitative means. There appears to be some evidence for the efficacy of cue-controlled relaxation and biofeedback, with the question remaining whether or not these procedures add to the effects created by progressive relaxation alone.

**Theory**

Jacobson. In attempting to explain the effects of progressive relaxation, Jacobson (1938) argued as follows: relaxation precludes motor unrest because of its basic incompatibility with contraction. Relaxation reduces tone in the muscles, thereby diminishing reflexes. The result is fewer proprioceptive impulses (impulses received from the muscles) leading to even fewer reflexes. Excitation of nerve centers decreases with diminishing visual, muscle, and joint sensations. Jacobson believed that if no proprioceptive feedback was being received from the skeletal muscles, then it was impossible to feel anxious (Davison, 1966). Thus, Jacobson contends that "...mental and emotional activity always involve a motor element. By decreasing this motor element, relaxation apparently
diminishes such activity (Jacobson, p. 299)." Jacobson's peripheralist position holds that perceived tensions are requisite to feelings and thoughts (Davison). In 1977, Jacobson adds that training in progressive relaxation helps individuals to conserve adenosine triphosphate, their source of energy.

Support for Jacobson's position on how progressive relaxation works was provided by Gellhorn (1953). Gellhorn used curare-like substances to relax the skeletal musculature of cats, and thus diminish proprioceptive impulses from the muscles. In effect then, he mimicked the presumed effect of progressive relaxation. Gellhorn found that reductions in the excitability of the sympathetic division of the hypothalamus and reductions in the excitability of the cerebral cortex followed the drug-induced muscle relaxation. Gellhorn's experiments, however, are criticized by Davison (1966) who contends that anxiety can indeed be experienced while under the influence of paralytic drugs such as curare.

Mathews and Gelder. Mathews and Gelder (1969) proposed an alternative explanation. They believe that progressive relaxation acts upon a central process (arousal level), through which changes in (a) autonomic activity and (b) feelings of anxiety are thought to occur. However, Conner's (1974) results did not support the idea that autonomic response effects of progressive relaxation
training are a result of autonomic level shifts.

Davidson and Schwartz. Davidson and Schwartz (1976) believe that cognitive (mental) and somatic (muscular) relaxation are distinct processes which may not depend upon one another, although more profound relaxation can be experienced if both types of relaxation are achieved. Furthermore, they believe that progressive relaxation primarily affects the somatic system and should be most effective with individuals experiencing low cognitive anxiety and high somatic anxiety (bodily tension and autonomic stress). Persons having the reverse configuration are advised to deal with their cognitive anxiety ("mind racing") by reading, watching television, or playing chess, while individuals experiencing high anxiety in both areas are instructed to engage in physical activity like sports or dancing. In other words, techniques which involve activity in the realm within which anxiety exists should be employed.

To support their notion, Davidson and Schwartz (1976) recount data that supported the effectiveness of progressive relaxation over hypnotic relaxation (primarily a cognitive technique) on a host of somatic measures. This theory would also account for the possible coexistence of (cognitive) anxiety and (somatic) relaxation produced by paralytic drugs. Further support for this theory is derived through the work of Norton and
Johnson (1983), who found that progressive relaxation was more effective in reducing somatic anxiety than in reducing cognitive anxiety in individuals experiencing snake phobia. These authors also suggest tailoring the treatment to the type of anxiety experienced.

The Davidson and Schwartz (1976) theory also has significant implications in the area of anxiety measurement. According to these authors, there exist metabolic measures, attentional and multi-process measures, performance measures (e.g. reaction time), cognitive measures (e.g. skin conductance, questionnaires), and somatic measures (e.g. EMG activity, respiration, heart rate, blood pressure, and questionnaires). The outcome of a study may be determined in large part by the types of dependent variables chosen. This notion may account for some of the inconsistency between paper and pencil tests and physiological measures noted by Lehrer (1973). If progressive relaxation is utilized, then it would follow from this theory that somatic measures should be employed. Thus, the type of anxiety experienced needs to be considered both in the choice of treatment and in the measurement of treatment results.

As a final yet interesting note to the work of Davidson and Schwartz (1976), Lehrer (1982) believes that the research shows that more contemporary progressive
relaxation procedures are less effective when physiological arousal is the target of the relaxation treatment. He suggests that when Wolpe (1958) and others incorporated progressive relaxation into behavior therapy, the problem areas for application were primarily cognitive and behavioral in nature. Modifications of the procedure thus appropriately included greater use of suggestion (aimed at cognitive anxiety) with less time spent working with the muscle groups (somatic anxiety). In support of this hypothesis, Greenwood and Benson's (1977) examination of the more recent literature led them to the conclusion that abbreviated progressive relaxation does not reduce autonomic nervous system activity, and Lehrer (1973) reports an inconsistent relationship between progressive relaxation and autonomic measures in the literature.

Other theories. Other explanations for the effectiveness of progressive relaxation have been discussed as well. For example, Davison (1966) suggests that progressive relaxation may simply produce "pleasant affective states" not unlike those produced by sex or eating that by their very nature are not compatible with the experience of anxiety. Davison also posits that progressive relaxation may eliminate efferent messages to the muscles (which curare does not do) and thus reduce anxiety. Another explanation can be found in the writings of Burish and Lyles (1931) who suggest that
progressive relaxation forces clients to become involved in their treatment and subsequently feel like "effective causal agents" more in control of their own improvement.

Other authors (Borkovec & Hennings, 1978; Greenwood & Benson, 1977) offer the idea that if the tension-release cycle of progressive relaxation does not impact autonomic activity directly, perhaps it serves to enhance the focusing of attention inward. Similarly, Burish, Carey, Krozaly, and Greco (1987) propose that progressive relaxation may divert attention away from chemotherapy and toward more relaxing thoughts in cancer patients. Finally, Freedman and Pappsdorf (1976) introduce the possibility that the treatment helps insomniacs because it is monotonous and repetitive.

**Summary.** While some controversy no doubt remains, it seems that the Davidson and Schwartz (1976) hypothesis is most consistent with the results of the pertinent research. Given this theoretical orientation, the question then becomes whether somatic or cognitive anxiety is affected by progressive relaxation, and does that depend on whether contemporary or Jacobsonian procedures are employed?

**Components Analysis**

According to Borkovec and Hennings (1978), the two components of progressive relaxation are the tension-release cycle and physiological attention.
focusing. These authors found that subjective improvement in insomnia must have been due to the tension-release component of progressive relaxation, since progressive relaxation without physiological attention focusing did not differ from standard progressive relaxation. In the treatment of general tension these same authors actually found progressive relaxation to be inferior to its nonattention-focusing counterpart.

Consistent with these results, Borkovec, Kaloupek, and Slama (1975) found progressive relaxation to be superior in every way to progressive relaxation without the tension-release cycles (i.e. only attention focusing) for the treatment of insomnia. Similarly, while Borkovec, Grayson, and Cooper (1978) did not find progressive relaxation without tension-release to be significantly inferior to standard progressive relaxation, they did find progressive relaxation more efficient in that subjects who used tension-release required significantly fewer training cycles to achieve relaxation. Haynes, Moseley, and McGowan (1975), on the other hand, could not detect any difference between progressive relaxation with tension-release and progressive relaxation without tension-release in lowering frontalis EMG levels.

Sime and DeGood (1977) found a positive relationship between the awareness of muscle tension and the elimination of muscle tension, thus indirectly suggesting
that physiological attention focusing may be an active ingredient as well. These authors also found biofeedback to be significantly more effective than progressive relaxation in increasing tension awareness, and progressive relaxation to be significantly better than a placebo condition. An alternative explanation, however, is offered for the superiority of biofeedback.

Thus it seems that the tension-release component of progressive relaxation is important to the process, although there are conflicting findings. The contribution of physiological attention focusing appears to be less clear.

**Moderating Variables**

According to Davidson and Schwartz (1976), investigations of the efficacy of progressive relaxation are discordant in parameters such as procedure, length of treatment, and methodology, thus making comparisons difficult. The type of anxiety being addressed and the method of measurement have already been identified as important moderator variables. Following will be a consideration of other potential variables which may influence outcome. Excluded from this discussion will be variables such as time of day for training, length of individual training sessions, and training site (as identified by Snyder, 1984) simply because they have not been attended to in the research.
**Live Versus Taped Administration**

Borkovec and Sides (1979) examined 25 controlled studies of progressive relaxation. Of the studies which exhibited the superiority of progressive relaxation, 73% used live administration. Of the studies which found no difference between the progressive relaxation and control groups, 70% used taped instructions. These two groups of studies were significantly different on this variable. Lehrer's (1982) review of the literature also led him to the conclusion that live instruction is more effective, possibly because the therapist is better able to tailor the procedures to meet the individual client's needs.

Russell, Sipich, and Knipe (1976) found live relaxation using the Bernstein and Borkovec (1973) 16-muscle group sequence to lead to significant decreases in self-reported anxiety and a physiological measure of anxiety. Unexpectedly, the control group improved on the physiological measure, but the 16-muscle group "tape" subjects only improved on the self-report measure. Further support for live training was provided by Beiman, Israel, and Johnson (1978) who studied 40 individuals for whom tension was a significant problem. They found live progressive relaxation training provided for greater reduction in physiological arousal during the training period. Following training, live relaxation was superior to all treatments in control over electrodermal responses,
while both live relaxation and self-relaxation training had an advantage over taped relaxation and biofeedback with respect to respiration rate. Finally, while Putre, Loffio, Chorost, Marx, and Gilbert (1977) argue that the use of tapes may improve efficiency and promote standardization for research purposes, they did not find taped progressive relaxation instructions to be superior to tapes of stories in reducing muscle tension in children.

In a controlled investigation of the effectiveness of live versus taped progressive relaxation, Paul and Trimble (1970) found live relaxation to be superior to its recorded counterpart in inhibiting physiological arousal and physiological responses to stressful imagery. No differences were noted on the self-report measures. Nonspecific factors which might account for this divergence were ruled out because presence of experimenter seemed to make no difference in groups learning hypnosis or control procedures. The authors thus concluded that the crucial missing element for the group which received recorded instructions was the response-contingent feedback. That is, these subjects had to move from muscle group to muscle group without any check on the degree of relaxation achieved and further work on a particular group as necessary. Paul and Trimble suggest that progressive relaxation procedures incorporate both live and taped
training, or that recorded systems be developed which will allow the client to control his/her own movement through the various muscle groups.

Conversely, Borkovec et al. (1978) hypothesize that based on their results it might be that therapist presence is an important variable influencing improvement on physiological measures. Similarly, Borkovec and Sides (1979) acknowledge the potential importance of therapist presence, but discuss participant control over the pacing of the treatment as accounting for the superiority of live administration. Thus, while it may not be completely clear what the operating mechanisms are in this area, it does seem that live relaxation training has fared better in the empirical literature.

**Individual Versus Group Instruction**

There is also some controversy about the efficacy of group versus individual administration of the progressive relaxation. Pender (1984), for example, observed that group relaxation provided for interaction which promoted learning and regular practice. She claims that the participants motivated and supported one another. Pender used individual sessions later in the process to facilitate integration of the procedures into personal lifestyle and schedule. Thus, she advocates a combination of these two modes of instruction.
In contrast to these ideas, Nath and Rinehart (1979), found no difference between group and individual progressive relaxation procedures. What becomes unclear, though, is how they handled differential pacing. That is, with live administration of group procedures, it would be difficult to allow each subject to progress from muscle group to muscle group at her/his own pace.

Therapist experience

According to Snyder (1984), the qualifications of the progressive relaxation instructors are not mentioned in all of the studies. This variable, however, may affect outcome. For example, Turner and Ascher (1982) found experienced therapists to be superior in the treatment of insomnia to clinicians who received 10 weeks of training in the procedures. These differences showed up in latency to sleep onset, number of awakenings, and difficulty falling and returning to sleep.

Duration of Training

As previously discussed, contemporary progressive relaxation procedures are more abbreviated than those outlined by Jacobson (1938). Snyder's (1984) analysis of the literature indicated that between 1 and 6 sessions of training usually occur. Borkovec and Sides' (1979) literature review revealed an average of 4.57 training sessions in studies that demonstrated the superiority of progressive relaxation, while in other studies only 2.30
sessions were administered. This difference was significant, and thus it may be that the amount of training received may influence outcome. It is possible though that the necessary or optimal number of sessions may depend upon other factors, as Borkovec and Hennings (1978) found that 3 to 4 sessions of training were not sufficient when working with general tension subjects as opposed to insomniacs. Extended training may not be without its costs, however, as Danton, May, and Lynn (1984) advise that the time-consuming and monotonous nature of progressive relaxation may result in shortcuts and unintentional omissions in the training protocol.

Home Practice

While advised by most procedural manuscripts, Snyder (1984) indicates that some studies do not mention the assignment of home practice, while others require up to four such periods each day. Hillenberg and Collins (1983) manipulated this variable and did not find any significant differences between subjects assigned home practice and those advised against work outside of the session on self-report and physiological measures. Consistent with these results, Lick and Heffler (1977) found no evidence to suggest that progressive relaxation procedures were enhanced by the use of a home practice recording.

Interestingly, in their study Hillenberg and Collins (1983) found the mean percentage of self-reported practice
to be 57%, and only 62% of that supposed practice could be verified through the use of a marked tape procedure. Thus, considering both of these figures, it might be said that there was only a 35% compliance rate. While Pender's (1984) subjects reported good compliance to home practice instructions, Hillenberg and Collins believe complete compliance to be unrealistic, and question the actual amount of practicing that has occurred in previous investigations. This idea is consistent with the findings of Riley, Berry, and Kennedy (1986) which point to a lack of congruency between a more sound indicator of compliance and other less reliable measures, as well as Freedman and Papsdorf's (1976) report that their subjects discontinued or curtailed practicing over time. Hillenberg and Collins entertain the idea of a minimum number of practice sessions needed for improvement, especially if two per day is considered to be too demanding.

Population

In the Borkovec and Sides (1979) review, 47% of the studies which demonstrated progressive relaxation's superiority employed "patient" samples, while 80% of the other studies used "normal" subjects. Furthermore, according to Lehrer (1978), the effects of relaxation are more difficult to measure in nonanxious participants, who by their very nature can relax without training. Finally, while Nicassio and Bootzin (1974) found progressive
relaxation training to be more effective for younger insomniacs. Pendleton and Tasto (1975) did not find any differential effectiveness for college students versus employed adults.

Client Position

Snyder (1984) points out that some progressive relaxation investigations specify that the client remains recumbent throughout the training period, while others indicate that the client was made to sit upright in a comfortable chair. Jacobson (1957) advocates having participants lie flat on their backs when initially learning progressive relaxation procedures. According to Pender (1982), however, this may result in neck or upper back muscle strain and drowsiness.

Treatment Rationale

Riley et al. (1986) found that the inclusion of a treatment rationale had no effect upon the compliance of participants to practicing progressive relaxation.

Summary

It would appear as if live administration by experienced therapists with more anxious individuals might optimize chances for positive outcome. It is less clear whether individual or group administration is preferable, and what the ideal client position during training might be. Issues such as duration of training and home practice seem even more complex. The existence of interactions is
also possible, in that the ideal training program may depend upon the individual client and her/his presenting concern.

Meta-analysis

Definition

Hedges and Olkin (1985) define meta-analysis as "...the rubric used to describe quantitative methods for combining evidence across studies" (p. 13). According to these authors, it can be described as "...an analysis of the results of statistical analyses" (p. 13), because the summary statistics of primary research articles are used in a higher-order analysis which attempts to quantitatively synthesize a collection of studies in a particular area of research.

The remainder of this chapter will be used to present: (a) a history of meta-analysis; (b) a brief procedural synopsis; and (c) a consideration of its limitations and strengths. In Chapter III, the specific meta-analytic procedures which were employed will be described in detail.

History

While the qualitative review and procedures for combining probabilities and correlations have been familiar methods to researchers throughout this century, the advent of meta-analysis is a relatively recent development. The limitations of existing methods combined
with the expanding body of research in psychology and education led some investigators to seek new methods which would bring more order to the literature.

In 1971, Light and Smith pointed out the weaknesses of four existing methods of combining studies. They first suggested that listing variables which have been shown to affect a dependent variable is cumbersome and fails to separate the important variables from the less important ones. Second, choosing a "favorite study" from a group of studies eliminates almost all of the relevant data. Third, determining averages across studies for a statistic of interest ignores the variance between studies that is of primary interest. Finally, "taking-a-vote," involves deciding for each study whether the relationship between an independent variable and a dependent variable is: (a) positively significant, (b) negatively significant, or (c) nonsignificant. Which of the three relationships exists between the two variables is determined by simply counting the number of votes or studies assigned to each of three relationship categories, and choosing the category with the highest total.

While vote taking has been regarded by Light and Smith (1971) as the most acceptable of the four procedures described, several inherent limitations are discussed. For example, this method allots one vote to each study regardless of sample size. Furthermore, vote taking
limits conclusions to independent variables which were included in every study, and is not sensitive to interactions among variables. Glass (1977) describes the loss of descriptive information as a "serious deficiency" of the vote taking method in that the strength of an effect is not determined. Finally, Kazdin (1985) compares qualitative reviews in general to visual inspection, noting limitations in relationships which can be discerned when working with large numbers of variables and studies.

To address the limitations of what were viewed as inadequate methods of combining data, Light and Smith (1971) developed a procedure that they termed the "cluster approach." The advantage this meta-analytic forerunner offered was its ability to not only incorporate conflicting studies into the same analysis, but also to attempt to account for these differences. However, Glass (1976) points out that the need for original data is a serious limitation of this approach.

In the late 1970s, Gene Glass of the Laboratory of Educational Research at the University of Colorado, and Robert Rosenthal of the Psychology Department at Harvard University worked on what has come to be called meta-analysis. Each credits the other (Glass, 1977; Rosenthal, 1984) with independently developing meta-analytic procedures, and it is clear that both played a significant role in advancing this relatively novel way
of combining studies.

Procedural Synopsis

Using essentially the same statistical methods that are employed in primary data analysis (Glass, 1976), meta-analysis involves treating the study (or some part of the study) as the "subject" in the analysis. The question then becomes: is there a consistent relationship between two variables across the sample or population of studies (for correlational research) or is there a consistent experimental effect on the dependent variable? If this is the case, attention is directed toward estimating the magnitude of that relationship or effect. If there is inconsistency in the data, a search for variables which might moderate that relationship or effect is in order. It is important to keep in mind that, as pointed out by Cook and Leviton (1980), meta-analysis is a set of "flexible techniques," and not a "single technique."

Limitations and Strengths

Currently, the use of meta-analysis is on the rise. Rosenthal (1984) suggests that there might be a "revolution in the making." Glass (1976) advises that "...we face an abundance of information. Our problem is to find the knowledge in the information (p. 4)." He goes on to recommend that priority be given to integration rather than simply adding more information to the "pile." However, not all researchers have fondly accepted the
increasing visibility of meta-analytic procedures, nor have they advocated their application. Indeed, meta-analysis has not been without its critics, but its supporters have been quick to meet their challenge.

Meta-analysis offers researchers the opportunity to qualitatively and quantitatively synthesize a body of empirical literature, and speak statistically about the overall effectiveness of a particular treatment while potentially identifying variables which moderate effectiveness. These procedures can provide the framework for organizing an assemblage of studies, and can point to meaningful primary research questions. In other words, meta-analysis can be an extremely useful adjunct to primary research.

Perhaps one of the strongest criticisms leveled at meta-analysis, however, is that it has not provided the increased objectivity and explicitness that it had promised (Wilson, 1985). Wilson reports that various meta-analyses have produced findings on therapeutic outcome as much in conflict as those of more traditional reviews. It is pointed out that different meta-analyses do not agree on such things as which studies should be included, how to handle multiple measures, and how to deal with the issue of methodological quality (Wilson), or appropriate meta-analytic techniques and important characteristics of studies (Cook & Leviton, 1980). Kazdin
(1985) advises, however, that while the validity of meta-analytic conclusions does depend on the acceptability of initial decisions and assumptions such as these, decision rules have yet to be determined and all decisions are made explicit in the meta-analysis.

Judgment of methodological quality and the decision to include "flawed" studies in a meta-analysis have been particularly controversial. In their landmark meta-analysis of psychotherapeutic outcome, Smith and Glass (1977) chose not to exclude studies with a less than rigorous research design. This provoked Eysenck (1978) to reject the Smith and Glass report as a "garbage in-garbage out" phenomenon, and reiterate his belief that there is no study of therapeutic outcome that is without "serious weaknesses." Glass (1976), however, believes that studies can have several flaws in their design and analysis without their validity being seriously jeopardized, and that poorly-designed experiments yield nearly the same results as their well-designed counterparts. He suggests that eliminating the poorly-designed experiments from the meta-analysis means throwing away a significant amount of data. According to Glass (1977): "...many weak studies can add up to a strong conclusion." He illustrates this point by proposing that 100 hypothetical studies supporting the efficacy of therapy with subsets of 10 each flawed in their own way could not be discarded as
collectively supporting therapeutic outcome.

A strength of meta-analysis is that the researcher can code a variable such as methodological quality and determine whether or not it covaries with outcome. Other differences among studies can be coded as well to attempt to account for what Glass (1976) terms the "essential, largely irreducible" variance in findings. Standardizing research seems unlikely according to Glass (1977), and attempting to make studies the same in every respect eliminates the need to do any comparisons. Still, Kazdin (1985) cautions that while broad classes of variables and their interactions can be examined, more subtle findings/interactions specific to one or a few investigations may go unnoticed. Additionally, it may not be possible to code some important variables (e.g., treatment integrity) because the necessary information is not included in the research report.

Other researchers have taken issue with the criticisms directed at qualitative reviews by meta-analysis proponents. Cook and Leviton (1980) credit meta-analysis with bringing to the forefront weaknesses in qualitative reviews, but suggest that those weaknesses are not inherent to the method. They believe that both quantitative and qualitative reviews can make use of effect sizes, incorporate information about the direction of findings, detect interactions, and necessitate
decisions and judgments. Cook and Leviton acknowledge the superiority of meta-analysis when the sample of studies to be reviewed gets large.

Strube et al. (1985) have pointed out other limitations inherent to meta-analytic procedures. One liability that they discuss is the nonrandom selection of studies. Published investigations will be biased in the direction of statistical significance, and are likely candidates for inclusion. There is also a directional bias in that studies which are consistent with "the prevailing scientific atmosphere" are more easily retrieved. Another limitation discussed by these authors is data retrieval, as information necessary for the meta-analysis may be incomplete or expunged because of its irrelevance to the researcher or its nonsignificance. Strube et al. also mention the difficulty in judging internal validity, combining case and noncase studies, and having multiple dependent measures or multiple measures over time for each subject. These particular issues will be discussed further in the next chapter.

Finally, much of the controversy surrounding meta-analysis is in no doubt tied to the "less conservative conclusions" about relationships and effects that it has produced (Cook & Leviton, 1980). However, two characteristics of meta-analysis must be kept in mind in this regard. First, it is possible that a weak but
significant treatment effect might not be detected in individual studies, but might show up in the larger meta-analysis. Second, a meta-analysis might result in isolating a subset of studies (that share certain characteristics) which has a significant treatment effect.

Carrying forth its strengths, controversy, and criticisms, meta-analysis continues to stimulate the interest of researchers in psychology and education. While Glass (1976, 1977) reports that financial support is still funneled into primary research, and the integration of research continues to be viewed by some as a contribution of lesser importance, Kazdin (1985) suggests that: "Meta-analysis has an important role as a methodology for treatment evaluation in clinical psychology (p. 50)." Kendall and Maruyama (1985) acknowledge that initial criticism may have been well founded as meta-analysis is certainly not a "statistical panacea," but add that researchers are becoming more aware of limitations, are continuing to make improvements, and will continue to use meta-analysis in the synthesis of literature. They perceive a trend away from trying to determine if therapy works, and toward focusing on smaller sets of studies and looking for moderating variables within different treatments.
Purpose

The purpose of this study will be to apply the statistical techniques collectively called meta-analysis to the body of research addressing the efficacy of progressive relaxation. Generally speaking, there will be an attempt to address the overall effectiveness of this behavioral technique, as well as identify any variables which moderate the size of the effect. Following will be Chapter III (Method) which will detail this particular attempt to locate, organize, quantify, and analyze the progressive relaxation research.
CHAPTER III

METHOD

Chapter III will provide a description of: (a) the literature search, (b) the moderator variables, and (c) the analyses. Following this chapter will be a presentation of the results of the meta-analysis.

Literature Search

Relevant studies initially were identified using a computerized search procedure. In July, 1986, a search through Psychological Abstracts using the search title "Progressive-Relaxation-Therapy" yielded a total of 289 studies. A search through Dissertation Abstracts at that same time using the descriptors "progressive relaxation" and "progressive muscle relaxation" in the clinical psychology area yielded 109 articles. An updated search carried out in May, 1987 produced an additional 22 investigations through Psychological Abstracts, and 4 articles through Psych Alert.

Computerized search strategies of this type rely upon the proper indexing of each article, and they tend to generate some irrelevant articles while missing some more pertinent ones. Also, this search is limited to articles
published after 1966, but that is of little consequence
given the relatively recent interest in studying the
efficacy of progressive relaxation. Nevertheless,
computerized searches are a good place from which to
start, provided that there is a follow-up procedure to
expand the pool of applicable studies. In this
investigation, the ancestry approach, as described by
Cooper (1984), was employed to locate additional
investigations. Simply stated, the references from the
relevant research already obtained were perused to
determine if there were missing studies, and the reference
lists of the missing studies (once located) were examined
as well.

To be included as part of the meta-analysis, a study
had to satisfy the following criteria:

1. It must have had at least some type of control
group (wait list, placebo), and a progressive relaxation
group among its treatment groups. This eliminates
conceptual problems tied to combining within-subjects and
between-subjects investigations, and also permits
directional conclusions in terms of treatment and outcome
independent of spontaneous recovery or placebo effects.
Including only controlled studies is slightly more
restrictive than the original meta-analysis of Smith and
Glass (1977). That is, these authors also examined
studies which contrasted one treatment group with another,
but such comparisons were of interest to them since Smith and Glass did not limit their review to one therapeutic procedure. For the purposes of this meta-analysis, if more than one control group was employed in a particular study, the control group that appeared to have the strongest placebo value was chosen for comparison with the progressive relaxation group.

2. For a study to be included, the progressive relaxation subjects must not have been exposed to any other form of treatment except that the relaxation could be enhanced by biofeedback, imagery, or conditioning to some cue. It is the author's belief that these three procedures at best serve to further promote the effects of progressive relaxation. With this in mind, studies of systematic desensitization were excluded because this treatment is more complex than progressive relaxation with an appendage, and systematic desensitization was previously examined in the meta-analysis of Smith and Glass (1977).

3. It was decided to limit this meta-analysis to noncase studies of progressive relaxation. Strube et al. (1985) speak to the conceptual difficulties of combining case and noncase reports into a single meta-analysis. There also are practical concerns involved, in that if any sort of combination was possible, single subjects would take as much or more time to incorporate into the
meta-analysis as groups of individuals. Beyond all of this, there is the problem of few (if any) published sources of instruction on how to statistically handle case reports.

4. For practical purposes, only articles written in English were examined. This criterion, however, only excluded a few investigations.

5. Studies for which data reporting was so inadequate that even estimates are impossible to construct were also eliminated. Very few investigations were lost to this standard, because in most circumstances there are methods to manage incomplete reporting of data. Incorporating such studies sometimes involves work as tedious as reconstructing numbers from graphs, however.

No other exclusion criteria were applied to the literature. A total of 71 published articles which met these standards were located and secured, 9 of which were constructed in such a way as to permit their being broken down into 2 separate studies. Coding a single study twice challenges the notion of independent observations, but not breaking these investigations down into two experiments would have meant eliminating some potentially important variance. That is, an article might have compared two different types of progressive relaxation to a control group, and it is of interest in this meta-analysis which type of progressive relaxation is most effective. Thus,
80 cases were included. (A complete list of studies included in the meta-analysis is contained in Appendix A.) It is likely that there are a small number of studies which may have been overlooked given the number of journals in the psychological, educational, and medical fields through which this research has been published, and there were a few investigations that could not be obtained. The author is confident, however, that this group of articles approaches the number that truly exist.

Over 100 dissertations also seemed relevant to this project, based on the search strategy and a rough screening using Dissertation Abstracts. Of this total, 80 were ordered through interlibrary loan for further examination. Obtaining dissertations in reasonable lengths of time without paying exorbitant fees was problematic, and near the end of the process, only 8 appropriate dissertations (9 cases) were secured and coded. The purpose of retaining this sample was to enable the analysis to uncover any sizeable difference in effects between the published and unpublished manuscripts. Researchers are only too cognizant of a publication bias for significant findings (Rosenthal, 1984).

Moderator Variables

When the appropriate studies were secured, each was summarized on a coding sheet (See Appendix B). The coding sheet attempted to capture all of the possible differences
that existed between studies, and ease the conversion of the study to numerical form. This study summary included information on the subjects and difficulty that they were experiencing, described the methodology and treatment in considerable detail, and of course embodied the results of each investigation. Inadequate reporting of methodology, treatment, etc. forced careful reading between the lines and some searching for information through referenced articles and books. The end result was that close estimates were made on the unspecified characteristics of various studies, if such estimates could be justified as reasonably accurate. Many characteristics thus remained unspecified.

Henceforth these coded characteristics of studies — with the exception of the results — will be referred to as **moderator variables**. Moderator variables represent dimensions along which studies in a particular area of research differ, and eventually become the **independent variables** in the meta-analysis. These variables have been shown to influence outcome, might be expected to influence outcome, or may not be expected to influence outcome but are coded regardless. It is advisable to be overly inclusive of moderator variables (Cooper, 1984) because: (a) if there are differences among the studies with respect to some characteristic it is possible that those differences might moderate outcome, (b) it is impossible
to know beforehand which moderator variables will have the strongest influence (that is one of the purposes of the meta-analysis), and (c) it is extremely cumbersome to return to previously coded studies to add new moderator variables.

After the studies were carefully reviewed by the author and a coding sheet was filled out for each, moderator variables were constructed sometimes directly and sometimes indirectly from the information reported on the summary sheets. After the meta-analyst becomes thoroughly familiar with the body of research with which he/she is working, it becomes apparent that certain potential moderator variables (e.g. in this review time of day treatment took place) cannot be coded because of inadequate reporting of information. Interestingly, fine detail on treatment conditions such as room temperature is sometimes given, with only sketchy information provided about (for example) the treatment itself. While some moderators cannot be coded, others must be adjusted or added to accommodate the state of the literature. From the articles reviewed and the corresponding coding sheets, the following 58 moderator variables were constructed:

1. Publication year. For example, it might happen that more recent research produces differential results. In effect, only eight studies appropriate to this meta-analysis were published prior to the 1973 manual by
Bernstein and Borkovec.

2. Whether the manuscript was published or was a dissertation. A publication bias toward significant findings has already been noted.

3. Whether or not the study included Thomas Borkovec as an author. Borkovec, who coauthored the most recent training manual, was involved in several publications and it might be that his research findings are different. No other author seemed unusually prolific in this area of research.

4. Whether the subjects were: (a) college students, (b) adults not attending college, or (c) children under the age of 18. Many studies drew from introductory psychology subject pools, but a large number involved other adult populations, and there were several which employed children. As previously mentioned, studies have suggested that younger participants fair better, and that there is no difference between college students and working adults.

5. The total number of subjects in the study.

6. Number of subjects in the progressive relaxation therapy group.

7. Number of subjects in the control group.

8. The mortality percentage of the progressive relaxation group. Smith, et al. (1980) speak to problems in internal validity which may result from high mortality
or differential mortality between treatment groups.

9. The mortality percentage of the control group.

10. The percent of the subjects who were male.

Several studies employed all men or all women, some were heterogeneous, and it was impossible to decipher percentages from several.

11. The mean age of the subjects. Frequently this number had to be estimated. If not specified, students were coded as age 20 (Smith, et al., 1980), and adults were coded as age 42 based on the mean of a sample of 24 studies which reported adult subject age. Leaving these estimates out of the analysis would essentially mean ignoring information, however nonspecific, that the studies did provide.

12. Whether or not the mean age was estimated. Anytime estimates are constructed in a meta-analysis it is possible to create an accompanying moderator variable which can signal the researcher that that subset of studies is producing differential results.

13. Whether the subjects were suffering from: (a) a medical complication (e.g. cancer and chemotherapy, tension headaches, hypertension); (b) a psychiatric complication (DSM III diagnosed); (c) a psychological complication (e.g. behavioral problem, conditioned response, phobia, insomnia, general anxiety); (d) no complication; or (e) a contrived complication (e.g. loud
noises, noxious films presented to the participants). This seemed to be the optimal way to group the variety of difficulties represented in the various studies. It was commonplace for subjects to be screened for drug usage, previous experience with the therapeutic techniques, etc. prior to their inclusion in the study.

14. Whether or not the subjects were suffering from insomnia. Since many studies investigated the effect of progressive relaxation on insomnia, it was decided to make this a moderator variable in and of itself. It becomes obvious then, by considering the overlap between this moderator variable, the previous one, and some that follow that these "independent variables" in a meta-analysis are not necessarily independent of each other.

15. Whether or not the participants were suffering from a high and generalized level of anxiety. Again, many studies focused on this population. Research has suggested that the effects of progressive relaxation are easier to measure in anxious populations.

16. Whether or not the subjects were suffering from alcoholism.

17. Whether or not the subjects were suffering from some specific anxiety such as test anxiety or speech anxiety.

18. Whether or not the subjects were suffering from any complication. This was essentially a reduction of
moderator variable 11.

19. The authenticity of the presenting problem: (a) tested or screened, (b) previously diagnosed, (c) contrived, or (d) none.

20. How the subjects were obtained: (a) solicited by the experimenter (often through introductory psychology subject pools), (b) responded to an advertisement, (c) recognized a problem and sought treatment, (d) were referred, (e) were committed to treatment without choice, or (f) were already in a facility and/or receiving some treatment and this additional relaxation treatment was offered. These different strategies were outlined by Smith, et al. (1980), with the exception of the last alternative (i.e. f) which was frequent in this particular literature. It seems possible that the method through which subjects were obtained might impact results, and thus the inclusion of this moderator variable.

21. Whether subjects were divided into groups through: (a) random assignment, (b) stratified random assignment (e.g. equating groups for age or intensity of problem), (c) matched pairs, or (d) nonrandom assignment. According to Smith, et al. (1980), this is another study characteristic which affects internal validity.

22. An overall estimate of internal validity as: (a) high, (b) medium, or (c) low. Adapted from the Smith et al. (1980) standards, studies were judged to have high
internal validity if they randomly assigned subjects to groups and had less than 15% mortality total and relatively equivalent mortality between progressive relaxation and control groups. A rating of medium internal validity was given to studies which had random assignment but mortality higher than 15% or unequal between groups, failed randomization with low mortality, or were well-designed matching studies. Low internal validity studies had severely differential mortality or weak matching strategies.

23. Type of control group: (a) wait list, (b) relaxation placebo, or (c) activity which had nothing to with relaxation, therapy, or improving performance. As previously mentioned, Grimm's (1980) review of the cue-controlled relaxation literature did reveal that experimental design affected outcome.

24. Credibility of the control group. Two practitioners with doctoral degrees in counseling psychology and one counseling psychology intern rated on a five-point scale each control treatment as to how credible and likely it was to enhance expectations to become more relaxed (See Appendix C). Those three ratings were averaged and entered as a moderator variable for each study. If inert treatments with high credibility produce results similar to those of progressive relaxation, then perhaps expectancy effects account for much of the
beneficial effects of relaxation training.

25. Whether or not there was another treatment group besides progressive relaxation and control in the study. This of course made no difference in the final results comparing the relaxation and control groups.

26. Type of treatment: (a) progressive relaxation therapy alone, (b) progressive relaxation therapy with imagery, (c) progressive relaxation therapy with a conditioned cue (e.g., cue-controlled relaxation), or (d) progressive relaxation with biofeedback. If these treatment additions do not produce differential results then they may be unnecessary appendages. This question has been raised in the literature, as discussed in Chapter II.

27. Type of progressive relaxation therapy: (a) Bernstein and Borkovec (1973)/Paul (1966) where all (usually about 16) muscle groups are practiced during each session, (b) Wolpe and Lazarus (1966) where Jacobson's procedures are abbreviated but still only one muscle group per session is relaxed, and (c) Jacobson’s (1938) extensive set of procedures. Most studies fit well into one of these three categories, with the great majority adhering to the more contemporary procedures of Bernstein and Borkovec.

28. Number of muscle groups worked with in the first session. It is conceivable that this moderator variable
and the several that follow could affect the efficacy of the treatment.

29. Whether or not all muscle groups are done each session.

30. Whether of not the number of muscle groups per session is reduced as treatment proceeds as intimated by Bernstein and Borkovec (1973).

31. Whether or not the application of skills to anxiety-producing situations outside of therapy is encouraged.

32. Whether the progressive relaxation treatment was: (a) live, (b) taped, or (c) a combination of the two. The superiority of live administration seems well documented.

33. Whether the treatment was done: (a) in groups, (b) individually, or (c) a combination of the two. As previously outlined, there seems to be some controversy surrounding this issue.

34. The number of individuals in treatment groups (assigned a value of one if seen individually).

35. Whether the subject was in a (a) recumbent position or (b) upright during treatment. Again, some controversy exists as to which is the best position.

36. Whether or not the author specified that a progressive relaxation treatment rationale was given to subjects. One study addressing the effect of treatment
rationale found that it did not affect participant compliance.

37. Whether or not the author specified that subjects had the opportunity to signal the existence of remaining tension and thereby ascertain additional tension-release cycles to more completely relax a specific muscle group. If treatment was provided on tape it was assumed that this was not the case unless there was some specified mechanism which allowed subjects to control their progression through the tape. Participant control over movement through the muscle groups has been postulated as one explanation for the superiority of live administration.

38. The number of times each day subjects were instructed to practice the procedures at home. There is no direct evidence in the literature which suggests that home practice has an enhancing effect.

39. Whether or not a tape was given for home practice.

40. Whether or not the experimenter personally administered the progressive relaxation treatment.

41. The educational background of the therapist: (a) psychological, (b) medical, or (c) some combination of the two. Psychology and medicine seem to have both made significant contributions to the empirical research in this area.
42. The experience of the therapist as adopted directly from Smith, et al. (1980, p. 65):

- Undergraduates or other untrained assistants = 0 years
- MA candidates = 1 year
- MA-level counselor or therapist = 2 years
- Ph.D. candidate or psychiatric resident = 3 years
- Ph.D.-level therapist = 5 years
- Well-known, Ph.D.-level therapist = 7+ years

At least one study has shown that more experienced therapists procure better results.

43. Whether or not subjects were tested during the course of treatment.

44. The number of sessions of relaxation training.

As discussed in Chapter II, short training periods may be a threat to positive outcome.

45. The number of weeks of training.

46. The rate in sessions per week.

47. The length of each session.

48. The total number of hours each subject had to invest in progressive relaxation training.
49. Whether the treatment time was sufficiently detailed in the article or whether it had to be estimated.

50. Whether treatment was administered at (a) a university psychology department or counseling center, or (b) a hospital, clinic, VA, medical school, or treatment home.

Several other additional moderator variables were coded to characterize the results of each study. Following will be a discussion of how the outcome measures were managed along with the presentation of these final eight moderator variables.

Three types of dependent variables related to relaxation were coded: (a) self-reported measures of anxiety (e.g. Spielberger State-Trait Anxiety Inventory), (b) psychophysiological measures of anxiety (e.g. heart rate), and (c) performance measures of anxiety (e.g. amount of sleep). The performance category included any behavior that was expected to change as a result of the relaxation treatment. This category subsumed subjects' own ratings of behavioral change and others' ratings of the subjects' behavior and anxiety. Dependent variables not coded include measures not directly related to anxiety such as depression, loneliness, and interpersonal sensitivity. One can only speculate how relaxation training might affect these personality features.
While Luiselli, Marholin, Steinman, and Steinman's (1979) review of four journals over a three-year period showed that 64% of all group studies on muscular relaxation employed no dependent measure of anxiety, that was clearly not the case in the current review. It was not uncommon, however, for assessments to be done in only one or two of the three measurement areas presented above. Luiselli et al. report that 18% of the group studies they located utilized self-report measures, 18% employed physiological measures, and there were no group studies which included a behavioral measure.

For each dependent measure included from each study, an effect size was computed to statistically represent the superiority of the progressive relaxation group over the control group on that particular measure. In this meta-analysis, Hedges's $g$ was used as an effect size indicator (Hedges, 1981). Hedges's $g$ quantifies the posttreatment advantage of having been in the progressive relaxation group instead of the control group on some measure of outcome. Hedges's $g$ is equal to the standardized difference between two means (in this case treatment and control) divided by the pooled standard deviation. It is similar in structure and function to Cohen's $d$ and Glass's $A$ (Rosenthal, 1984). Hedges's $g$ was coded as a positive number if the effect was in the expected direction (e.g. a reduction in anxiety) or
negatively if the results were unexpected, and there is a correction formula for small sample sizes (i.e. less than 10).

One positive feature of Hedges's $g$ is the use of both treatment and control data to compute a standard deviation which is then used to standardize the mean difference between the two groups. Effect sizes such as Glass's $d$ only use the standard deviation of the control group for this purpose, which does not seem as conceptually sound given that the comparison involves both treatment and control groups. In terms of limitations, Hedges's $g$ does not incorporate preexisting differences between treatment and control groups into the computational formula. That is, only the posttreatment data is considered.

While this limitation is very typical of meta-analytic effect sizes, it does necessitate assuming that the control and treatment groups have the same pretreatment means on various dependent measures. It in fact was not uncommon for these progressive relaxation studies to rule out initial differences through statistical tests. Also, it seems that over the long run preexisting differences would even themselves out and there would be little effect on the overall mean effect size for the treatment. However, this effect size limitation has more impact on the search for moderator variables, in that differential results among studies are
presumed to be the product of differences in the characteristics of studies and not preexisting differences in the treatment groups.

Ironically, there were several studies in this meta-analysis for which preexisting differences between groups had to be taken into account, despite the design of the effect size formula. Several studies reported the results of $t$-tests done on pre-post change scores, $F$s derived from repeated measures analyses of variance, or $F$s produced by analyses of covariance. All of these tests incorporate preexisting differences between groups into the computations. The result was modest differences between what various effect sizes represented, and these differences were coded as moderator variables:

51. Whether or not the statistical tests were done on change scores.
52. Whether or not the statistical tests involved repeated measures.
53. Whether or not the statistical tests involved residualized scores (analysis of covariance).

When the posttreatment means, standard deviations, and sample sizes were given, $d$ was easily computed. Alternately, when the $t$-statistic was given for the difference between the treatment and control means, a simple conversion produced $d$. If the results of $F$-tests were reported along with treatment means and sample sizes,
it was possible to work backwards to produce $\mu$. Analysis of covariance $F$s were treated as regular analysis of variance $F$s, and any test which involved repeated measures necessitated an adjustment of the sample size in computing $\mu$. Computer programs were written which quickly and accurately computed $\mu$ from these various sources.

Occasionally, only the results of post hoc tests were available for consideration. This necessitated converting the level of significance associated with the difference between progressive relaxation group and control group means to a $z$-score, which was then run as a $z$-score to compute $\mu$. This produced a conservative estimate of $\mu$. The other infrequent conversion involved using the significance levels in nonparametric tests to estimate $\mu$. Again, moderator variables were created to ensure that these estimation procedures did not produce widely different effect sizes:

54. Whether or not the effect size was estimated from a post hoc test.

55. Whether or not the effect size was estimated from a nonparametric statistic.

In a few cases standard deviations necessary to computing the effect size were not reported, but there were other studies employing the exact same measurement. This permitted deriving an estimate by averaging the analogous standard deviations in the other studies,
provided that Hartley's E-Max Test for Homogeneity of Variance indicated insignificant variance among them. Also, several studies did not specify the exact number of subjects in each treatment group. Presumably close estimates were made however, based on the high probability of equal distribution of subjects across treatment conditions. In any event, estimation of standard deviation and sample size were coded as potential moderator variables:

56. Whether or not standard deviation was estimated.
57. Whether or not sample size was estimated.

If a study reported no significance for an outcome measure, its effect size was be estimated to be zero. Cooper (1984) describes this as a conservative alternative when the specific results of hypothesis tests are missing. Simply leaving nonsignificant findings out of the analysis would improperly inflate the final mean effect size. However, unless progressive relaxation was detrimental relative to control procedures, the true effect size would be somewhere between zero and one which would have been produced by a significant result. For this reason, final computations with these zeros removed will be done to provide a rough upper limit on what the advantageous effect of progressive relaxation over a control "treatment" might be.
Having multiple effect sizes within studies (e.g. a measure of self-reported anxiety, a measure of heart rate) creates a unique problem for meta-analysis. If studies contribute more than one effect size, which frequently is the case, entering all of the effect sizes into the analysis would violate rules of statistical independence (Wilson, 1985). Ideally, each study would contribute one effect size, and one obvious way to accomplish this would be to average all of the effect sizes for a particular investigation. This was done in the current meta-analysis, but these average effect sizes will be used only if certain conditions can be met as will be immediately detailed.

As already discussed, effect sizes within each study can be classified into one of three categories: (a) self-reported measures of anxiety, (b) psychophysiological measures of anxiety, and (c) performance measures of anxiety, and thus a maximum of three consolidated effect sizes per study can be derived by averaging the various measures within each of these three categories. For example, in a study which employed heart rate and systolic blood pressure as dependent measures, the two corresponding effect sizes can be averaged to produce one psychophysiological effect size. To ensure then that progressive relaxation therapy does not have differential effects on these three types of measures, an analysis of
variance, as described below, was carried out. Whether effect sizes are averaged across the whole study or within the three types of measures, a final moderator variable was:

58. The number of effect sizes used to determine the average effect size(s) for a particular study.

The Analyses

A preliminary two-way analysis of variance will be run to determine whether: (a) effect sizes differ across measures, (b) effect sizes differ between publications and dissertations, and/or (c) that there is an interaction. Assuming that there is no interaction, if the main effect due to publication status is significant, then dissertations will be excluded from further analyses. If the main effect due to type of measure is significant, then it will be best to run three separate meta-analyses, one for each type of effect size. Otherwise, it would be less complicated and reasonably justifiable to proceed with one meta-analysis using the average effect size for each study.

Following a decision on the appropriateness of one (versus three) meta-analyses, and whether or not to include dissertations in the analyses, the next question of importance was: Are the average effect sizes for a particular meta-analysis homogeneous? Hunter, Schmidt, and Jackson (1982) describe this inquiry as one of the
primary properties and early steps in "state-of-the-art" meta analyses. This question can be answered by calculating a test statistic $Q$ (Hedges & Olkin, 1985) using the average effect sizes from the studies and then determining whether or not $Q$ (distributed $\chi^2$) is significant. This test and other statistical operations will be described more fully in Chapter IV.

If a test of homogeneity demonstrates that there is an insignificant amount of variance among the average effect sizes (studies), then there will not be any variables which moderate the effects of the treatment. That is, there will be no variance to moderate. The meta-analysis then ends by first calculating a weighted mean effect size (Hunter et al., 1982). This weighted mean effect size ($\bar{\eta}$) is not to be confused with "average effect size" ($\bar{\gamma}$) which has been used in this section to identify the consolidation of effect sizes within a study and not across studies. The mean effect size is "weighted" because it takes into account the sample size upon which each effect size is based (Hedges & Olkin, 1985), and it represents the average superiority (or inferiority) of the treatment group over the control group following therapy. After calculating this weighted mean effect size, it must then be determined whether or not it is significantly different from zero (Hunter et al.). In other words, it must be decided whether the treatment had
a significant effect beyond that of control procedures.

On the other hand, if the homogeneity hypothesis can be rejected, a search for moderator variables among study characteristics is in order (Hunter, et al., 1932). Also, when the null hypothesis is barely retained, examining potential moderators of outcome is still a sound decision. In either case, the list of 58 potential moderator variables (independent variables) coded for each study would enter into the analyses along with their corresponding average effect size (dependent variable). Some of these moderator variables are obviously continuous (e.g., number of sessions), while others are categorical (e.g., live versus taped). This is of no consequence, however, as categorical variables can be recorded numerically and entered into the analysis using "effects coding."

Searching for moderator variables involves returning to those study characteristics associated with the average effect sizes (Hunter et al., 1982), and attempting to divide the studies into subsets that have homogeneous average effect sizes. Subsets are determined by a moderator variable or variables which account for a significant amount of variance in average effect size. It may be, for example, that once live administrations are separated from taped administrations, there is little variance in the effect of progressive relaxation within
each of the two levels of administration.

There is some controversy about whether hypothesized moderator variables should be specified prior to any analysis after which they are inspected in an attempt to account for effect size variance, or whether there should be a random check through all possible moderator variables. The problem with checking only a few hypothesized variables is that potentially important variables not identified by primary research studies may be overlooked, and it would be ludicrous to code all possible moderator variables if they then were not going to be put to use. The difficulty with coding all possible moderator variables and examining each is of course capitalization on chance. That is, as pointed out by Hunter, et al., (1982), significant associations may occur based on chance. These authors point out that while this problem is exacerbated by the usually high number of study characteristics and the fact that sample size is only the number of studies, there are no statistical solutions to this dilemma.

If necessary, and at the risk of capitalizing on chance, it was decided to search all coded moderator variables for potential moderating effects. This would be done using a stepwise regression analysis (as suggested by C. F. Bond, personal communication, May, 1987) that chooses study characteristics, one at a time, which
correlate most highly with average effect size. After the moderator variable with the highest correlation is chosen, a second variable which provides for the largest increment in the proportion of variance accounted for by the model may be added if it accounts for significantly more variance than the first moderator variable by itself (Pedhazur, 1982). Theoretically, this process could continue until a variable is reached which does not add significantly to the prediction power of the model. It also is possible that variables already chosen can lose their prediction power as other moderator variables are added, and thus be deleted from the model.

This "disaggregation" should produce subsets of studies with homogeneous average effect sizes, for which weighted mean effect sizes can be computed. Subsets with higher weighted mean effect sizes might suggest optimal treatment conditions and/or populations based on the moderator variable(s) from which they are constructed. It might also be that methodological variables moderate effect, which would complicate the issue of the efficacy of progressive relaxation therapy.
CHAPTER IV
RESULTS

The results are presented in three sections: (a) preliminary analysis, (b) meta-analysis, and (c) selected comparisons. A discussion of the results will follow this chapter.

Preliminary Analysis

A two-way analysis of variance (3 types of measures x 2 publication status classifications) initially was run on the average effect sizes from the individual studies. Prior to running the analysis, each effect size (\( \bar{g} \)) was multiplied by its weight (Rosenthal, 1984; Rosenthal & Rubin, 1982):

\[
w = \frac{2(n_1 n_2)(n_1 + n_2 - 2)}{(n_1 + n_2)^2 + 2(n_1 + n_2 - 2)}
\]

Applying weights to effect sizes allows consideration of the treatment and control group sample sizes in determining a study's contribution to the weighted mean effect size (\( \bar{g} \)). This is a favorable adaptation, because small samples tend to produce more spurious results than larger samples, which tend to be more reliable (Hedges & Olkin, 1985). Thus, larger samples are weighted more
heavily in the final computations.

Strictly speaking, running an ANOVA on these data violates the assumption of independence of error components (Keppel, 1982). That is, the effect sizes are not independent of one another in that each study may contribute up to three (self-report, psychophysiological, and performance) effect sizes. Despite this shortcoming, this method was chosen because there was no other viable alternative (C. F. Bond, personal communication, June, 1987). Ideally, the above preliminary analysis would be carried out by entering for each study the self-reported anxiety, psychophysiological anxiety, and performance effect sizes into a repeated measures ANOVA to determine if these measures differ from one another. What impedes this repeated measures strategy, however, is the large amount of missing data that would make the analysis very weak. That is, very few studies measured anxiety in all three areas.

Since a nonrepeated measures ANOVA was the only viable option, a strategy was developed (C. F. Bond, personal communication, June, 1987) to enhance confidence in the final results of the meta-analysis if the ANOVA indicated no significant differences among self-report, psychophysiological, and performance average effect sizes, thereby supporting consolidation to one average effect size per study. Given that the meta-analysis brought
about a "disaggregation" of the studies due to influential moderator variables, similar analyses were planned within each type of effect size to insure consistency of results. That is, there would be an attempt to make sure that any influential moderator variable(s) had a similar impact on the three types of measures.

The results from the two-way analysis of variance are presented in Table 2. As can be seen in Table 2, the self-report, psychophysiological, and performance measures of anxiety did not produce significantly different effect sizes, $F(2, 143) = 0.515$. Published investigations, however, did yield higher effect sizes than did the small sample of dissertations, $F(1, 143) = 5.793, p < .025$. The interaction term was not significant, $F(2, 143) = 0.040$. Tables 3 and 4 reveal the weighted mean effect sizes for these various subsets. Recall that "mean" effect size ($\bar{g}$) refers to consolidation of effect sizes across studies while "average" effect size ($g$) refers to within-study combinations. The weighted mean effect size is formed by summing the products of average effect sizes and their weights, and dividing by the sum of the weights (Rosenthal, 1984).

Because the dissertations were few in number, were not chosen in a completely random fashion, and differed from the 80 published reports in effect size, they were excluded from any further analyses. Furthermore, since
Table 2

Results of an Analysis of Variance on Type of Measure X

<table>
<thead>
<tr>
<th>Publication Status</th>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>Type of measure</td>
<td>5.410</td>
<td>2</td>
<td>2.705</td>
<td>0.515 ns</td>
</tr>
<tr>
<td></td>
<td>Publication status</td>
<td>30.441</td>
<td>1</td>
<td>30.441</td>
<td>5.793 *</td>
</tr>
<tr>
<td></td>
<td>Interaction</td>
<td>0.417</td>
<td>2</td>
<td>0.209</td>
<td>0.040 ns</td>
</tr>
<tr>
<td>Within</td>
<td></td>
<td>751.438</td>
<td>143</td>
<td>5.255</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>787.706</td>
<td>148</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < .025
Table 3

Weighted Mean Effect Sizes for Types of Measures

<table>
<thead>
<tr>
<th>Type of Measure</th>
<th>N</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Report</td>
<td>45</td>
<td>0.334</td>
<td></td>
</tr>
<tr>
<td>Psychophysiological</td>
<td>42</td>
<td>0.274</td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td>47</td>
<td>0.451</td>
<td></td>
</tr>
</tbody>
</table>

*a* Published studies only.

Table 4

Weighted Mean Effect Sizes for Publications and Dissertations

<table>
<thead>
<tr>
<th>Publication Status</th>
<th>Na</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Published</td>
<td>134</td>
<td>0.346</td>
<td></td>
</tr>
<tr>
<td>Dissertation</td>
<td>15</td>
<td>0.072</td>
<td></td>
</tr>
</tbody>
</table>

*a* Number of effect sizes. Each study could contribute up to three (self-report, psychophysiological, and performance) average effect sizes.
the type of dependent measure did not seem to make a significant difference in outcome, the overall average effect size for each study was used. Again, this was not a simple average of the self-report, psychophysiological, and performance effect sizes within each study, but rather represented the average of every single effect size derived from a particular study.

Meta-Analysis

As mentioned in the preceding chapter, a test of homogeneity of these 80 effect sizes, one per study, was then conducted. The test statistic $Q$ (Hedges & Olkin, 1985) is formed by first squaring the difference between each effect size $g_i$ and the weighted mean effect size $\bar{g}$ and multiplying by the weight $w_i$ (Rosenthal, 1984). $Q$ represents the sum of these 80 weighted squared differences (70.486), and is distributed $\chi^2$ with $k - 1 = 79$ degrees of freedom (Hedges, 1982; Rosenthal & Rubin, 1982). The null hypothesis that the effect sizes were homogeneous could not be rejected ($\chi^2(79) = 70.486, p > .750$), and thus it did not appear that there were any influential moderator variables. That is, despite the qualitative and structural differences among the studies, it did not appear that this heterogeneity caused significant heterogeneity among the results.

The weighted mean effect size ($\bar{g}$) for the 80 cases was determined to be 0.337 with a standard deviation of
0.047. A hypothesis test to determine if this weighted mean effect size is significantly different from 0 then had to be executed. Essentially, this was a test of the hypothesis that progressive relaxation therapy subjects sustained less anxiety after treatment than did control subjects. Since the weighted mean effect size divided by its standard deviation is normally distributed (Hedges and Olkin, 1985), this number (z) can be referred to the standard normal distribution to evaluate its significance. In this case, the null hypothesis that the weighted mean effect size (I = 0.337) was not significantly different from zero was rejected (z = 7.155, p < .001). That is, it appeared that the progressive relaxation subjects had less anxiety following treatment as a result of treatment than the control subjects.

It is of interest to consider the magnitude of the weighted mean effect size. Cohen (1977) describes the closely related effect size d as small if d = 0.2, medium when d = 0.5, and large when d = 0.8. Thus, a weighted mean effect size of 0.337 falls between the small and medium designations. That is, Cohen would depict the difference between the progressive relaxation and control group anxiety means as small to medium following treatment.

Another way to interpret a weighted mean effect size of 0.337 is to make use of the Binomial Effect Size
Display (Rosenthal, 1984). According to this strategy, a weighted mean effect size of 0.337 is equivalent to a change in success rate from 42% to 58%, attributable to progressive relaxation therapy (See Table 5). In other words, it might be said that 58% of the progressive relaxation subjects were less anxious following treatment, while only 42% of control subjects experienced such a reduction.

Table 5

<table>
<thead>
<tr>
<th>Condition</th>
<th>Less Anxious</th>
<th>More Anxious</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progressive Relaxation</td>
<td>58%</td>
<td>42%</td>
</tr>
<tr>
<td>Control</td>
<td>42%</td>
<td>58%</td>
</tr>
</tbody>
</table>

The weighted mean effect size and number of studies, through a series of conversions, can be used to estimate the number of studies averaging null results that would need to be found to neutralize the weighted mean effect size. In other words, the meta-analyst can determine the number of studies showing no difference between treatment and control groups needed to not reject the hypothesis that \( \bar{H} = 0 \). Rosenthal (1984) developed this statistic in response to the potential "file drawer problem," a concern
that studies with insignificant results are filed rather than published. In this particular meta-analysis, approximately 1,500 studies averaging null results which were unpublished or simply not located would have to exist to bring the weighted mean effect size 0.337 down to a level not significantly different from 0. Unfortunately, with 1,580 studies, a very small weighted mean effect size could be highly significant, simply indicating a weak but reliable treatment effect.

A final note on the magnitude of the weighted mean effect size involves the fact that many studies in this meta-analysis did not report means, ts, Fs, etc. when specific results were not significant. This could have a substantial suppressing influence on \( \bar{r} \), since it is conceivable that a low to medium range effect size (treatment effect) might not produce significant findings in individual studies. Hypothetically, it is even possible that a weak treatment effect could exist which would not produce significant results in a single study, yet still would yield a significant weighted mean effect size.

To attempt to circumscribe this problem, a weighted mean effect size was calculated after eliminating all effect sizes which were set at 0 because the author simply reported insignificant results. This elevated the weighted mean effect size from 0.377 to 0.519, which is
within the medium range proposed by Cohen (1977). It is not inconceivable that \( \bar{g} \) might have approached this substantially higher value had sufficient data been available for exact computation of all effect sizes. That is, while it is possible that results reported as insignificant might have favored the control group or truly represented no difference between progressive relaxation and control, it is more likely that such results represented a treatment advantage.

Selected Comparisons

Given homogeneity of the average effect sizes, a search for moderator variables was not appropriate. It is interesting, however, to examine a select few variables and compare weighted mean effect sizes between/among groups. It should be noted that this is a departure from meta-analytic strategy, which ended with the finding of homogeneity and computation of a weighted mean effect size. Making these additional comparisons is of descriptive value, however, and may point to salient primary research questions.

As can be seen in Table 6, studies which trained participants in progressive relaxation along with biofeedback had the highest weighted mean effect size (0.517), followed by studies using progressive relaxation with a conditioned cue (0.420), progressive relaxation alone (0.313), and progressive relaxation with imagery...
Thus, progressive relaxation fared better when presented with an added procedure (0.412) rather than by itself (0.313). Furthermore, as presented in Tables 7, 8, and 9, the weighted mean effect sizes for the studies which employed live relaxation training, individual administration, and the Bernstein and Borkovec procedures were higher. Table 10 displays the contrast between studies which combined all three of these strategies to those that did not.

As can be seen in Table 11, studies whose participants were insomniacs produced somewhat higher effect sizes than studies which did not investigate insomnia. Similarly, studies with subjects who did not experience a high and generalized level of anxiety, and studies with subjects who were not alcoholic (Tables 12 and 13, respectively) produced somewhat larger effects. Table 14 shows that publications which employed children produced higher weighted mean effect sizes (0.566) than ones treating adults (0.381) and college students (0.248). Table 15 reveals the considerable advantage of treating subjects with a medical complication (0.649) over treating subjects with a psychological complication (0.347), psychiatric complication (0.301), no complication (0.170), or a contrived complication (0.185). It also seems apparent from these weighted mean effect sizes that progressive relaxation therapy works best when a genuine
Finally, as might be expected, studies which compared progressive relaxation to a wait list condition produced higher effect sizes than studies which used a placebo treatment. These results are displayed in Table 16. None of the above comparisons can be considered to be an absolute indicator of the conditions under which the treatment works best. This is because confounding variables may exist which may account for the superiority of one group over another. For example, live administration may fare better than taped administration because of the potential opportunity for additional tension-release cycles as necessary. Nevertheless, these unplanned comparisons are interesting to consider.
Table 6

Weighted Mean Effect Sizes for Progressive Relaxation Variations

<table>
<thead>
<tr>
<th>Type of Relaxation</th>
<th>N</th>
<th>$\bar{g}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Biofeedback</td>
<td>9</td>
<td>0.517</td>
</tr>
<tr>
<td>With Conditioned Cue</td>
<td>7</td>
<td>0.420</td>
</tr>
<tr>
<td>Alone</td>
<td>58</td>
<td>0.313</td>
</tr>
<tr>
<td>With Imagery</td>
<td>6</td>
<td>0.266</td>
</tr>
</tbody>
</table>

Table 7

Weighted Mean Effect Sizes for Live and Taped Relaxation Training

<table>
<thead>
<tr>
<th>Type of Training</th>
<th>N</th>
<th>$\bar{g}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live</td>
<td>51</td>
<td>0.420</td>
</tr>
<tr>
<td>Taped</td>
<td>29</td>
<td>0.226</td>
</tr>
</tbody>
</table>

Table 8

Weighted Mean Effect Sizes for Individual and Group Administration

<table>
<thead>
<tr>
<th>Type of Administration</th>
<th>N</th>
<th>$\bar{g}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>38</td>
<td>0.374</td>
</tr>
<tr>
<td>Group</td>
<td>24</td>
<td>0.250</td>
</tr>
</tbody>
</table>
Table 9
Weighted Mean Effect Sizes for Types of Treatment

<table>
<thead>
<tr>
<th>Type of Treatment</th>
<th>N</th>
<th>( \bar{\eta} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bernstein and Borkovec</td>
<td>50</td>
<td>0.403</td>
</tr>
<tr>
<td>Other</td>
<td>22</td>
<td>0.211</td>
</tr>
</tbody>
</table>

Table 10
Weighted Mean Effect Sizes for Live, Individual, Bernstein and Borkovec Treatment Versus Other Studies

<table>
<thead>
<tr>
<th>Treatment Paradigm</th>
<th>N</th>
<th>( \bar{\eta} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live, Individual, Bernstein</td>
<td>62</td>
<td>0.490</td>
</tr>
<tr>
<td>and Borkovec</td>
<td>18</td>
<td>0.301</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 11
Weighted Mean Effect Sizes for Insomnia Studies Versus Noninsomnia Studies

<table>
<thead>
<tr>
<th>Type of Subjects</th>
<th>N</th>
<th>( \bar{\eta} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insomniacs</td>
<td>16</td>
<td>0.390</td>
</tr>
<tr>
<td>Noninsomniacs</td>
<td>64</td>
<td>0.326</td>
</tr>
</tbody>
</table>
Table 12
**Weighted Mean Effect Sizes for General Anxiety Studies Versus Other Studies**

<table>
<thead>
<tr>
<th>Type of Subjects</th>
<th>N</th>
<th>$\bar{r}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>High/General Anxiety</td>
<td>11</td>
<td>0.290</td>
</tr>
<tr>
<td>Other</td>
<td>69</td>
<td>0.344</td>
</tr>
</tbody>
</table>

Table 13
**Weighted Mean Effect Sizes for Alcoholism Studies Versus Nonalcoholism Studies**

<table>
<thead>
<tr>
<th>Type of Subjects</th>
<th>N</th>
<th>$\bar{r}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcoholics</td>
<td>4</td>
<td>0.231</td>
</tr>
<tr>
<td>Nonalcoholics</td>
<td>76</td>
<td>0.341</td>
</tr>
</tbody>
</table>

Table 14
**Weighted Mean Effect Sizes for Subject Classifications**

<table>
<thead>
<tr>
<th>Type of Subjects</th>
<th>N</th>
<th>$\bar{r}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>7</td>
<td>0.566</td>
</tr>
<tr>
<td>College Students</td>
<td>30</td>
<td>0.248</td>
</tr>
<tr>
<td>Adults</td>
<td>41</td>
<td>0.381</td>
</tr>
</tbody>
</table>
Table 15

**Weighted Mean Effect Sizes for Complication Classifications**

<table>
<thead>
<tr>
<th>Complication</th>
<th>N</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical</td>
<td>22</td>
<td>0.649</td>
</tr>
<tr>
<td>Psychological</td>
<td>33</td>
<td>0.347</td>
</tr>
<tr>
<td>Psychiatric</td>
<td>4</td>
<td>0.301</td>
</tr>
<tr>
<td>Contrived</td>
<td>5</td>
<td>0.185</td>
</tr>
<tr>
<td>None</td>
<td>16</td>
<td>0.170</td>
</tr>
</tbody>
</table>

Table 16

**Weighted Mean Effect Sizes for Types of Control**

<table>
<thead>
<tr>
<th>Type of Control</th>
<th>N</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wait List</td>
<td>30</td>
<td>0.418</td>
</tr>
<tr>
<td>Placebo</td>
<td>50</td>
<td>0.295</td>
</tr>
</tbody>
</table>
CHAPTER V
DISCUSSION

The discussion of the results is divided into five sections: (a) general results, (b) debilitating influences on g, (c) selected comparisons, (d) limitations, and (e) a summary statement.

General Results

A weighted mean effect size of 0.377 was found for progressive relaxation therapy as compared to control procedures. This weighted mean effect size was highly significant, indicating that progressive relaxation subjects were significantly less anxious than control subjects following treatment. Anxiety was assessed by a combination of self-report, psychophysiological, and performance measures. Cohen (1977) would describe this posttreatment difference in anxiety between the progressive relaxation and control groups as small to medium in size.

It should be noted that most of the control groups in this population of studies involved a seemingly credible placebo, thus undermining expectancy explanations for the treatment's effectiveness. Expectancy effects are further
discredited by the fact that subjects with no real complication seemed to benefit less from the procedures, and performance measures of anxiety actually responded more favorably to progressive relaxation than did self-report measures. However, studies with a placebo control instead of a wait-list control did evidence smaller posttreatment differences between the treatment and control groups, thus nurturing an expectancy hypothesis.

When the weighted mean effect size ($\bar{g} = 0.377$) was adjusted as described in the previous chapter, it moved into the medium range ($\bar{g} = 0.519$). Still, both of these numbers are substantially smaller than effect sizes reported for the related treatment systematic desensitization (0.91, Smith & Glass, 1977; 1.05, Smith et al., 1980). The progressive relaxation weighted mean effect sizes are more consistent with the effect sizes reported for all forms of psychotherapy (0.68, Smith & Glass), cue-controlled relaxation (0.68, pilot study), and biofeedback (0.43, Sharpley & Rogers, 1984). It must be kept in mind, however, that the latter two meta-analyses involved pre/post treatment comparisons, and did not look exclusively at the differences between the experimental and control groups following treatment.

Turning to the moderator variables, it was somewhat surprising to find given the wide variety of journals,
authors, and populations represented, that there was insignificant variance among studies in the treatment's effectiveness. That is, it appeared that progressive relaxation was consistently useful under a variety of conditions. Some post hoc comparisons, presented below, did reveal conditions under which the procedure seemed to be most effective.

Debilitating Influences on $\bar{g}$

Interestingly, it was not uncommon for investigators to give more glowing reviews of progressive relaxation therapy in their discussion sections that are not consistent with these final results. However, when the results sections of those same studies were examined closely, there commonly were several measures of anxiety which did not show significant treatment effects. In all fairness to these authors' optimism, computations of treatment effectiveness in this meta-analysis erred on the conservative side. That is, effect sizes were assigned a zero value if nonsignificance was reported, the control group with the seemingly strongest credibility was always chosen if more than one control group was available, and conservative estimates of $\bar{g}$ were made when $\bar{g}$ had to be estimated.

Primarily, the Bernstein and Borkovec (1973) progressive relaxation procedures were employed in these studies. However, despite the fact that Bernstein and
Borkovec recommend 10 training sessions, the mean number of training sessions reported in the published investigations (after excluding one outlier) was 5.680. Given Borkovec and Sides' (1979) report that studies demonstrating the superiority of progressive relaxation have a larger number of training sessions, it seems that having a mean number of sessions that is just more than half of what is recommended by Bernstein and Borkovec might have a debilitating influence on outcome and thus the weighted mean effect size.

Another debilitating influence on \( \bar{x} \) relates to the issue of somatic versus cognitive anxiety. As previously discussed, contemporary progressive relaxation procedures have been modified to better address cognitive anxiety (Lehrer, 1982), and are believed to be less effective when somatic anxiety is the target of the intervention (Greenwood & Benson, 1977; Lehrer, 1978, 1982). Yet, psychophysiological anxiety was used as one of the primary measures in this collection of studies. It was not unexpected, then, that the weighted mean effect size for psychophysiological measures of anxiety was the lowest. It was surprising, however, to find that performance measures demonstrated a greater treatment effect than self-report measures of anxiety. This is encouraging since researchers often find it difficult to substantiate therapeutic effectiveness on a behavioral level.
The small sample of dissertations was excluded from the meta-analysis after it was demonstrated that their average effect sizes differed significantly from those of the published investigations. It is disturbing to note that as a group the dissertations showed almost no difference between treatment and control groups. It should be recalled though that the dissertations were not sampled in a completely random fashion, and even if all 100 plus in existence averaged null results that would not be sufficient to negate the weighted mean effect size derived from the published investigations. As previously mentioned, nearly 1,500 studies averaging null results would have to be found to bring \( A \) down to a level not significantly different from zero.

**Selected Comparisons**

While there was an insufficient amount of variance among the average effect sizes to initiate a search for moderator variables, several comparisons of interest were carried out on the 80 cases for descriptive purposes. Specifically, progressive relaxation was found to be more effective when there was an accessory to the treatment, specifically biofeedback or a conditioned cue. This contradicts literature reviewed in Chapter II which suggested that biofeedback is not a useful appendage. A hypothesis that any additional procedure will enhance outcome cannot be supported since studies with progressive
relaxation and imagery yielded a weighted mean effect size somewhat smaller than progressive relaxation alone.

Additionally, the Bernstein and Borkovec (1973) procedures produced a weighted mean effect size almost double that of the other treatment alternatives combined. Similarly, as predicted in the literature, studies with live administration produced a weighted mean effect size nearly twice as large as studies using tapes. The weighted mean effect size for individual administration exceeded that for group administration, and studies that employed a combination of live, individual, Bernstein and Borkovec training produced much larger average effect sizes than studies which lacked one or more of these characteristics. It might be that this combination is superior because it allows for some tailoring of the procedures to meet the individual's needs.

Keeping in mind the potential for confounding variables and interactions, it seems that a counselor could maximize the chance for therapeutic success with progressive relaxation by teaching the Bernstein and Borkovec procedures individually to a particular client, and by supplementing the training with a conditioned cue, a more efficient accessory than biofeedback.

In addition to these administrative contrasts, various population comparisons were made as well. Subjects experiencing a medical complication (e.g., tension
headache) made the greatest gains by far. Similarly, studies with children had higher average effect sizes than studies employing adults and college students. The weighted mean effect size for studies using college students was actually rather low, but this could be because college students are often selected out of convenience and have no pressing medical or psychological concern pertinent to the study. Effect sizes were somewhat higher among studies whose participants were insomniacs, nonalcoholics, or who did not have a high/general level of anxiety. Lower success rates among individuals with high and generalized anxiety is consistent with the belief that contemporary relaxation procedures are less suited for somatic anxiety, assuming that generalized anxiety is primarily somatic in nature.

Limitations

In addition to general limitations inherent to meta-analytic procedures, there were particular limitations associated with this body of literature and this specific meta-analysis. First, only located, published investigations of progressive relaxation were used in the final analysis. A few studies were also excluded due to severely insufficient reporting of results. However, it is unlikely that the addition of a few published reports would significantly change the weighted mean effect size. Similarly, while unpublished
dissertations may produce less positive results, their addition would not erase the significant difference between the treatment and control groups. Nevertheless, conclusions are limited to the published research.

Another potential limitation is that the analysis used to justify the aggregation of the three different types of measures was not ideally suited for the data because of nonindependence of observations. It was, however, the most viable alternative. Also, the 80 cases were not all independent of one another in that some studies contributed more than one case to the meta-analysis when more than one experimental group of interest was employed. The alternative, however, was to lose some potentially important variance.

Another set of limitations relates to the handling of effect sizes. While Hedges's $g$ is supposed to be computed using posttreatment mean and standard deviations, oftentimes studies reported the results of repeated measures tests, or operated upon residualized or change scores. On the other hand, when the appropriate posttreatment scores are available Hedges's $g$ is computed in such a way as to ignore preexisting differences between the treatment and control groups, a problem intrinsic to the statistic itself. Occasionally, effect sizes had to be estimated, and often they had to be set at zero because of insufficient reporting of results. Finally, combining
effect sizes within the self-report, psychophysiological, and performance categories involves the assumption that these latent classifications are meaningful and that different measures within these categories respond to progressive relaxation therapy in the same way.

A final limitation involves the timing of the measurement. The great majority of studies measured the immediate effects of progressive relaxation and did not attempt to demonstrate long-term gains. Whether or not long-term effects parallel short-term effects remains undemonstrated.

Summary Statement

This meta-analysis apparently is the first thorough quantitative review of the published progressive relaxation literature. As opposed to other meta-analyses (e.g. Smith & Glass, 1977), this research synthesis maintained a high degree of purity in that only one procedure was examined and only controlled studies were included. It appears that progressive muscle relaxation does help individuals reduce anxiety to a limited extent. The procedures seem to be fairly robust with regard to different populations, types of administration, etc., although certain groups of studies did sustain greater reductions in anxiety.
APPENDIX A

STUDIES INCLUDED IN THE META-ANALYSIS


APPENDIX B

CODING SHEET

Authors

Title

Journal Year Volume Pages

Population

Student - nonstudent Clinical - nonclinical

N Male Female Age

Mortality: Treatment Control

Difficulty

Somatic - nonsomatic

Degree of genuineness

Methodology

Random assignment - random stratified - nonrandom - matched pairs

Solicited - volunteered

Type of control: wait list - placebo - activity

Placebo credibility

Blinding of experimenter: blind - not blind and tmt - not blind not tmt

Assignment of therapist: random - nonrandom

Flaws

When tested: pre post during

Treatment

Type of treatment: PMR PMR+imagery FM+CCR PMR+bio other

Simultaneous comparison: yes - no

Live - taped Group - individual

Number sessions Length of session

Number weeks Total time

Rate in sessions/week Time of day: am aft eve

114
Environment

Client position: recumbent - upright

Rationale: yes - no  
Signal tension: yes - no

Experience of therapist  
Education of therapist  

Number of muscle groups during onset  

Number hours/week of home relaxation  

Deviations from standard procedures  

<table>
<thead>
<tr>
<th>Measure</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Type</td>
</tr>
<tr>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>SD</td>
<td>SD</td>
</tr>
<tr>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>t</td>
<td>g</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measure</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Type</td>
</tr>
<tr>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>SD</td>
<td>SD</td>
</tr>
<tr>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>t</td>
<td>g</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measure</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Type</td>
</tr>
<tr>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>SD</td>
<td>SD</td>
</tr>
<tr>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>t</td>
<td>g</td>
</tr>
</tbody>
</table>

Follow-up?  
Comparison to other treatments as control?
In my meta-analysis of progressive relaxation therapy, each study compares progressive relaxation with some sort of control procedure (i.e. placebo, wait list, meaningless activity). Like treatment subjects, control subjects are measured on several indices of anxiety, and it can be assumed that both receive rationales for their respective "treatments," and both are "treated" in the same setting. Would you help me out by rating each of the following control procedures on a scale from 1 to 5 anchored in the following way:

5 = Very credible and likely to enhance expectations to become more relaxed.

4 =

3 =

2 =

1 = Not very credible and not likely to enhance expectations to become more relaxed.

1. Instructed to sit quietly and listen to the sound of a biofeedback machine and spend 3 periods per day relaxing at home.
2. Had brief weekly meetings with the experimenter.
3. Instructed to generate positive thoughts and images while listening to quiet and melodic music.
4. Assigned to a waiting list.
5. Heard ocean surf and instructed to imagine a relaxing scene of their choice.
7. Participated in a discussion group (therefore some practice talking in front of others - for speech anxious people).
8. History, discussion of practical problems, advice, reassurance (with no interpretation or emotional material).

116
Constructed hierarchy of bedtime activities and paired them with neutral images (a systematic desensitization imitation for insomniacs).

Instructed to walk actively and concentrate on problems.

On a wait list and actually told that they were part of a control group.

Instructed to allow physiological activity to stabilize and listen to music to prevent boredom.

Listened to sedative music.

Practiced tests (for test anxious) under nonevaluative conditions.

Had conversations with therapist over phone to report problems - with no intervention.

Thought they were inhaling a relaxing gas (N2O).

Reconditioned the subconscious by presenting anti-anxiety messages at subliminal levels.

Analyzed a musical score (for people with musical performance anxiety).

Clay modeling.

Given reading material and told to relax.

Instructed to get completely comfortable and rest quietly.

Instructed to relax and enjoy tape with stories on it.

Hooked up to polygraph which they were told detects anxiety responses and shocks finger, thereby punishing such responses.

Instructed to rest.

Listened to tape devoid of any meaningful relaxation training.

Instructed to sit quietly and relax.

Listened to soft and relaxing music.

Instructed to concentrate on neutral imagery and resultant feelings of relaxation.

Instructed to quietly rest.

Instructed to become as relaxed as possible.

Instructed to free the mind of intruding thoughts, focus on the music, and allow the body to become relaxed.

Just scheduled time to relax because everyone already knows how to do it.

Heard a monotonous, random tone they thought was an indication of muscular relaxation (i.e. biofeedback).

Given a "relaxation time-release" (placebo) pill.

Given health counseling, educational materials, and problems and solutions were explored.

Had supportive conversations with therapist.

Instructed to get comfortable and rest quietly.

Did exercises that they were told promoted relaxation.

Instructed to relax at home.

Instructed to sit quietly and relax using their own strategy.
Discussed neutral topics and topics related to problem.

Supposedly built up tolerance to stress by listening to sonar signals and picking out a target signal whenever it occurs.

Instructed to self relax.
Instructed to sit quietly.
Instructed to rest comfortably.
Instructed to sit and rest quietly.
Instructed to relax and they were given false feedback which indicated progress.
Instructed to sit quietly with eyes closed.
Had sessions with therapist who encouraged individuals to find alternate ways to deal with tension without specifying them.
LIST OF REFERENCES


Gellhorn, E. (1953). The physiological basis of neuromuscular relaxation. Archives of Internal Medicine, 102, 392-399.


