A Comparison of Verbal and Nonverbal Relaxation Induction Techniques in Neurologically Impaired Rehabilitation Patients.

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A COMPARISON OF VERBAL AND NONVERBAL RELAXATION INDUCTION TECHNIQUES IN NEUROLOGICALLY IMPAIRED REHABILITATION PATIENTS

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy

in

The Department of Psychology

by
Warren T. Jackson, III
B.S., Georgia Institute of Technology, 1988
M.A., Louisiana State University, 1990
December 1994
DEDICATION

This work is dedicated to Warren T. Jackson, Jr., my father, who set the example of impeccable professionalism and a vigorous work ethic. He is missed, yet the memory of his life is a continuing source of inspiration.
ACKNOWLEDGMENTS

I would like to express deep appreciation to my doctoral dissertation committee members for their support of this project. In particular, I would like to thank Wm. Drew Gouvier, Ph.D., who has served as my major professor, chair of my dissertation and thesis committees, co-author of several publications, friend, and mentor in the field of rehabilitation neuropsychology. Dr. Gouvier is a master facilitator of work in progress, who helped me keep this project running smoothly. I am indebted to Phillip J. Brantley, Ph.D. for the rather long-term use of the biofeedback equipment that was so vital for this project. General thanks are due Dr. Brantley and William F. Waters, Ph.D. for their important roles in both my clinical and research skill development over the years. I also wish to thank the other members of my committee, Dirk D. Steiner, Ph.D., Fredda Blanchard-Fields, Ph.D. (my minor professor), and Billy M. Seay, Ph.D., who graciously agreed to replace Dr. Blanchard-Fields on the committee when she left LSU. Very special thanks are due Brandi B. Smiroldo, whose dedication, positive attitude, and conscientiousness helped keep this project on track, and Mark S. Warner, Ph.D., a close friend and colleague who assisted in development of the verbal relaxation induction used in this study. Dr. Warner provided support on many levels during this project. I would also like to thank Eleanor B. Callon, Ph.D. and the staff from Our Lady of the Lake Rehabilitation Center for their part in the conduct of this study. During my internship at the University of Alabama at Birmingham, J. Scott Richards, Ph.D., Thomas A. Novack, Ph.D., Mark S. Mennemeier, Ph.D., and the staff from Spain Rehabilitation Center were extremely helpful in data collection. I also thank Robert E. Taylor, Ph.D. and Jesse B. Milby, Ph.D. for
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ABSTRACT

This study compared the relaxation responses of neurologically impaired rehabilitation patients during verbal and nonverbal relaxation induction protocols. Seventy inpatients undergoing rehabilitation served as voluntary participants: (a) 20 patients with right-hemisphere brain dysfunction, (b) 20 patients with left-hemisphere dysfunction, and (c) a contrast group of 30 non-neurologically impaired orthopedic/medical patients. In the first phase of the study, all subjects underwent an evaluation that involved completion of screening instruments, self-report measures, and a brief neuropsychological test battery. In the second phase of the study, all subjects underwent two successive relaxation induction protocols: (a) verbal, and (b) nonverbal. Order of presentation was counterbalanced across subjects. The nonverbal relaxation induction consisted of a 6.5-minute videotaped depiction of scenes from a walk through the forest. The verbal relaxation induction consisted of a 6.5-minute audiotaped guided imagery script describing the forest-walk scenes depicted in the videotaped nonverbal induction.

Subject ratings of perceived relaxation (vertically-oriented 100 mm visual analogue scale), unilateral forehead surface electromyographic (EMG) activity, and unilateral digital (index finger) skin temperature were the dependent measures of experimental outcome. Ratings of perceived relaxation were made several times throughout the experimental procedure: before and after application of physiological recording sensors; after the first 3.5-minute benign distractor task, 6.5-minute resting baseline, and 6.5-minute relaxation induction; and after the second benign distractor task, resting...
baseline, and relaxation induction. Physiological data were recorded during both sets of baseline and relaxation induction intervals.

Results of separate $3 \times 2 \times 4$ [patient groups (between) x order of relaxation inductions (between) x treatments (within)] repeated measures ANOVAs for each of the dependent measures indicated that, in terms of ratings of perceived relaxation and treatment preference, rehabilitation inpatients with right-hemisphere brain dysfunction tended to respond best to the verbal relaxation induction, whereas patients with left-hemisphere dysfunction tended to respond best to the nonverbal induction. Ancillary findings and the implications for further use of the nonverbal relaxation induction in clinical treatment of rehabilitation patients were discussed.
INTRODUCTION

A variety of applied relaxation techniques have been developed and adapted for use with a large number of clinical populations (Lichstein, 1988). The common objective of these techniques is to "neutralize aversive arousal" (Rosenthal, 1993). Anxiety symptoms and mood alterations are not only common among medically ill patients (Wise & Taylor, 1990), but also among individuals who have sustained damage to the central nervous system due to cerebrovascular accident (i.e., stroke; Malec, Richardson, Sinaki, & O'Brien, 1990; Swindell & Hammons, 1991) or traumatic brain injury (Prigatano, 1992; Stuss, Gow, & Hetherington, 1992). Given the presence of aversive arousal among persons who have brain damage, the use of clinical relaxation strategies appears to be indicated. Unfortunately, little guiding research is available in the literature to address the questions that arise when considering the use of relaxation strategies in the care of persons with neurological impairment. This study was designed to compare the relaxation responses of neurologically impaired rehabilitation patients with unilateral right- and left-hemisphere brain dysfunction during verbal and nonverbal relaxation induction protocols.

A comprehensive review of cerebral lateralization is beyond the scope of this paper (for reviews see Benson & Zaidel, 1985; Geschwind & Galaburda, 1987); however, a brief summary of major findings is pertinent to its introduction. The two hemispheres of the human brain are anatomically and functionally asymmetrical; however, laterality of function is relative, not absolute. The dominant left hemisphere primarily mediates language
functions, verbal memory, complex voluntary movements, auditory processing of language-related sounds, and visual processing of letters and words. In contrast, the non-dominant right hemisphere is specialized to mediate spatial processes, nonverbal memory, movements of spatial patterns, tactile recognition of complex patterns, auditory processing of non-language sounds, and visual processing of complex geometric patterns (Kolb & Whishaw, 1990). The left hemisphere more efficiently processes information in a logical, analytic, temporal-sequential manner; whereas, the right hemisphere is best suited for simultaneous and holistic processing required in spatial reasoning and imagery (Dean, 1986).

Efforts to synthesize reductionist analyses of functional lateralization and localization have recently emerged in the literature. Leisman (1990) recommended the development of a more holistic understanding of brain-behavior relations. Of particular relevance to the proposed study is the relation between cerebral hemisphere activity and autonomic nervous system functioning that is integrated at the subcortical level (Leisman & Koch, 1989). A functional system is inherent: the bilaterally symmetrical autonomic nervous system is controlled by the bilateral hypothalamus which is in turn controlled by the bilateral limbic system and the bilateral, but asymmetrical cerebral cortex (Koch & Leisman, 1990). Thus, hypothesized Leisman (1990), "... autonomic nervous system imbalance may be treatable by appropriate left or right hemisphere-directed therapies and may elucidate for us a better understanding of neuropsychological integration" (p. 40).

This assertion holds special relevance to the development of clinical relaxation techniques for use with patients who have lateralized brain damage. It is logical to attempt to activate parasympathetic (relaxation)
impulses via the unimpaired half of the system by using appropriate modality-specific input. Thus, for patients with right-hemisphere brain dysfunction, a relaxation protocol that will elicit predominantly verbal processing in the unimpaired left hemisphere is indicated. Conversely, a primarily nonverbal processing mode is indicated for patients with left-hemisphere dysfunction. The purpose of this study was three-fold: (a) to develop a nonverbal relaxation induction protocol for use with patients who have language impairment (i.e., aphasia) secondary to left-hemisphere brain dysfunction, (b) to measure both psychological and physiological aspects of experimentally-induced relaxation among inpatients undergoing rehabilitation, and (c) to discover better ways of matching types of relaxation treatment to rehabilitation patients, considering their disability/capability patterns and simple preferences. Below is a brief review of some of the major forms of relaxation that have been widely used, relevant to developing clinical relaxation techniques for use with rehabilitation patients.

A Brief Survey of Clinical Relaxation Strategies

Eastern religion scholars believe that the earliest formal relaxation can be traced to the fourth century B.C. and the birth of Hinduism (Berry, 1971; Feuerstein, 1975). Innumerable Hindus and Buddhists practiced religion-based relaxation in the form of meditation, yoga, and later Zen, obscured from the Western world until the early 1890s (Lichstein, 1988). At the 1893 World Parliament of Religions in Chicago, visiting Buddhist scholars delivered the first formal presentation of their meditative practices and gained much positive exposure (Layman, 1976).
Western relaxation methods began to emerge a few years later as the fledgling fields of psychology and psychiatry began their rapid growth. While working in the physiology department at the University of Chicago, Edmund Jacobson (1929) published his classic text describing progressive relaxation. Just three years later, Johannes Schultz (1932), a Berlin psychiatrist, described a systematic procedure for relaxation, based on the Berlin neurologist Oskar Vogt's practice of clinical hypnosis. Schultz's system was known as autogenic training. Thus, the years between 1890 and 1930 can roughly be considered the period of time during which modern clinical relaxation was born. Three main forms of relaxation had emerged: (a) meditation, (b) progressive relaxation, and (c) autogenic training. These strategies were used in a variety of settings: experimental, clinical, and popular. However, it was not until the 1950s-era growth in clinical psychology and the subsequent development of behavioral medicine as a specialty area in the 1970s that applied relaxation gained widespread integration into mainstream clinical treatment (Lichstein, 1988). With growing acceptance and wider application came many variations on the three basic forms of relaxation, including the use of guided imagery and newer behavioral and cognitive-behavioral approaches. Below is a brief summary of several prominent clinical relaxation techniques and their theoretical bases, provided to familiarize the reader with the basic tenets of each approach. For detailed critical reviews of the empirical support for these various techniques, see Lehrer and Woolfolk (1993a) and Lichstein (1988).
Meditation

**Technique.** Two main forms of meditation are identifiable among a diversity of approaches: (a) mantra meditation, and (b) breath meditation. Both of these procedures involve sitting passively while focusing full attention on a single, continuous stimulus. The attentional focus of mantra meditation is a word or short phrase that is repeated aloud or covertly. Traditionally, the mantra was an excerpt from a religious text or liturgy (Morgan, 1953); however, secular mantras have been employed more recently. In breath meditation, respiratory processes are the focus of attention.

**Theory.** In its traditional form, meditation has three prime goals: (a) attainment of wisdom through contemplation, (b) reaching altered states of consciousness, and (c) relaxation (Lichstein, 1988). This review addresses only the third goal from which contemporary clinical theories of meditation effects arise.

Transcendental Meditation (TM; Bloomfield, Cain, & Jaffe, 1975) has been the most popular form of mantra meditation since it began around 1960. Benson and colleagues (Benson, Beary, & Carol, 1974) introduced a secular version of TM in which an emotionally neutral word (e.g., "one") is covertly repeated instead of the sanskrit mantra used in TM. To elicit the relaxation response, Benson (1975) proposed that the following conditions must exist: (a) "a quiet environment," i.e., minimal sensory stimulation, (b) "a mental device," i.e., attentional focus on a single stimulus, (c) "a passive attitude," i.e., minimal cognitive activity, and (d) "a comfortable position," i.e., minimal kinesthetic stimulation (pp. 112-113). The combination of these internal and external stimulus conditions is thought to elicit increased parasympathetic functioning. Thus, Benson coined the term, "relaxation response."
Several theories have been proposed to explain the relaxing effects of breath meditation. These theories include hypotheses about enhancing right brain hemisphere functioning (Earle, 1981), the soothing and efficient properties of diaphragmatic breathing as opposed to thoracic breathing (Comroe, 1965), vagus nerve stimulation associated with diaphragmatic breathing (Hirai, 1975), mild decreases in carbon dioxide pressure (hypocapnia) in the arteries (Wolpe, 1958), and cognitive diversion (Rosenthal, 1980).

Overall, the empirical support of TM has been fraught with methodological errors, particularly selection-bias and experimenter-bias effects, that raise strong questions about its validity (Smith, 1975). The most comprehensive reviews conclude, however, that meditation is a legitimate approach to developing increased parasympathetic functioning (Lichstein, 1988; Shapiro, 1980; West, 1979). It is possible that individuals who experience the most profound relaxation effects via meditation have an interest in matters of religion and spirituality, "self-exploration," and the mystical. They may also have more sophisticated understanding of their own internal states, both psychological and physiological. To date, these predictors of successful meditation effects have not been systematically studied.

**Progressive Muscle Relaxation**

**Technique.** Progressive muscle relaxation (PMR) involves the sequential relaxation of skeletal muscle groups, either with or without contraction or "tensing" of the muscle(s) before each step in relaxation. Jacobson (1938) described a systematic sequence, called "cultivation of the
muscle-sense," in which the subject was directed to concentrate on the
differences between the sensations of muscle tension and the contrasting
sensations of muscular relaxation. Through this process, the subject gained
an understanding of internal muscular tension cues that signal the need to
apply the relaxation sequence and reduce this state of tension. Jacobson's
(1929) original formal procedure involved the relaxation of only two or three
muscle groups each session until a total of almost 50 skeletal muscle
subgroups had been treated. At this training pace, a client could require
between three and six months of treatment until they reached mastery of
muscle-sense training (Lichstein, 1988). Once muscle-sense training was
completed, the tension component was gradually reduced and the patient was
directed to simply relax any areas of muscle that the therapist observed to be
tense. Jacobson (1938) wrote, "In its simplest form, the method of relaxation
consists of directing the patient to relax whatever parts appear to the physician
to be tense with no previous training as to muscle-groups and sensations"
(p.80).

Jacobson (1967) attempted to popularize abbreviated PMR protocols
later in his career because his basic procedure was often considered too
cumbersome for frequent clinical use. This concern led other scientist-
practitioners to develop shorter methods based on original PMR guidelines
(Bernstein & Borkovec, 1973). Wolpe (1958) developed an abbreviated
protocol that relaxed 15 muscle groups in about 20 minutes. This procedure
was employed in the context of "reciprocal inhibition" of anxiety and is still
widely used in what is now systematic desensitization.

Goldfried (1971) reformulated systematic desensitization as a method of
self-control, promoting the development of a very brief and portable version of
relaxation training that could be applied frequently during the course of daily living. This technique grew out of a concern over the fundamental discontinuity between deep relaxation trained in a peaceful environment and the stressful demands of daily life. Various forms of self-control relaxation have emerged, yet these procedures share PMR as a common element (Deffenbacher & Suinn, 1982). After initial instruction in standard PMR, subsequent sessions seek to gradually abbreviate the protocol and reduce therapist guidance, until the subject can elicit a self-directed state of relaxation in the natural (stressful) environment.

Theory. Jacobson’s formulation of PMR was based on the premise of neuromuscular circuits, emphasizing the integration of central and peripheral nervous system functioning and the interplay of afferent (sensory) and efferent (motor) neural processes. Jacobson (1938) asserted that brain activity could be manipulated by input from the skeletal muscle system. Two bases exist for this assertion: (a) skeletal muscle accounts for a substantial portion of afferent input to the brain, and (b) skeletal muscles are under direct voluntary efferent control. Jacobson theorized that by intentionally relaxing the muscles of the skeletal system, parasympathetic nervous system functioning would be increased.

Jacobson’s work has been criticized on grounds of selection-bias effects, lack of statistical analyses, lack of experimental randomization, and neglect of various control conditions such as imaginal focus (Lichstein, 1988). Despite these criticisms, the work of Jacobson literally set the standard for methodological rigor in its day. PMR and PMR-based strategies have demonstrated consistent positive effects in treatment of anxiety disorders (Borkovec & Sides, 1979). In addition, abbreviated PMR can lead to
improvement in a wide variety of conditions, including depression in adolescents and postpartum women, aversion to chemotherapy, muscle tension headache, and low back pain (Bernstein & Carlson, 1993). These techniques are widely employed in current clinical practice.

Rosenthal (1993) hypothesized that structured PMR-based relaxation strategies are most effective for very anxious patients because the set of concrete motor activities (i.e., muscle tense-relax cycles) serve as competing behaviors for covert anxiety-related verbalizations (i.e., "worry"). On the other hand, PMR-based techniques may exacerbate symptoms in the case of somatoform disorders and chronic pain, especially during the muscle tensing intervals of the protocol. It may also be possible that use of PMR with patients who have neuromuscular dysfunction secondary to brain damage violates its theoretical assumptions, in that normal functioning of neuromuscular circuits may be altered.

**Autogenic Training**

In the foreword of a recent update of autogenic training (AT; Linden, 1990), Lehrer reported that AT is probably the world's most widely-used relaxation strategy. AT is applied by a large proportion of German physicians, and it is also widely used in Japan and in the former Soviet Union. Luthe (1970a, 1970b, 1970c, Luthe & Schultz, 1969a, 1969b; Schultz & Luthe, 1969) provided the definitive English-language six-volume set of texts on AT practice and principles. This work has recently been updated and condensed by Linden (1990).

**Technique.** The AT technique pairs the use of therapist-guided nature imagery with attentional focusing on specific somatic sensations. Six standard
somatic sensation attentional foci, or "formulas," were employed in the original AT procedure: (a) heaviness in the extremities, (b) warmth in the extremities, (c) cardiac regulation, (d) respiratory regulation, (e) abdominal warmth, and (f) forehead coolness. The first two foci, heaviness and warmth, each have seven sequential parts: dominant arm, non-dominant arm, both arms, dominant leg, non-dominant leg, both legs, and arms and legs together. While applying these formulas, the subject simultaneously imagines pleasant nature scenes. The full AT package takes between 8-10 weeks of training and another 4-6 months of daily practice on the part of the client in order to experience maximal benefits.

As in meditation and PMR, AT has been adapted by contemporary American practitioners in order to be more cost effective (Pikoff, 1984). Lichstein (1988) described an abbreviated 25-minute induction for all six standard formulas. A number of other clinicians (Lichstein & Sallis, 1982; Nicassio & Bootzin, 1974; Sargent, Green, & Walters, 1972; Surwit, Pilon, & Fenton, 1978) have used an even shorter form of AT that applies only the first two formulas, heaviness and warmth.

Theory. The theoretical foundation of AT is Hess' (1957) seminal work in the area of functional anatomy and physiology. Animal research on the neurophysiology of the diencephalon led Hess to discover that electrical stimulation of the anterior hypothalamus elicited a "trophotropic" autonomic nervous system response consistent with increased parasympathetic functioning. Hess coined the term "ergotropic" responses to describe the opposing, excitatory sympathetic process. AT theorists maintain that by limiting the afferent stimulation from the environment to the reticular activating system and the thalamus, the hypothalamus inhibits ergotropic activity and the
trophotropic system emerges by default (Lichstein, 1988). Gellhorn (1967) postulated that relaxation practice acts as a form of "trophotropic tuning," that effectively lowers the threshold for trophotropic functioning and develops a stronger trophotropic response.

Overall findings support the use of AT as a method of clinical relaxation (Lichstein, 1988; Linden, 1990; Linden, 1993). A large proportion of the experimental findings have been published in German or Japanese, but the research reported by American scientists and practitioners is favorable. These broad generalizations must be qualified. First, much variation exists between AT research protocols, with American methods often incorporating abbreviated AT (i.e., heaviness and warmth formulas only; Pikoff, 1984), while European researchers have applied a uniformly more strict interpretation of the original AT described by Luthe and Schultz (1969-1970). Second, AT combines physiological control techniques with imagery. Clinical research shows that this combination is effective in producing relaxation, but it is unclear why AT works or which component accounts for most of the variance in predicting positive response. Greater understanding of AT's therapeutic mechanisms awaits further research. Until AT is better understood, practitioners must rely on clinical judgment rather than empirical findings when deciding which patients are best suited for AT.

Guided Imagery

Imagery has long been used in meditative practices and in combination with other relaxation strategies. It has been used alone as a relaxation technique and included in various forms of psychotherapy, including
psychoanalytic (Leuner, 1978) and cognitive-behavioral (Crits-Christoph & Singer, 1981) approaches.

**Technique.** In guided imagery relaxation, the therapist describes a scene that the subject has commonly experienced so memories can easily be retrieved. Guided imagery content usually consists of the detailed description of a situation or scene that the subject has previously experienced as quiet, pretty, and restful, such as a nature scene (Lichstein, 1988). The subject is encouraged to imagine that he or she is an active participant in the image, rather than a passive observer. To cultivate this sense of active presence in the image, the therapist describes many details of the scene that appeal to a variety of sensory modalities.

**Theory.** Despite its frequent use in clinical practice, little is known about the psychological and physiological mechanisms of relaxing imagery (Lichstein, 1988; Sheikh, 1983). Guided imagery has been conceptualized as an attentional distractor, a form of self-reinforcement, and as a means of relaxation, depending on the clinical application or the specific research paradigm. Crits-Christoph and Singer (1981) reviewed the usefulness of guided imagery in reducing phobic anxiety, general level of distress, and unwanted thoughts. Other guided imagery applications have demonstrated positive effects in reducing childbirth anxiety (Horan, 1973), reducing laboratory-induced pain (Greene & Reyher, 1972), and helping manage depressive symptoms in severely depressed patients (Schultz, 1978). Lang and his colleagues (Lang, 1977, 1979; Lang, Kozak, Miller, Levin, & McLean, 1980; Lang, Levin, Miller, & Kozak, 1983) have produced some excellent research in the area of arousing (i.e., fear) imagery; however, further basic and applied research is needed in the area of relaxing imagery.
Behavioral and Cognitive-Behavioral Approaches

Scientist-practitioners have begun to apply assessment and treatment techniques from cognitive-behavioral and behavior therapy to the area of clinical relaxation. Poppen (1988) approached relaxation training from a strict behavioral perspective, whereas Smith (1990) applied recent techniques from cognitive-behavioral psychology.

Behavioral Relaxation Training. Behavioral Relaxation Training (BRT; Poppen, 1988) is a thorough and detailed system of assessment and relaxation treatment. Poppen conceptualized relaxation as a response class involving four domains of behavior: (a) motoric behavior that manipulates the physical environment, (b) verbal behavior that affects the social environment, (c) visceral behavior that maintains the internal environment, and (d) observational behavior that seeks and differentiates stimuli. Each domain has both overt and covert modes.

In the area of assessment, Poppen (1988) developed the Behavioral Relaxation Scale (BRS) to measure the motoric components of relaxation. The BRS is based on the premise that characteristic behaviors are reliably observable during relaxation. The BRS is an observational rating scale that describes criterion behaviors for eight postures (e.g., "head," "shoulders") and two behaviors (e.g., "quiet," "breathing") while the subject is seated in a reclining chair or lying in the supine position. Ratings are made on the BRS during one-minute observation periods divided into three intervals: (a) 30 seconds of breathing observation, (b) 15 seconds of observation for the nine other components, and (c) 15 seconds to record the ratings. A Likert-type self-report relaxation scale was also developed (Schilling & Poppen, 1983). Finally, an observational rating system similar to the BRS was created for
subjects who would be seated upright during BRT (Upright Relaxation Scale; Poppen, 1988).

The first session of BRT is for acquisition of relaxation behavioral skills. The therapist leads the subject through four training steps: (a) labeling, or pairing of each motoric behavior with a single word, such as, "hands;" (b) description and modeling of the relaxed behaviors by the therapist; (c) imitation of the behaviors by the subject, and (d) feedback and correction of imitated behaviors. BRT involves no muscle tense-relax cycles like those found in PMR. After the initial acquisition training, BRT sessions last approximately 30 minutes and consist of adaptation (5-10 minutes), pre-training observation (5 minutes), proficiency training (15-30 minutes), and post-training observation (5 minutes). As a supplement to BRT, subjects are instructed in diaphragmatic breathing (Bacon & Poppen, 1985). Because BRT is a new technique, not enough data is yet available to prove its clinical utility.

Cognitive-Behavioral Relaxation Training. The recent work of Smith (1990) serves as a good framework for developing relaxation inductions to meet the specific needs and preferences of individual patients. Smith (1990, pp. 102-134) presented a summary of steps to develop an individualized relaxation protocol, or "script," that is applied during training. Each script may incorporate various physical approaches (e.g., muscle tense-relax cycles), "unrestrictive mental exercises" (e.g., somatic focusing used in AT, or guided imagery), and/or "restrictive mental exercises" (e.g., mantra meditation). Smith (1990) provided no empirical support for the use of his formulation of clinical relaxation in cognitive-behavioral therapy, and stated that his model and instructions were intended to be "extended hypotheses, not proven facts."
Summary

Recent reviewers (Holmes, 1984; Lehrer & Woolfolk, 1984; Lichstein, 1988) have made some consistent conclusions about the "state of the art" of clinical relaxation methods of stress reduction. First, across all of the comparative studies of different clinical relaxation strategies, no single method has emerged as most effective for all populations. Second, even within well-defined patient populations, variation exists in treatment response to different relaxation techniques. The most methodologically sound studies within discrete patient populations often find no significant difference between compared relaxation techniques; however, the relaxation techniques are effective in producing clinically significant global arousal reduction responses. Third, individual subjects show specific patterns of arousal reduction across relaxation techniques. Findings such as these have recently prompted practitioners of clinical relaxation to call for an increased emphasis on matching subjects to treatment preference as defined by perceived efficacy and simple liking.

Individual-Difference Variables Predicting Treatment Outcome in Relaxation Research

Despite the existence of little research on subject variables that predict favorable response to relaxation induction, two variables have emerged that warrant further attention in relaxation research: (a) expectancy and (b) locus of control. Expectancy for success is an important variable in the outcome of most psychological treatments (Lehrer & Woolfolk, 1993b), but this has not been firmly supported in the relaxation research. During one-session relaxation inductions, expectations were found to have negligible effects for responses to both PMR (Beiman, 1976) and meditation (Woolfolk & Rooney,
1981). On the other hand, Brown (1977) reported that positive expectancy was related to relaxation outcome when treating hyperkinesis in children and Agras, Horne, and Taylor (1982) found a firm relation between immediate decreases in systolic blood pressure during relaxation and expectancy. Thus, the relation of subject expectancy to relaxation effects requires further research to help clarify these equivocal findings.

As proposed by Rotter (1966), internal locus of control is the expectancy or belief that reinforcement is contingent upon the relatively permanent characteristics of the individual and his/her own behavior; whereas, external locus of control is the expectancy or belief that reinforcement is due to environmental factors beyond the control of the individual. Rotter's notion of locus of control has been adapted for prediction of health-related behaviors (Wallston, Wallston, Kaplan, & Maides, 1976; Wallston, Wallston, & DeVellis, 1978). In general, internal locus of control appears to be associated with successful outcome for some forms of stress management (e.g., exercise programs, biofeedback); however, such an association with mainstream relaxation techniques has received inconsistent support (for review, see Lehrer & Woolfolk, 1993b). In addition, some forms of EMG biofeedback, which involve an external agent (i.e., the biofeedback apparatus), tend to be favored by individuals with a more external locus of control (Prager-Decker, 1979). Health locus of control variables are worth exploring in relaxation research until these findings are better understood.

Clinical Relaxation in Neurorehabilitation

Recent advances in physical medicine and rehabilitation have been at the forefront of interdisciplinary health care (Frank, Gluck, & Buckelew, 1990).
The function of the interdisciplinary team is to develop an individualized, multifaceted program of treatment so comprehensive that its application requires the cooperative effort of multiple health care disciplines. The behavioral scientist-practitioner has found a place on such treatment teams as the areas of health and rehabilitation psychology have experienced recent growth. Neuropsychologists have also developed and refined cognitive-behavioral treatment strategies (Lawson-Kerr, Smith, & Beck, 1990) that have won them a position on the interdisciplinary treatment teams for neurologically impaired patients (Barry & O'Leary, 1989).

Interdisciplinary care of the patient with neurological impairment is particularly challenging to the treatment team because of the clinical manifestation of medical, neurobehavioral, communication, motor, and sensory-perceptual problems (Bontke, 1991). The neuropsychologist is called upon to define the parameters of impairment and develop a treatment plan that seeks to increase the frequency of compensatory and on-task therapy behaviors, and shape greater accuracy in performance of target behaviors. In addition, the consulting neuropsychologist works to decrease the frequency, intensity, and duration of maladaptive competing behaviors such as agitation, combativeness, pain behavior, social inappropriateness, and disruptive attention-seeking. Given these targets for behavioral intervention, reducing aversive arousal in neurologically impaired rehabilitation patients is strongly indicated. Unfortunately, little quality research exists in this area.
Traumatic Brain Injury

Individuals who have sustained traumatic brain injury (TBI) often manifest a variety of neurobehavioral sequelae that indicate the need for arousal reduction (Callon & Jackson, in press). Unfortunately, the use of clinical relaxation strategies with TBI patients is poorly documented. Poppen (1988) reported a study that examined the use of BRT with three male brain-injured patients aged 22, 29, and 30. All three TBI patients had been reported by staff to be "nervous" or "irritable." Time since injury was not reported, but because BRT was conducted at a residential treatment facility, it is probable that the subjects were less than one-year post injury.

In this experiment, 30-minute BRT sessions were conducted three times per week. Each session was comprised of a five-minute adaptation period, 15 minutes of relaxation, and five minutes of assessment. The experiment used Horner and Baer's (1978) multiple-probe-across-subjects design in order to minimize the potentially aversive effects of repeated measurement in the absence of training. Thus, subjects two and three were given baseline sessions until subject one met criterion on all 10 BRT relaxation behaviors. Subject three remained in baseline until subject two met all 10 criteria. Baseline sessions were used to control for therapist contact and relaxation instructions. Training criterion was set to be 80% relaxed behavior during the five-minute assessment period. Six proficiency sessions were administered after each subject met the criterion. Post-training and three-week follow-up assessments were also performed.

Dependent measures included frontalis electromyographic (EMG) recording, self-report of relaxation, and two neuropsychological tests of
psychomotor performance. The results showed that the TBI patients reached the 80% criterion in four to eight sessions. Behavioral Relaxation Scale (BRS) scores reflected substantial display of relaxed behavior for all three subjects. Frontalis EMG levels however, did not reflect any consistent change or relation to BRS scores. In contrast, self-report scores showed increased levels of reported relaxation. Finally, scores on the psychomotor tests showed no improvements that could not be explained by simple practice effect.

Overall, this study indicates the utility of BRT with TBI patients. Unfortunately, generalizability to TBI patients in acute rehabilitation is compromised by small sample size and inadequate reporting of neuropsychological impairment levels within the sample. The relaxation modeling component of BRT is quite promising but needs further study.

Cerebrovascular Disorders

Only one study was found that examined the effectiveness of relaxation training with individuals who had experienced a cerebrovascular accident (CVA). Marshall and Watts (1976) sampled 16 CVA patients (15 males, mean age of 50.9) with moderate to severe communicative impairment (between 35th and 80th percentile rankings on the Porch Index of Communicative Ability, PICA; Porch, 1967). Among the patients, time since onset of aphasia ranged from 4 to 70 months.

All subjects were administered a mini-battery of four 15-item verbal tasks that required them to (a) give the function of 15 common objects, i.e., ball, spoon, etc., (b) name each object, (c) use the name of each object in a functional "carrier phrase," e.g., "You throw a _______," and (d) repeat the name of each object. Subjects were administered the verbal tasks on two
occasions: once, after a 30-minute relaxation procedure, and again, after a 30-minute control condition of rest while seated in a quiet testing room. The relaxation strategy was a PMR-based tense-relax procedure applied to the non-hemiparetic muscle groups. The experimenter modeled each muscle contraction, presumably for better comprehension of instructions. Relaxation and control conditions were conducted within four days of each other, and order of administration was counterbalanced across subjects. No subject received speech therapy between testings.

The authors reported statistically significant differences between relaxation and control condition scores on the verbal naming task and on the mini-battery overall scores. Despite a statistically significant effect in the hypothesized direction, the clinical significance is questionable. The mean mini-battery overall scores were 10.92 out of a possible 15 for the relaxation condition and 10.27 for the control condition. While this finding was statistically significant, it did not represent a clinically significant change in functional communication ability.

In addition to the authors' liberal interpretation of treatment effect, two methodological problems can be identified. First, no measure of relaxation effect was made, neither self-report nor physiological. Second, the huge range in time since onset of aphasia is problematic because of the likelihood that intervening variables introduced systematic error variance. It is possible that the change in mini-battery scores reflects spontaneous recovery among patients in the acute phase of rehabilitation, rather than relaxation treatment effect.

Overall, the use of clinical relaxation studies in CVA patients has been neglected in the literature. It is important to note, however, that EMG
biofeedback has been frequently used with CVA patients in the functional retraining of hemiparetic extremities. EMG-based neuromuscular retraining for specific muscle groups is considered outside of the domain of relaxation and arousal reduction and, therefore, beyond the scope of this review. The reader is referred to several excellent reviews of EMG biofeedback in treatment of neuromuscular disorders (Basmajian, 1979; Fogel, 1987; Keefe & Surwit, 1978; Krebs, 1987).

Degenerative Diseases

Although degenerative diseases of the central nervous system differ from TBI and cerebrovascular disorders in terms of both symptoms and prognosis (Brandstater, Bontke, Cobble, & Horn, 1991), the dementias manifest predictable neurobehavioral problems that are potentially responsive to arousal reducing relaxation exercises. The subcortical dementias, especially Parkinson's disease and Huntington's chorea, have overt motor behaviors that may benefit from relaxation.

Macpherson (1967) was the first to report a case study that employed PMR in the treatment of the involuntary movements experienced by a 60-year-old female patient with Huntington’s chorea. The author used a three-stage treatment plan over a period of six weeks during which time the frequency of involuntary movements decreased enough to allow for discharge to home environment. During the first stage of treatment, daily one-hour PMR sessions were conducted for a two-week period. The second stage incorporated subcutaneous EMG feedback to teach the patient to attend to afferent sensory input associated with onset of involuntary movements. The third stage required the patient to initiate relaxation when she detected the level of
afferent sensation associated with the movements. The results of one-year follow-up assessment were extremely favorable.

In a similar case study, Bannister (1977) used a PMR-based approach to suppress the involuntary movements of a 60-year-old male patient with Huntington's chorea. Relaxation training began during the thirteenth week of the patient's hospitalization. Individual and group psychotherapy were discontinued while 30-minute biweekly sessions of audiotaped relaxation training were implemented. The author did not have access to any means of psychophysiological recording, so he improvised by using small strips of transparent adhesive tape to provide the patient with tactile biofeedback whenever a facial movement occurred. After this treatment plan was implemented, the patient's "movements were barely visible, and emotional outbursts were infrequent and short-lived" (p. 323).

Discharge to home was made three weeks after the sixth relaxation session, when the adhesive tape was implemented. Bimonthly outpatient follow-up sessions maintained treatment effect until 11 months after discharge when the patient moved out-of-state and treatment was interrupted. Following his move, the patient experienced a sharp increase in symptoms again that necessitated rehospitalization. The same treatment plan was implemented and the patient again improved enough to be discharged seven weeks later. Bannister's study is valuable because it demonstrates a treatment reversal (A-B-A-B) design.

A more recent study employed BRT in the treatment of two patients (58-year-old male, 54-year-old female) with advanced Huntington's chorea (Fecteau & Boyne, 1987). The study used a repeated pretest-posttest design with a multiple baseline to allow for both within- and between-subjects
comparisons (Thyer & Curtis, 1983). The first subject received seven treatment sessions followed by six baseline sessions. This order was reversed for the second subject. The baseline condition consisted of a 20-minute rest period in which the subjects were blindfolded, fully reclined in a chair, and instructed to relax the best that they could. BRT sessions lasted 25-30 minutes and proceeded as described by Poppen (1988) with the exclusion of two of the 10 relaxed behaviors (eyes closed relaxed breathing) due to the oculomotor impersistence and irregular breathing experienced by the two subjects. Three dependent measures were made at the beginning and at the end of each BRT and baseline session: (a) heart rate, (b) frontalis EMG, and (c) observational ratings on the Behavioral Relaxation Scale (BRS).

Results showed that BRT was associated with lower heart rate and increased overt display of relaxed behaviors as rated on the BRS. EMG data were reported to be too variable for interpretation. It would have been desirable for the authors of this study to have included a self-report measure of relaxation.

The above studies reflect creativity on the part of the authors in tailoring existing relaxation strategies to meet the special needs of patients with involuntary motor movements. The case reports in the literature demonstrate remarkably effective treatment outcomes, but a note of caution is needed. It is reasonable to posit that for every success akin to those reported above, there are multiple treatment failures that did not receive attention due to the bias of contemporary psychology to report only positive experimental findings.
Rationale

Historically, the primary method for managing the agitated patient with neurological impairment has been pharmacological (Lader, 1984; Rose, 1988). Recent research has documented adverse side effects associated with the use of both major and minor tranquilizers (Curran, 1986; Hayward, Wardle, & Higgit, 1989). The use of memory-impairing benzodiazepines and neuroleptic phenothiazines that may cause Parkinsonian motor dysfunction (i.e., tardive dyskinesia) is usually contraindicated in neurologically impaired patients. A hopeful trend in psychiatry appears to be the use of more sophisticated pharmacological interventions after attempting to manage agitation and other behavior disorders through environmental and behavior management strategies (Sakauye, 1992).

The development of effective clinical relaxation strategies is one alternative to continued overuse of pharmacological arousal reduction techniques. Unfortunately, the guiding literature is immature. As seen in the preceding review of applied relaxation in the treatment of neurologically impaired patients, the literature is grossly deficient. Only one controlled group outcome study exists, and unfortunately, it is fraught with methodological errors. Therefore, the problem of reducing the aversive arousal of patients with neurological impairment must be further addressed.

When developing the appropriate relaxation techniques for neurologically impaired patients, clinicians must carefully match treatment with the needs and abilities of the individual. The use of meditation with brain-damaged patients is considered suboptimal due to their decreased ability to structure their personal environment to satisfy Benson's (1975) four necessary conditions of relaxation: (a) a quiet environment, (b) a mental device, (c) a
passive attitude, and (d) a comfortable position. In addition, the phrase or word used in mantra meditation may not have enough stimulus value to maintain the attention of a brain-damaged patient. Lichstein (1988) argued that an additional fifth component is required for successful relaxation: cooperative volition or "passive volition" (Green, Green, & Walters, 1970). This fifth factor may often elude the neurologically compromised patient due to anosagnosia, disorientation to situation, and impaired goal-directed behavior.

PMR is a very good strategy with much basic and applied research supporting its use; however, patients who are hemiparetic or have abnormal muscular tone syndromes may experience increased discomfort. Thus, it may be contraindicated to use PMR in cases of spastic muscle tone secondary to upper motor neuron lesions. In addition, there is no well-researched precedent for unilateral PMR reported in the literature; however, this an option that merits further assessment. Passive strategies such as AT may be most appropriate for brain-damaged individuals, but one must consider how well patients who have aphasia are able to process the verbal directions. A related problem exists for patients with motor planning problems secondary to frontal lobe dysfunction and patients with limb apraxia. Passive guided imagery may be helpful, but it requires unimpaired verbal processing ability and its clinical efficacy with aphasic patients is unknown.

The literature is replete with relaxation induction protocols that rely on the verbal processing ability of the subject. All of the relaxation strategies reviewed above involve not only verbal directions to perform various motor behaviors (e.g., PMR and BRT), but also verbal content in the form of mantra-foci, AT somatic formulas, and guided imagery scripts. It is plausible that the brain-damaged patient with impaired language functions may have difficulty
performing relaxation activities that require sequential processing of verbal information. An alternative relaxation strategy that utilizes nonverbal processing is needed.

Music is a form of nonverbal sensory information that shows an affinity for right-hemisphere processing (Dean, 1986). Music therapists have traditionally promoted the use of music in psychology to facilitate behavior change (Hanser, 1985; Standley, 1986). More recently, music has been employed to reduce arousal by enhancing the process of learning diaphragmatic breathing and relaxation skills (Fried, 1990a, 1990b). Thus, music can be considered a form of nonverbal relaxation. In an experimental comparison of verbal and nonverbal relaxation protocols, however, music is not the optimal form of nonverbal induction. Recent physiological data showed that music aroused and excited rather than soothed the autonomic and muscular activity of college undergraduates, despite self-reports of increased relaxation and decreased anxiety (Davis & Thaut, 1989).

Another form of nonverbal relaxation is needed. The optimal nonverbal relaxation strategy for neurologically impaired patients should have the following characteristics: (a) adequate stimulus value to hold attention, but not elicit arousal, (b) face-valid content, and (c) high familiarity. A nonverbal visually-processed videotape depicting nature scenes analogous to those described verbally in guided imagery relaxation scripts has all of these characteristics. Most people are quite familiar with television and also find picturesque scenery to be pleasant. Television has relatively high stimulus value, but it is not novel (so as to be arousing, per se). Videotaped nature scenes should hold attention, but not elicit arousal. In an effort to better meet the needs of rehabilitation patients with language impairment due to brain
dysfunction, this study compared the relaxation responses of patients with right- and left-hemisphere brain dysfunction during content-matched audiotaped guided imagery (verbal) and videotaped (nonverbal) nature scenes. In addition, various predictors of relaxation effectiveness were explored.

**Hypotheses**

Hypothesis One

Patients with primarily right-hemisphere brain dysfunction will demonstrate significantly better relaxation (i.e., lower muscle tension, warmer digital skin temperature, and higher ratings of perceived relaxation) in response to a verbal relaxation induction (audiotaped guided imagery).

Hypothesis Two

Patients with primarily left-hemisphere brain dysfunction will demonstrate significantly better relaxation in response to a nonverbal relaxation induction (videotaped forest-walk scenes).

Hypothesis Three

The right- and left-hemisphere brain dysfunction patients with the least neuropsychological impairment will tend to demonstrate better relaxation in response to the verbal and nonverbal relaxation inductions, respectively.
Hypothesis Four

Orthopedic/medical patients, serving as contrast subjects, will demonstrate the greatest relaxation response for both inductions, compared to the neurologically impaired patients. Among orthopedic/medical patients, no differential relaxation response to the verbal and nonverbal inductions is expected; no differential preference for one relaxation induction is expected.

Hypothesis Five

No significant order of relaxation induction effects will be found for ratings of perceived relaxation or preference data; however, significant order effects for the physiological data might be found due to subject habituation to the experimental stimulus characteristics (e.g., the experimental setting, the psychophysiological testing procedures, etc.).

Hypothesis Six

Patients with (a) higher internal health locus of control scores will respond better to the verbal relaxation induction, whereas patients with (b) higher external health locus of control scores will respond better to the nonverbal relaxation induction. In addition, patients with (c) higher ratings of anticipated level of relaxation and (d) lower ratings of anticipated difficulty in becoming relaxed will show better responses to both forms of relaxation induction when such variables as age, severity of damage, and time since injury are statistically controlled.
METHOD

Subjects

Seventy-five rehabilitation inpatients served as voluntary participants. Data was collected between March 16, 1993 and July 24, 1994 at two sites: the Rehabilitation Center at Our Lady of the Lake (OLOL) Regional Medical Center (Baton Rouge, LA; n = 64) and the University of Alabama at Birmingham (UAB) Spain Rehabilitation Center (Birmingham, AL; n = 11). Five subjects were excluded from the final data analysis for various reasons. One patient, a 32-year-old male who had sustained traumatic amputation of both legs and a mild spinal cord injury, was diagnostically dissimilar to the rest of the orthopedic/medical patients. Another subject was illiterate due to no formal education and limited intellectual functioning, calling into question the reliability of his self-report responses. Two subjects yielded unusually high unilateral forehead electromyogram (EMG) readings late in the experimental procedure, suggesting loss of proper electrode conductivity. Finally, one patient admitted for non-neurological medical problems (i.e., cardiac arrhythmia and congestive heart failure) demonstrated lower than expected cognitive performance during participation. Further review of her medical records revealed a history of transient ischemic attack (TIA) consistent with cerebrovascular compromise.

The remaining 70 patient participants were divided into three groups: (a) 20 patients with right-hemisphere brain dysfunction, (b) 20 patients with left-hemisphere brain dysfunction, and (c) 30 non-neurologically impaired patients admitted for orthopedic/medical reasons, serving as a contrast group.
Table 1
Diagnostic Composition of Participating Subjects by Group

<table>
<thead>
<tr>
<th>Primary Diagnosis</th>
<th>Right-hemisphere Brain Dysfunction</th>
<th>n</th>
<th>Secondary/Tertiary Diagnoses</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVA, unspecified</td>
<td>11</td>
<td></td>
<td>Hypertension</td>
<td>9</td>
</tr>
<tr>
<td>CVA, basal ganglia</td>
<td>2</td>
<td></td>
<td>Diabetes, unspecified</td>
<td>6</td>
</tr>
<tr>
<td>CVA, internal capsule</td>
<td>2</td>
<td></td>
<td>Arthritis, unspecified</td>
<td>2</td>
</tr>
<tr>
<td>Cerebellar hemorrhage</td>
<td>1</td>
<td></td>
<td>Cardiac arrhythmia</td>
<td>1</td>
</tr>
<tr>
<td>CVA, parietal lobe</td>
<td>1</td>
<td></td>
<td>Congestive heart failure</td>
<td>1</td>
</tr>
<tr>
<td>CVA, subcortical, unspecified</td>
<td>1</td>
<td></td>
<td>Knee surgery</td>
<td>1</td>
</tr>
<tr>
<td>Intracranial hemorrhage</td>
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<td></td>
<td>Myocardial infarction</td>
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</tr>
<tr>
<td>Lacunar infarct, unspecified</td>
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<td></td>
<td>Peripheral vascular disease</td>
<td>1</td>
</tr>
<tr>
<td>Left-hemisphere Brain Dysfunction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>12</td>
<td></td>
<td>Arthritis, unspecified</td>
<td>5</td>
</tr>
<tr>
<td>Abscess, frontal lobe</td>
<td>1</td>
<td></td>
<td>Hypertension</td>
<td>5</td>
</tr>
<tr>
<td>Cerebellar infarct</td>
<td>1</td>
<td></td>
<td>Diabetes, unspecified</td>
<td>3</td>
</tr>
<tr>
<td>CVA, basal ganglia</td>
<td>1</td>
<td></td>
<td>Bradycardia</td>
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</tr>
<tr>
<td>CVA, parietal lobe</td>
<td>1</td>
<td></td>
<td>Congestive heart failure</td>
<td>1</td>
</tr>
<tr>
<td>CVA, parietal-occipital region</td>
<td>1</td>
<td></td>
<td>Coronary artery disease</td>
<td>1</td>
</tr>
<tr>
<td>Lacunar infarct, temporal lobe</td>
<td>1</td>
<td></td>
<td>Internal carotid artery stenosis</td>
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</tr>
<tr>
<td>Subarachnoid hemorrhage</td>
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<td></td>
<td>Pelvic fracture</td>
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</tr>
<tr>
<td>Subdural hematoma, frontal-parietal region</td>
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<td></td>
<td>Scoliosis</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Wallenberg’s syndrome</td>
<td>1</td>
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</table>

(Table continued)
Table 1

<table>
<thead>
<tr>
<th>Orthopedic/Medical</th>
<th>$n$</th>
<th>Secondary/Tertiary Diagnoses</th>
<th>$n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total knee arthroplasty</td>
<td>12</td>
<td>Osteoarthritis</td>
<td>13</td>
</tr>
<tr>
<td>Hip fracture with pinning</td>
<td>5</td>
<td>Hypertension</td>
<td>9</td>
</tr>
<tr>
<td>Neuromuscular dysfunction</td>
<td>3</td>
<td>Diabetes, unspecified</td>
<td>4</td>
</tr>
<tr>
<td>Total hip arthroplasty</td>
<td>3</td>
<td>Neuromuscular dysfunction</td>
<td>3</td>
</tr>
<tr>
<td>Bilateral femoral artery bypass</td>
<td>1</td>
<td>Total knee arthroplasty</td>
<td>2</td>
</tr>
<tr>
<td>Cervical fusion</td>
<td>1</td>
<td>Abdominal aortic aneurysm</td>
<td>1</td>
</tr>
<tr>
<td>End stage renal disease</td>
<td>1</td>
<td>Anemia, unspecified</td>
<td>1</td>
</tr>
<tr>
<td>Knee fusion</td>
<td>1</td>
<td>Breast cancer/mastectomy</td>
<td>1</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>1</td>
<td>Coronary artery disease</td>
<td>1</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>1</td>
<td>Open heart surgery, unspecified</td>
<td>1</td>
</tr>
<tr>
<td>Spinal tumor</td>
<td>1</td>
<td>Peripheral vascular disease</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prostate cancer/orchiectomy</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total hip arthroplasty</td>
<td>1</td>
</tr>
</tbody>
</table>

**Note.** CVA = cerebrovascular accident.

Table 1 shows the primary diagnoses and concomitant medical conditions of all participating subjects found in the initial history and physical report completed by the attending physiatrist upon admission. A majority of the neurological patients had experienced a cerebrovascular accident (CVA; i.e., stroke). Unilaterality of brain dysfunction was based on medical chart summaries of radiographic examinations (e.g., computed tomography,
magnetic resonance imaging) and the presence of clinical neurological deficits such as hemiplegia. Much care was taken to exclude potential subjects with possible bilateral brain damage. All of the neurologically-impaired subjects experienced symptom onset less than one year prior to their participation in the study. The modal diagnostic category among the orthopedic/medical patients was chronic arthritis and related functional problems requiring joint replacement in 50% of the cases. The mean age of participating subjects was 70.9 years ($SD = 8.9$; range 44-90 years). Years of education ranged from 2 to 21 with a mean education level of 11.3 years ($SD = 4.2$). All subjects demonstrated at least basic functional literacy upon screening. Participant composition was 58.6% female, 77.1% white, and 54.3% resided in urban communities. All subjects endorsed the southern United States as their representative geographical region. Table 2 shows the demographic composition of the total sample and each of the three diagnostic groups.

Patients were screened via chart review and initial evaluation by rehabilitation psychology personnel (licensed Doctoral-level clinical psychologists and their Master-level clinical assistants) within ten days of admission. Subjects who met the following criteria were considered for participation in the study: (a) left-hemisphere dominance for language ability, as defined by a history of right-handed motor dominance, or left-handed motor dominance in the presence of both aphasia and a well-documented unilateral left-hemisphere lesion; (b) no prior formal relaxation therapy; (c) did not meet DSM-III-R diagnostic criteria for mood disorders, anxiety disorders, or somatoform disorders (American Psychiatric Association, 1987); (d) no gross visual field deficits (i.e., homonomous hemianopsia); however, unilateral
Table 2

Demographic Composition of Participating Subjects by Group

<table>
<thead>
<tr>
<th></th>
<th>Total (N = 70)</th>
<th>Right</th>
<th>Left</th>
<th>Ortho</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>M  SD</td>
<td>M  SD</td>
<td>M  SD</td>
<td>M  SD</td>
</tr>
<tr>
<td>(Range)</td>
<td>(44-90)</td>
<td>(53-79)</td>
<td>(48-90)</td>
<td>(44-88)</td>
</tr>
<tr>
<td><strong>Years of education</strong></td>
<td>11.3 4.2</td>
<td>9.8 4.9</td>
<td>12.6 3.0</td>
<td>11.5 4.1</td>
</tr>
<tr>
<td>(Range)</td>
<td>(2-21)</td>
<td>(2-21)</td>
<td>(7-18)</td>
<td>(3-18)</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>29 41</td>
<td>10 50</td>
<td>10 50</td>
<td>9 30</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>41 59</td>
<td>10 50</td>
<td>10 50</td>
<td>21 70</td>
</tr>
<tr>
<td><strong>Black</strong></td>
<td>16 23</td>
<td>9 45</td>
<td>3 15</td>
<td>4 13</td>
</tr>
<tr>
<td><strong>White</strong></td>
<td>54 77</td>
<td>11 55</td>
<td>17 85</td>
<td>26 87</td>
</tr>
<tr>
<td><strong>Laborer</strong></td>
<td>6 9</td>
<td>3 15</td>
<td>2 10</td>
<td>1 3</td>
</tr>
<tr>
<td><strong>Semi-skilled worker</strong></td>
<td>12 17</td>
<td>7 35</td>
<td>2 10</td>
<td>3 10</td>
</tr>
<tr>
<td><strong>Not in Labor Force</strong></td>
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<td>2 10</td>
<td>4 20</td>
<td>6 20</td>
</tr>
<tr>
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<td>4 20</td>
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<td>4 13</td>
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<td>2 10</td>
<td>4 20</td>
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<tr>
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<td>2 10</td>
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<tr>
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<td>11 55</td>
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<td>0 0</td>
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(Table continued)
Table 2

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Note. Right = right-hemisphere brain dysfunction; Left = left-hemisphere brain dysfunction; and Ortho = orthopedic/medical patients. Observation ranges are shown in parentheses below means (M) and standard deviations (SD). Occupational categories are consistent with those used by Barona et al. (1984; see Appendix A).

visuospatial neglect was allowed (as defined by the presence of unilateral suppression errors upon bilateral stimulation of peripheral visual fields); (e) no gross hearing or vision impairment; (f) no serious global aphasia, as defined by the inability to establish a reliable means for communication (e.g., verbal responses, head nods, gestures); (g) no suspected sedation related to tranquilizer medication; and (h) a score of at least 15 on the Folstein Mini-Mental State Exam (MMSE; Folstein, Folstein, & McHugh, 1975); however, three patients were admitted to the study with scores less than 15 (two with a score of 13, and one with a score of 12) because the MMSE underestimated their overall cognitive status due to the presence of expressive
aphasia with relatively minimal receptive deficits. Premorbid intellectual functioning was calculated using regression formulas to estimate Wechsler Adult Intelligence Scale-Revised (WAIS-R) performance based on demographic variables (Barona, Reynolds, & Chastain, 1984; Appendix A; reviewed by Klesges & Troster, 1987).

Each potential subject was given a thorough explanation of the intended study and then presented with the site-appropriate informed consent form (see Appendix B). If a prospective subject was unable to provide his or her signature, verbal consent along with the witnessing signature of a significant other or staff member was obtained. The participation refusal rate at OLOL Rehabilitation Center was approximately 50%. Each participant in the study was treated in accordance with the Patient's Rights of the appropriate rehabilitation center and the Ethical Principles of Psychologists and Code of Conduct (American Psychological Association, 1992). At the close of each subject's experimental participation, a debriefing statement was read aloud (Appendix C).

Materials

Included in the study were five brief paper-and-pencil self-report measures, six standardized neuropsychological tests, three self-report measures of perceived experimental (relaxation) effects, two Likert-type rating scales of experimental expectancy, two measures of psychophysiological functioning, and one brief structured interview. Each instrument fell into one of the following design element categories: (a) subject screening and evaluation of internal validity; (b) prediction of experimental (relaxation) outcome; or (c) measurement of experimental (relaxation) outcome.
Subject Screening/Internal Validity Measures

Mini-Mental State Exam. The Folstein Mini-Mental State Exam (MMSE; Folstein, Folstein, & McHugh, 1975) is a brief, easily administered measure of overall mental status. The MMSE consists of 11 items that screen the areas of orientation, registration (i.e., immediate verbal memory), attention and calculation, recall, and language. Potential scores range from zero to 30. The MMSE has been widely used as a gross measure of overall cognitive functioning, both in research and clinical practice. Most studies reviewed by Mitrushina and Satz (1991) reported good test-retest stability ranging from .89 (dementia patients, one-month interval) to .95 (neurological patients, 24-hour interval) to .99 (clinically stable geriatric patients, 28-day interval). Excellent norms (stratified by age and education level) have recently been published (Crum, Anthony, Bassett, & Folstein, 1993). Low to moderate positive correlations between the MMSE and many other neuropsychological measures have been reported (Mitrushina & Satz, 1991); however, one group of investigators found that four of the five MMSE language items failed to correlate with neuropsychological test scores (Feher, Mahurin, Doody, Cooke, Sims, & Pirozzolo, 1992). Overall, these findings suggest that the MMSE is a good measure for clinical research purposes, especially when it is used in a screening capacity.

Clinical experience suggests that the MMSE can underestimate the cognitive ability of patients who have moderate to severe nonfluent expressive aphasia, but relatively mild receptive and comprehension deficits. Of the 30 points possible on the MMSE, 24 require expressive language function. Thus, patients who are oriented to place and time, but cannot provide verbal responses to the 10 orientational questions, lose 10 points immediately. For
the orientation section of the MMSE, a multiple-choice format was used in this study to assist patients who had moderate to severe expressive aphasia. Each item was read aloud according to the standard administration (e.g., "What year is it now?") and the patient was shown a vertically-oriented list of four choices, one of which was the correct answer (e.g., 1992, 1993, 1994, 1995). Patients could then indicate the correct answer via "yes/no" verbalization, pointing, or head nod. This multiple-choice format could not be used for all of the MMSE items requiring expressive language ability; thus, patients with expressive aphasia still automatically lost 14 points. Due to this penalty for expressive deficits, three patients were admitted to the study with scores less than 15 (two with a score of 13, and one with a score of 12). The MMSE underestimated the cognitive functioning of these three patients due to the presence of severe expressive aphasia with relatively minimal receptive and comprehension deficits.

Reitan-Kløve Sensory-Perceptual Exam. The Reitan-Kløve Sensory-Perceptual Examination is a set of procedures used to determine how accurately a subject can perceive bilateral tactile, auditory, and visual stimulation when the perception of unilateral stimulation is essentially intact (Reitan & Wolfson, 1985). In this study, the auditory and visual components of the procedure were administered to rule out impaired auditory perception and gross visual field deficits (i.e., homonomous hemianopsia), respectively. To test auditory perception, the examiner presented a stimulus by rubbing thumb and index finger together lightly, quickly, and sharply, next to the subject's ear. For visual perception, the examiner made discrete finger movements in the subject's peripheral visual field: above eye level, at eye level, and below eye level. Using the least amount of stimulation necessary to elicit responses, the
examiner first established that the subject could respond reliably to unilateral stimulation. Then, unilateral stimulation was interspersed with bilateral simultaneous stimulation. Suppression errors occurred when the subject reported unilateral sensation after the presentation of bilateral simultaneous stimulation, suggesting the presence of sensory-perceptual dysfunction in the hemisphere of the brain contralateral to the side of diminished sensation. Subjects who made suppression errors were admitted to the study; however, those who made consistent errors during unilateral stimulation were excluded.

Structured Interview. The Structured Clinical Interview for DSM-III-R-Patient Edition (SCID-P; Spitzer, Williams, Gibbon, & First, 1990) is a semi-structured interview for making Axis I DSM-III-R diagnoses. It is divided into nine modules, seven of which represent the major Axis I diagnostic classes. Administration of the SCID-P yields a record of the current (past month) and lifetime occurrence of psychiatric disorders (Spitzer, Williams, Gibbon, & First, 1992). Multi-site test-retest SCID-P trials documented overall weighted kappa coefficients of .61 for current diagnoses and .68 for lifetime diagnoses (Williams et al., 1992). Each subject was given the Anxiety Disorders (F.1-F.17) module of the SCID-P in order to rule out any past or present anxiety disorder. Those subjects who met these DSM-III-R diagnostic criteria were excluded from the study.

Center for Epidemiological Studies-Depression Scale. The Center for Epidemiological Studies-Depression (CES-D; Radloff, 1977) Scale is a 20-item instrument designed to measure depressive symptoms in the general population. Respondents are asked to rate the frequency and duration of depressive symptoms experienced "during the past week." Ratings range from 0, "Rarely or none of the time (less than one day)" to 3, "Most or all of the time
(5 to 7 days)." The potential range of scores is from zero to 60, with higher scores indicating greater depression.

Corcoran and Fischer (1987) reported good internal consistency with coefficient alphas ranging from .85 to .90. Split-half and Spearman-Brown reliability coefficients ranged from .77 to .92. Test-retest stability coefficients (tested over two to eight weeks) ranged from .51 to .67. Strong concurrent validity has been established using both community samples (Roberts & Vernon, 1983) and psychiatric samples (Weissman, Sholomskas, Pottenger, Prusoff, & Locke, 1977). In addition, confirmatory factor analytic studies have indicated that the CES-D Scale factor structure is stable for frail elderly adults (Davidson, Feldman, & Crawford, 1994; Hertzog, Van Alstine, Usala, Hultsch, & Dixon, 1990), suggesting its usefulness in evaluating elderly rehabilitation inpatients. In this study, the CES-D was used to assist in the exclusion of subjects who met DSM-III-R diagnostic criteria for Major Depression.

Wahler Physical Symptoms Inventory. The Wahler Physical Symptoms Inventory (WPSI; Wahler, 1983) is a self-report questionnaire designed to measure the level or intensity of somatic complaints. Respondents rate 42 symptoms on a six-point Likert-type scale ranging from 0, "Almost never" to 5, "Nearly every day." The WPSI score is derived by dividing the sum of ratings by the number of items omitted or double scored subtracted from 42. The WPSI manual (Wahler, 1983) reported internal consistency coefficients among different subject populations ranging from .85 to .94 (.92 for a sample of 70 male rehabilitation patients). Test-retest reliability coefficients ranging from .61 (13-week interval) to .94 (one-day interval) were reported for two undergraduate student populations. In this study, the WPSI was used to assist
in the exclusion of subjects who met DSM-III-R diagnostic criteria for a somatoform disorder.

**Social Desirability Scale.** The Marlowe-Crowne Social Desirability Scale (M-C SDS; Crowne & Marlowe, 1960) is a 33-item true-false questionnaire that was designed to measure socially desirable self-report response tendencies. The internal consistency coefficient reported by the developers was .88. A one-month test-retest interval yielded a correlation coefficient of .89 for a sample of 31 undergraduate students. The M-C SDS was included in this study to satisfy the recommendation of Borkovec, Johnson, and Block (1984) that experimental design in relaxation research should address treatment demand characteristics in order to maintain internal validity. This notion is particularly important in the present study given the fundamental importance of patient self-report of perceived relaxation as an outcome variable.

**Treatment Expectancy.** Two brief measures of experimental treatment expectancy were included in this study to further evaluate internal validity (Borkovec et al., 1984). Just prior to experimental participation, subjects were asked to rate their (a) expected level of relaxation during the experimental procedure, and (b) expected difficulty in becoming relaxed. Subjects' ratings were based on the information provided about the procedures during the informed consent process (Appendix B). Expected level of relaxation was measured on a seven-point Likert-type scale ranging from 1, "Not relaxed at all" to 7, "Completely relaxed" (Appendix D). Expected difficulty in becoming relaxed was measured on a similar scale ranging from 1, "Not difficult at all" to 7, "Very difficult" (Appendix E). Both scales were administered to each subject
just prior to experimental participation according to the standardized instructions found in Appendix F.

**Prediction of Experimental (Relaxation) Outcome**

Four widely-used neuropsychological tests with good normative data and psychometric properties were included in this study to (a) document the presence of cognitive deficits consistent with laterality of brain dysfunction diagnosed upon rehabilitation admission, (b) measure the severity of these cognitive deficits, and (c) evaluate the hypothesized inverse relation between level of cognitive impairment and relaxation treatment effect. Thus, neuropsychological measures were chosen for this study based on their sensitivity and specificity toward lateralized brain dysfunction. In addition, measures of trait anxiety and locus of control were included as individual difference factors predicting relaxation treatment outcome.

**Judgment of Line Orientation.** The Judgment of Line Orientation test, Form H (JOLO; Benton et al., 1983) is a nonverbal measure of spatial perception and orientation. The JOLO consists of 35 items (five practice items and 30 test items) in booklet form. Each item is made up of two straight lines drawn at different angles from horizontal (top booklet page) and a standardized fan-like array of 11 lines at 18-degree angles that serves as a spatial comparison template (bottom booklet page). The subject is instructed to identify the two lines in the comparison template that correspond to the two lines shown on the top booklet page. The maximum score is 30, including age and sex corrections described in the manual (Benton et al., 1983).

Franzen (1989) reported a JOLO (Form H) split-half reliability of .94 for a sample of 40 subjects. Using a sample of 37 patients, Benton et al. (1983)
reported a test-retest reliability coefficient of .90 (six-hour to 21-day intervals) with a 1.8-point standard error of measurement. The JOLO has demonstrated both good sensitivity and specificity toward right-hemisphere brain dysfunction. Subjects with right-hemisphere damage have been found to be more likely to score in the impaired range than subjects with left-hemisphere damage. Using a sample of 100 patients with unilateral brain damage, Benton et al. (1983) found that 46% of the patients with right-hemisphere brain dysfunction performed defectively (10% moderate impairment, 36% severe). In contrast, only 10% of the left-hemisphere patients showed impairment (8% moderate, 2% severe). Only one patient with left-hemisphere dysfunction scored less than 17 out of 30, whereas 18 of the right-hemisphere patients scored below 17 (1.5 percentile or lower).

Visual Form Discrimination. The Visual Form Discrimination test (VFD; Benton et al., 1983) is a nonverbal measure of complex pattern perception and recognition. Like the JOLO, it is presented in booklet format. The VFD test consists of two practice items and 16 test items. Each item presents a complex visual stimulus consisting of two major geometric figures and one smaller peripheral geometric figure (top booklet page) and an array of four similar geometric stimuli (bottom booklet page). One figure in the array is an exact match for the target stimulus, and the other three figures are distractors that have one of three alterations: (a) rotation of the peripheral figure, (b) rotation of a major figure, or (c) distortion of a major figure. The subject is directed to choose which stimulus from the distractor array matches the target stimulus. Two points are awarded for each correct response. One point is given for each incorrect response that represents a peripheral figure error. An incorrect
response involving a major figure rotation or distortion yields no points. The maximum score possible is 32.

Although reliability data is not offered in the VFD manual, Benton et al. (1983) demonstrated the sensitivity of the VFD when used with 58 patients who had "definitive diagnoses of hemispheric brain disease." Of the entire sample, 53% showed a defective performance (defined as a score of 23 or less out of 32). Over 30% of these patients obtained scores less than 20, whereas no subjects from the contrast group (85 healthy adults and patients with no neurological problems) scored below 23. In fact, among the control subjects, 84% scored 29 or above. Good specificity for right-hemisphere brain dysfunction was also demonstrated. Among the 58 patients with brain disease, the subgroup with posterior right-hemisphere lesions showed the highest frequency of defective performance (78% of these patients scored 23 or lower); whereas, only 47% of the patients with corresponding posterior left-hemisphere lesions were comparably impaired.

Auditory-Verbal Learning Test. The Rey Auditory Verbal Learning Test (AVLT; Rey, 1964) is a commonly-used instrument for evaluating verbal memory (Berg, Franzen, & Wedding, 1987). Rey (1964) demonstrated that the AVLT measures immediate verbal memory span over repeated trials, providing a learning curve. The susceptibility of patients to interference and their tendency to confabulate upon recall is also assessed. In addition, many investigators incorporate delayed and recognition memory trials to extend the clinical and research utility of the AVLT (Lezak, 1983). The AVLT consists of five learning trials in which a list of 15 words is read aloud to the subject by the examiner at the rate of one word per second. A measure of free (verbal) recall follows each trial. The five learning trials are followed by the presentation of a
new interfering 15-word list and its free recall. Then, the subject is asked to recall as many words as possible from the first list. Delayed free recall and recognition trials are generally conducted after 30 minutes.

Test-retest reliability coefficients among control subjects range from .64 to .79 (three-, six-, and 12-month intervals), showing a significant practice effect (Lezak, 1982). A more modest coefficient (.55 for a one-year interval) has been reported among older adults (Snow, Tierney, Zorzitto, Fisher, & Reid, 1988). To address the issue of test-retest instability due to practice effects, several alternate forms of the AVLT have been developed (Geffen, Butterworth, & Geffen, 1994). The AVLT is capable of discriminating between various memory-impaired and brain-damaged populations (Rosenberg, Ryan, & Prifitera, 1984; Ryan & Geisser, 1986). Specificity toward left-hemisphere brain dysfunction was reported by Miceli and his colleagues (1981), who found that nonaphasic patients with left-hemisphere lesions did significantly worse than a contrast group of patients with right-hemisphere lesions. Normative data (Wiens, McMinn, & Crossen, 1988) are comprehensive, including published regional norms collected in South Louisiana (Savage & Gouvier, 1992).

**Controlled Oral Word Association Test.** The Controlled Oral Word Association Test (COWAT; Spreen & Benton, 1977) is also known as Word Fluency and the FAS-Test (after Thurstone, 1938). The COWAT is a measure of verbal association fluency, or more specifically, the ability to produce individual words under restrictive search conditions (Marshall, 1986). The subject is given one minute to produce as many words as possible that begin with a particular letter of the alphabet. The COWAT consists of three trials ("F," "A," and "S" -words).
The interscorer reliability of the COWAT is almost perfect (Spreen & Strauss, 1991). Satisfactory test-retest coefficients ranging from .70 for elderly adults (one-year interval; Snow et al., 1988) to .88 for adults (19 to 42-day intervals; desRosiers & Kavanagh, 1987). The COWAT has demonstrated good sensitivity and specificity toward left-hemisphere brain dysfunction. Two studies have documented more severely impaired COWAT performance in patients with left frontal lobe damage (Parks et al., 1988; Perret, 1974) compared to patients with right frontal lobe lesions. In another investigation of specificity, patients with right-hemisphere damage failed to show serious impairment on the COWAT (Cavalli, De Renzi, Faglioni, & Vitale, 1981).

State-Trait Anxiety Inventory. The State-Trait Anxiety Inventory (STAI; Spielberger, Gorusch, & Lushene, 1970), is a 40-item, two-part questionnaire that measures both state anxiety (i.e., "... how you feel right now, that is, at this moment.") and trait anxiety (i.e., "... how you generally feel."). On the first 20 state anxiety items, ratings range from 1, "Not at all" to 4, "Very much so." Ratings for the second 20 trait anxiety items range from 1, "Almost never" to 4, "Almost always." Possible scores on each scale range from 20 to 80, with higher scores reflecting greater levels of perceived anxiety.

The STAI is a widely-used clinical and research instrument that has demonstrated solid psychometric properties. Test-retest reliability coefficients were reported among high school and college students ranging from .65 to .86 for the trait anxiety scale (30- and 60-day intervals) and from .16 to .62 for the state anxiety scale (one-hour, 20-day, and 104-day intervals; Spielberger, 1983b). Lower test-retest stability for the state anxiety scale is understandable given the emphasis on measuring unique situational factors present at the time of testing (i.e., transitory anxiety states). Internal consistency coefficients,
on the other hand, range from .86 to .95 among several large normative samples. The validity of the STAI has been established in over 2,000 studies (Spielberger, 1983a) using diverse patient and nonpatient populations in a wide range of clinical and research applications.

**Multidimensional Health Locus of Control Scales.** The Multidimensional Health Locus of Control (MHLC) scales, Form A (Wallston, Wallston, & DeVellis, 1978), is an 18-item instrument developed to measure beliefs about whether the resultant good health and related reinforcers that come from engaging in health-related behaviors arise from sources that are predominantly (a) internal, (b) a matter of chance, or (c) under the control of "powerful others" (e.g., doctors, family members). Each item is arranged on a six-point Likert-type scale ranging from 1, "Strongly disagree" to 6, "Strongly agree." The MHLC results in three scores, the first assessing level of "internality," and the other two assessing separate aspects of "externality" due to chance or the care of powerful others. Higher scores reflect stronger beliefs about the respective source of reinforcement for behaviors promoting health.

Reported internal consistency alpha coefficients range from .67 to .77 for the MHLC scales. The scales correlate with subjects' state of health and other measures of locus of control (Corcoran & Fischer, 1987). In addition, normative data has been collected among chronic patients, college students, and healthy adults.

**Measurement of Experimental (Relaxation) Outcome**

Adequate measurement of relaxation requires that experimental treatment effects be operationalized in terms of (a) the subject's phenomenological experience, (b) the degree of sympathetic quieting, and (c)
the behavioral effects of relaxation (Borkovec et al., 1984). Three self-report measures of perceived experimental effects and two physiological measures were included in this study. Behavioral effects were not measured due to the following methodological constraints: (a) examiners were not blind to the treatment conditions, (b) independent (blinded) observers were not available to rate overt signs of relaxation during the experimental sessions, and (c) no measurable behavioral effects such as increased performance in therapy or improved pain tolerance were expected after only one experimental relaxation session.

Relaxation Visual Analogue Scale. Subjects' perceptions of experimental treatment effects were measured by the relaxation visual analogue scale (R-VAS; Appendix G), which was developed for use in this study. The validity of the R-VAS is based on the literature investigating the use of visual analogue scales to measure perceived pain (Machin, Lewith, & Wylson, 1988; Murphy, McDonald, Power, Unwin, & MacSullivan, 1988). Visual analogue scales have become the most popular method of pain quantification (Murphy et al., 1988). The R-VAS is a 100-mm uncalibrated line between two small shaded-circle endpoints. It is vertically oriented to control for the presence of subtle visuospatial neglect that might influence the responses of neurologically impaired patients. The upper anchor of the R-VAS is "Very Tense" (scored zero points); the lower anchor of the R-VAS is "Completely Relaxed" (scored 100 points). Subjects were instructed to make a horizontal mark across the vertical R-VAS to represent their current level of perceived relaxation. Scores were obtained by measuring the distance (to the nearest mm) from the zero-point "Very Tense" endpoint to the subjects' horizontal marks, yielding scores from 0 to 100 at integer intervals. Higher
scores reflect greater levels of perceived relaxation. Standardized directions for administration of the R-VAS can be found in Appendix F.

The R-VAS was patterned after the Visual Analogue Dysphoria Scale (VADS; Stern, Rosenbaum, White, & Morey, 1991), designed to assist in the assessment of depressive symptoms in neurological patients. Because it was developed to measure perceptions of transitory internal states (i.e., dysphoria), the test-retest reliability of the VADS was not reported; however, correlational analysis was used to support its convergent and discriminant validity (Campbell & Fiske, 1959). For this study, R-VAS test-retest stability was evaluated by calculating the Pearson Product Moment correlation coefficients between R-VAS scores obtained after two comparable sets of control conditions during the experimental procedure. For the overall sample (N = 70), low to moderate positive correlations were found between R-VAS scores taken after repeated participation in a benign distractor task (r = .35, p < .01) and after repeated resting baseline periods (r = .57, p < .01). These findings are consistent with STAI state stability coefficients reported by Spielberger (1983b).

Treatment Preference. Two simple measures of treatment preference were obtained. After experimental participation, subjects were asked (a) which relaxation induction, "the tape you listened to or the video you watched," they most liked, and (b) which induction they found to be the most relaxing. Standardized instructions for obtaining treatment preference are shown in Appendix F.

Physiological Measures. Skeletal muscle tension and peripheral vasoconstriction are two physiological processes commonly associated with sympathetic nervous system arousal (Peek, 1987). A small portable
physiological recording apparatus was used in this study to measure unilateral forehead surface electromyographic (EMG) activity and digital (index finger) skin temperature. The apparatus consisted of three functional units: (a) J&J EMG Model M-57 biofeedback unit (Cram, 1985), (b) J&J Thermal Model T-68 biofeedback unit (J&J, 1985c), and (c) J&J Digital Integrator Model D-200 (J&J, 1985b). This configuration was used at the OLOL Rehabilitation Center \( n = 64 \), whereas a J&J EMG Model M-53 (J&J, 1985a) biofeedback unit was substituted for the M-57 at the UAB Spain Rehabilitation Center \( n = 11 \). Otherwise, the apparatus was identical at both data collection sites.

Psychophysiological assessment of forehead EMG has demonstrated good test-retest reliability (one-, seven-, and 27-day intervals) ranging from .81 to .94 during baseline conditions (Arena, Blanchard, Andrasik, Cotch, & Myers, 1983). Hand surface temperature has shown adequate test-retest reliability for short intervals (one- and seven-day intervals) ranging from .69 to .81, but less stability for three- and four-week intervals (.004 to .31; Arena et al., 1983).

**Benign Distractor Task**

The benign distractor task used in this study was the Leisure Interests Checklist, Form B (LIC; Rosenthal, Montgomery, Shadish, & Lichstein, 1989), a 135-item inventory designed to identify interests in a wide range of free-time activities. Respondents rate their typical level of interest in each activity on a four-point scale ranging from "Very Much" to "Not at All." In this study, the LIC was presented orally, using a self-report measure response poster (see Appendix F for standardized instructions). Subjects were engaged in the LIC for two 3.5-minute periods just prior to beginning the resting baseline intervals. The entire LIC was not administered, nor were any formal scores calculated or
analyses conducted. Rather, subjects were engaged in a conversational manner and encouraged to briefly elaborate, if possible, on their experiences participating in high-interest activities. Item 38 was omitted from this study due to its potentially offensive content (i.e., "Looking at sex books, films, or magazines").

Relaxation Induction Protocols

Two relaxation induction protocols were used in this study: (a) verbal, and (b) nonverbal. The nonverbal relaxation induction protocol was chosen from a collection of short music-video pieces that portray the natural landscape of the northwestern United States. "Faces of the Forest, Part II" (Nickman, Lanz, & Speer, 1985) is a brief (6.5 minutes) music-video that depicts scenes from in and around Mount Ranier National Park in the state of Washington. The video was photographed using a "Steadicam" technique that captures the scenes as one might experience them during a quiet walk in a forest. The soundtrack was not used in this study due to possible confounds related to individual differences in musical taste among participating subjects.

The verbal relaxation induction protocol consisted of a brief (6.5 minutes) audiotaped guided imagery script describing the exact scenes portrayed in the videotaped nonverbal induction (see Appendix H for transcript). This script was recorded by a licensed clinical psychologist with extensive experience in the application of relaxation therapy.

Relaxation Induction Equipment. The nonverbal relaxation induction videotape was shown using a standard 19-inch color television and a standard VHS video cassette recorder (VCR). Both the television and VCR were remote controlled for easy operation during the experimental procedure.
The verbal relaxation induction audiotape was played on a standard portable stereo radio cassette recorder. The television, VCR, and audio cassette recorder were situated on a rolling cart that was sized to present the nonverbal relaxation induction videotape at eye-level to subjects seated in wheelchairs.

**Design and Procedure**

This study employed a nonblinded between-group $3 \times 2 \times 4$ [patient groups (between) x order of relaxation inductions (between) x treatments with repeated measures of dependent relaxation variables (within)] mixed design (Hulley & Cummings, 1988; Schutz & Gessaroli, 1987; Stevens, 1992). Each subject from the three patient groups (right-hemisphere brain dysfunction, left-hemisphere brain dysfunction, and orthopedic/medical) underwent four treatment conditions: two resting baseline intervals and two experimental relaxation inductions. Subjects were randomly assigned to counterbalanced treatment orders.

All subjects completed the two phases of the study. The first phase involved completion of (a) the subject screening instruments (MMSE, SCID-P Anxiety Disorders module, and the Reitan-Kløve Sensory Perceptual Exam); (b) the self-report measures (CES-D, WPSI, M-C SDS, STAI, and MHLC); and (c) the brief neuropsychological test battery (JOLO, VFD, AVLT, and COWAT). This phase took approximately 1.5-2 hours. It was divided into two approximately hour-long sessions when needed, due to patient fatigue or physical discomfort. Although phase one always started with administration of the screening instruments, control procedures included counterbalancing the sets of self-report measures and neuropsychological tests across subjects.
In addition, the specific order of administration was randomized within the sets of self-report measures and neuropsychological tests for each participant. Because many of the subjects had cognitive impairment and/or age-related changes in visual acuity and fine motor control, the following modifications of the standard administration for the paper-and-pencil self-report measures were implemented. Scale rating anchors were enlarged (11 inches by 14 inches) and affixed to poster board in a vertical orientation with the corresponding numbers printed to both their left and right sides (see Appendixes D and E). Such a vertical orientation was adopted in order to maximize reading comprehension for the subjects who had mild to moderate unilateral visuospatial neglect as a result of their strokes. Both a standardized orientation to each self-report measure response poster and the standard directions (adapted for oral administration) were read aloud to each subject (see Appendix F). All self-report items were read aloud to the subjects exactly as they were originally written and in the correct order. Each subject was instructed to indicate his or her response via speech, gesture, or head nod. All neuropsychological tests were administered according to the standardized instructions found in their respective manuals.

Phase two (always completed in a single one-hour session) involved experimental administration of the verbal and nonverbal relaxation induction protocols. Each subject was randomly assigned to one of two induction orders: (a) the verbal relaxation induction followed by the nonverbal induction, or (b) the nonverbal induction followed by the verbal induction. Subjects were brought into the examining room and situated in their wheelchair approximately five feet in front of the television and VCR used to present the nonverbal relaxation induction. First, they were asked to rate their
(a) expected level of relaxation during the experimental procedure, and (b) expected difficulty in becoming relaxed (Appendixes D and E). Then, subjects marked their current level of perceived relaxation on the R-VAS (Appendix G).

Next, the subjects were familiarized with the physiological recording apparatus and attachments were made as follows. The thermal sensor was attached to an index finger using Dermacell-type paper tape. EMG electrodes were attached to the forehead according to the standard unilateral triangular configuration recommended by J&J (Cram, 1985). Figure 1 is a diagram of the electrode placement used in this study. Two silver/silver chloride input electrodes (18 mm housing) were placed horizontally, one cm above the subject’s eyebrow, bisecting a vertical line from the pupil. The silver/silver chloride reference electrode (18 mm housing) was placed above the two input electrodes, in line with the subject’s pupil. The three electrodes were 2.5-cm

![Diagram of unilateral forehead electrode placement.](image-url)
equidistant apart. For each neurological patient in this study, attachments were made on the same side of the body as the impaired brain hemisphere in order to avoid the confound of contralateral hemiparesis. Attachments were made to the dominant side (right) of each orthopedic/medical patient.

Following attachment of the physiological recording sensors, the subjects were engaged in the benign distractor task (LIC) for 3.5 minutes. The LIC was presented in a conversational manner and subjects were encouraged to briefly elaborate, if possible, on their experiences participating in high-interest activities. At the end of this 3.5-minute distraction task, subjects were asked to make another R-VAS rating of their current level of perceived relaxation. Next, the testing room lighting was dimmed to that provided by a single 40-watt incandescent bulb and subjects were instructed to find a comfortable position in their wheelchair and sit quietly during a 6.5-minute resting baseline interval (see Appendix F for standardized instructions). They were asked to keep their eyes open and look straight ahead (toward the television and VCR) during the resting baseline. Integrated EMG (µV) and skin temperature (°F) readings were recorded at 30-second intervals during this 6.5-minute resting baseline interval. The EMG units' wide filter settings (25-1000 Hz) were consistently used throughout the study. At the end of the resting baseline, subjects were again asked to rate their current level of perceived relaxation on the R-VAS. Together, the 3.5-minute benign distractor task and the 6.5-minute resting baseline served as a 10-minute psychophysiological adaptation period.

Subjects were then asked to allow themselves to become relaxed (Appendix F) while they were presented with the first 6.5-minute relaxation induction (verbal or nonverbal depending on predetermined order). Again,
integrated EMG and skin temperature readings were recorded at 30-second intervals and another R-VAS rating was obtained at the end of the induction. The remainder of the experimental session involved repetition of the above procedure using the second relaxation induction (verbal or nonverbal depending on predetermined order).

After the R-VAS rating from the first relaxation induction was obtained, the testing room was brightened by turning on the overhead fluorescent lights. The benign distractor task was then continued for another 3.5 minutes using the conversational administration of the LIC and a R-VAS rating was obtained. The testing room lights were then dimmed and the 6.5-minute resting baseline interval was repeated, followed by a rating on the R-VAS. Next, the second relaxation induction was administered, following the same procedures as outlined above, and another rating on the R-VAS was obtained. The testing room lights were again brightened and subjects were then asked (a) which relaxation induction they most liked, and (b) which induction they found to the most relaxing. Finally, the experimental debriefing statement was read aloud to each participant.

Statistical Analyses

All statistical analyses were conducted using SPSS release 4.1 for the IBM VM/CMS mainframe configuration (SPSS, 1988) available at Louisiana State University. The first course of analysis involved calculation of descriptive statistics, derivation of neuropsychological test summary scores (verbal, nonverbal, and total performance composites), and calculation of difference scores for the three experimental outcome variables (baseline data subtracted from relaxation induction data). One-way analyses of variance (ANOVARs)
were also conducted to check for group differences in demographic features (e.g., age, education level), clinical variables (e.g., trait anxiety, depression), and potential design confounds (e.g., treatment expectancy). In addition, reliability coefficients were calculated for the self-report instruments used in this study. During the second course of analysis, correlational studies were performed in order to identify possible dependent measure covariates and preliminary variable relations for multiple regression analysis.

The third course of analysis involved multivariate techniques. Assuming significant intercorrelation between dependent measures (perceived state of relaxation and physiological responding), a 3 x 2 x 4 [patient groups (between) x order of relaxation inductions (between) x treatments (within)] doubly multivariate repeated measures multivariate analysis of variance (MANOVA) was the most appropriate omnibus test (SPSS, 1988; Stevens, 1992); however, the actual lack of dependent measure intercorrelation necessitated a univariate approach. Multiple regression analysis was also attempted to determine which predictor variables accounted for significant variance in relaxation treatment effects.
RESULTS

Descriptive Data

Basic demographic data of participating subjects are presented in Table 2 (pp. 33-34). One-way ANOVAs revealed no group differences in age \( F(2, 66) = 1.15, p = .32 \) or years of education \( F(2, 67) = 2.47, p = .09 \). Males and females were adequately represented in the total sample \( \chi^2(1, N = 70) = 2.06, p = .15 \); however, among the orthopedic/medical patients, males were underrepresented \( \chi^2(1, n = 30) = 4.80, p = .03 \). Similarly, the representation of minority subjects approached a target 20% of the total sample \( \chi^2(1, N = 70) = 0.36, p = .55 \); however, Black subjects were moderately overrepresented \( \chi^2(1, n = 20) = 7.81, p = .005 \) among patients with right-hemisphere brain dysfunction. The total sample showed a reasonably even distribution of subjects among the occupational categories used in this study \( \chi^2(1, N = 70) = 7.66, p = .18 \); Barona et al., 1984). Only the orthopedic/medical patient group showed a relatively large proportion of subjects who had been employed as managers, clerical, and sales workers \( \chi^2(1, n = 30) = 18.0, p = .003 \).

Table 3 presents group data from the measures used to screen subjects and evaluate internal validity. Estimated WAIS-R scores were derived from demographically-based regression formulas (Barona et al, 1984; Appendix A). One-way ANOVAs showed statistically significant group differences in predicted premorbid scores of WAIS-R Verbal IQ \( F(2, 66) = 3.94, p = .02 \); Performance IQ \( F(2, 66) = 4.36, p = .02 \); and Full Scale IQ \( F(2, 66) = 3.94, p = .02 \). A series of post-hoc pairwise comparisons were conducted on each of these significant one-way ANOVAs using Tukey’s honestly significant
<table>
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<tr>
<th>Measure</th>
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<th>Right SD</th>
<th>Left M</th>
<th>Left SD</th>
<th>Ortho M</th>
<th>Ortho SD</th>
<th>F-ratio</th>
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<td>Performance IQ(^a)</td>
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<td>(78-114)</td>
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<tr>
<td>Full Scale IQ(^a)</td>
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<td>14.7</td>
<td>103.4</td>
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<td>M-C SDS</td>
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<td>1.3</td>
<td>4.5</td>
<td>1.6</td>
<td>7.0**</td>
</tr>
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<td>(1-7)</td>
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<td>Expected difficulty</td>
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<td>(1-7)</td>
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</table>

**Note.** \(^a\)WAIS-R estimates are derived from Barona et al. (1984; Appendix A).

*p < .05. **p < .01. ***p < .001.
difference test (HSD; SPSS, 1988) at the .05 significance level. Mean estimated WAIS-R Verbal IQ, Performance IQ, and Full Scale IQ scores were statistically lower for patients with right-hemisphere brain dysfunction than for patients with left-hemisphere dysfunction. Mean estimated Performance IQ for the right-hemisphere dysfunction patients was also statistically lower than that of the orthopedic/medical patients. Despite these statistical differences, the mean estimated IQ scores of all three groups fell in the average range (90-109) of intellectual functioning (Wechsler, 1981).

In addition to these group differences in estimated WAIS-R scores, a one-way ANOVA revealed statistically significant group differences in overall cognitive status as measured by the MMSE \( F(2, 67) = 10.57, p < .001 \). Tukey's HSD test showed significantly higher MMSE scores among the orthopedic/medical patients compared to the neurologically impaired patients. No statistically significant group differences were found for CES-D ratings of depressive symptoms \( F(2, 67) = 3.07, p = .053 \) or WPSI level of reported physical symptoms \( F(2, 67) = 1.14, p = .33 \). Visual inspection of the group means for reported depressive symptoms showed higher CES-D scores for both groups of neurologically impaired patients compared to those of the orthopedic/medical patients. It does not appear that patients with right-hemisphere brain dysfunction reported more depressive symptoms than those with left-hemisphere dysfunction.

Table 3 also shows the results of one-way ANOVAs indicating no significant group differences in socially desirable self-report bias determined by M-C SDS scores \( F(2, 67) = 0.70, p = .50 \) or ratings of expected difficulty in becoming relaxed during the experimental procedure \( F(2, 67) = 0.46, p = .63 \). For ratings of expected level of relaxation, however, one-way ANOVA revealed
the presence of significant group differences \( F(2, 67) = 7.04, p = .002 \).

Follow-up analysis with Tukey's HSD test showed a significantly higher
treatment expectancy (level of relaxation) among patients with left-hemisphere
brain dysfunction compared to the orthopedic/medical patients; however, no
difference emerged between patients with right- and left-hemisphere
dysfunction.

Table 4 presents group data from the measures used to predict
treatment outcome. One-way ANOVAs showed significant group effects for all
of the neuropsychological tests: JOLO \( F(2, 66) = 6.65, p = .002 \); VFD \( F(2, 67)
= 6.96, p = .002 \); AVLT \( F(2, 67) = 9.41, p < .001 \); and COWAT \( F(2, 67) = 7.23,
p = .001 \). Post-hoc application of Tukey's HSD test for each
neuropsychological measure revealed a consistent pattern of significant group
differences. On JOLO and VFD, which are most specific to right-hemisphere
brain impairment, the patients with right-hemisphere dysfunction scored
significantly lower than the orthopedic/medical patients. Patients with left-
hemisphere dysfunction also scored significantly lower on VFD than the
orthopedic/medical patients, suggesting that VFD demonstrated less specificity
for right-hemisphere impairment than JOLO in this study. Similar findings
emerged from the tests most specific to left-hemisphere lesions. On the AVLT
and COWAT, patients with left-hemisphere dysfunction scored significantly
lower than the orthopedic/medical group. Patients with left-hemisphere
dysfunction also performed significantly worse on the AVLT than patients with
right-hemisphere dysfunction, suggesting greater specificity to left-hemisphere
impairment than the COWAT in this study. Figure 2 graphically represents the
neuropsychological test data using box graphs that show mean lines (bold),
quartile lines, and score ranges (Gouvier, Jackson, Stuss, & Stethem, 1992).
Table 4
Predictor Measures: Descriptive Data by Group

<table>
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<tr>
<th></th>
<th>Right M SD</th>
<th>Left M SD</th>
<th>Ortho M SD</th>
<th>F-ratio</th>
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<td>JOLO</td>
<td>14.2 7.2</td>
<td>17.0 8.0</td>
<td>22.0 7.6</td>
<td>6.7**</td>
</tr>
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<td>(5-29)</td>
<td>(6-30)</td>
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<td>VFD</td>
<td>21.0 5.7</td>
<td>22.3 5.4</td>
<td>26.2 4.5</td>
<td>7.0**</td>
</tr>
<tr>
<td>(Range)</td>
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<td>(16-32)</td>
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<tr>
<td>AVLT</td>
<td>30.8 11.0</td>
<td>21.3 9.6</td>
<td>35.2 12.3</td>
<td>9.4***</td>
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<tr>
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<tr>
<td>COWAT</td>
<td>16.4 9.0</td>
<td>11.0 8.8</td>
<td>22.5 12.5</td>
<td>7.2**</td>
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<tr>
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<td>(3-60)</td>
<td></td>
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<tr>
<td>STAI State</td>
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<td>34.4 14.2</td>
<td>28.1 9.8</td>
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<tr>
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<tr>
<td>STAI Trait</td>
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<td>34.1 13.2</td>
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<tr>
<td>MHLC Internal</td>
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<td>23.5 4.7</td>
<td>25.0 5.3</td>
<td>0.7</td>
</tr>
<tr>
<td>(Range)</td>
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<tr>
<td>MHLC Chance</td>
<td>25.1 7.8</td>
<td>20.4 6.4</td>
<td>21.5 5.1</td>
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<tr>
<td>(Range)</td>
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<td>(9-32)</td>
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<tr>
<td>MHLC Powerful others</td>
<td>26.7 7.8</td>
<td>24.9 5.3</td>
<td>22.8 4.8</td>
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<td>(15-34)</td>
<td>(12-31)</td>
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</tbody>
</table>

Note. *p < .05. **p < .01. ***p < .001.
Figure 2. Neuropsychological test performance by group (R = right-hemisphere dysfunction; L = left-hemisphere dysfunction; and O = orthopedic/medical).
As shown in Table 4, no significant group differences emerged from one-way ANOVAs performed on STAI measures of state \([F(2, 67) = 2.77, p = .07]\) and trait anxiety \([F(2, 67) = 1.45, p = .24]\); however, the test of group differences for state anxiety scores approached statistical significance. Visual inspection of the state anxiety data reveals that the mean scores for both groups of neurologically impaired patients are somewhat higher than those of the orthopedic/medical patients. The norms offered by Spielberger (normal adults, ages 50-69; 1983b) place the mean state anxiety scores of the right- and left-hemisphere dysfunction patients in the 55-69th percentile range, whereas the mean score of the orthopedic/medical patients fell in the 33-35th percentile range. All of these scores fell within one standard deviation of the normative mean (Spielberger, 1983b). One-way ANOVAs also failed to show group differences for health locus of control (MHLC) scores. No group effects were found for internal health locus of control \([F(2, 67) = 0.74, p = .48]\) or external health locus of control associated with chance \([F(2, 67) = 3.03, p = .06]\) and powerful others \([F(2, 67) = 2.66, p = .08]\). Notably, the MHLC external scales approached statistical significance more closely than the internal scale. Visual analysis is unremarkable in this case.

Presentation of descriptive data concludes in Tables 5 and 6 which show group data from the outcome measures. Table 5 contains subject ratings of perceived relaxation (R-VAS) and the associated physiological data collected during each of the four experimental treatment conditions: (a) resting baseline interval prior to verbal relaxation induction, (b) verbal relaxation induction, (c) resting baseline prior to nonverbal relaxation induction, and (d) nonverbal relaxation induction. The reader is reminded that order of relaxation induction presentation was counterbalanced across subjects.
Table 5  
**Outcome Measures: Descriptive Data by Group**

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<th>Left</th>
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<tr>
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<td>Baseline(^{a})</td>
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<td>Verbal Induction</td>
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<td>Baseline(^{b})</td>
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<td>11.6</td>
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<tr>
<td><strong>Skin Temperature (°F):</strong></td>
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<td>89.1</td>
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<td>88.8</td>
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*Note.* \(^{a}\) Resting baseline interval prior to the verbal relaxation induction.  
\(^{b}\) Resting baseline interval prior to the nonverbal relaxation induction.
One-way ANOVAs were not conducted on these outcome variables, rather the presence of group effects was tested within a multivariate analytic context, described in the next section.

Table 6 shows overall treatment preference data as reported by subjects at the end of their experimental participation. Both the left-hemisphere brain dysfunction patients $[\chi^2(1, n = 20) = 9.80, p = .002]$ and the orthopedic/medical patients $[\chi^2(1, n = 27) = 10.70, p = .001]$ reported that they liked the nonverbal relaxation induction better than the verbal induction. Similarly, the nonverbal induction was reported to be more relaxing than the

Table 6

<table>
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<th>Treatment Preference by Group</th>
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<td>Most relaxing (n)</td>
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<tr>
<td>Orthopedic/medical:</td>
<td></td>
</tr>
<tr>
<td>Most liked (n)</td>
<td>5</td>
</tr>
<tr>
<td>Most relaxing (n)</td>
<td>8</td>
</tr>
</tbody>
</table>

Note. *$p < .05$. **$p < .01$. 
verbal induction by both the patients with left-hemisphere dysfunction \( \chi^2(1, n = 20) = 9.80, p = .002 \) and the orthopedic/medical patients \( \chi^2(1, n = 28) = 5.14, p = .02 \). On the other hand, no statistically significant differences were found among the patients with right-hemisphere dysfunction for treatment preference in terms of simple liking \( \chi^2(1, n = 20) = 0.20, p = .66 \) and overall relaxing effect \( \chi^2(1, n = 20) = 0.80, p = .37 \). Further analysis to test the effects of order of relaxation inductions on treatment preference by group produced chi-square values from 0.20 to 3.53 \( (p = .65-.06) \) for overall relaxing effect. In terms of simple liking, chi-square values ranged 0.83 to 3.68 \( (p = .36-.06) \). No patient group showed differential treatment preference between verbal and nonverbal inductions related to order of relaxation induction. For the entire sample, agreement was high between reports of simple liking and perceived relaxing effects of the induction procedures (Cramer's \( V = .76, p < .001 \)).

### Multivariate Analysis

Ratings of perceived relaxation (R-VAS), forehead EMG activity, and digital skin temperature are variables that share common conceptual meaning as dependent measures of relaxation (Borkovec et al., 1984). This conceptual commonality lends itself to a multivariate analysis of variance framework (MANOVA; Stevens, 1992); however, within each experimental condition, R-VAS, EMG (\( \mu \)V), and skin temperature (°F) data were strikingly unrelated for all three patient groups \( (\alpha = .01, \text{two-tailed tests}) \). These findings do not support the assumption that moderate to high intercorrelations would be found between dependent variables. If significant interrelations between the dependent variables R-VAS, EMG, and skin temperature had been confirmed during correlational analysis, a 3 x 2 x 4 [patient groups (between) x order of
relaxation inductions (between) x treatments (within)] doubly multivariate repeated measures MANOVA would have been the most appropriate omnibus test (SPSS, 1988; Schutz & Gessaroli, 1987; Stevens, 1992); however, the lack of dependent measure intercorrelation necessitated a univariate approach. Thus, in order to test hypotheses one, two, four, and five (see pp. 27-28), separate 3 x 2 x 4 repeated measures ANOVAs were conducted for R-VAS ratings, EMG data, and skin temperature data. Figure 3 is a graphic representation of the mean relaxation outcome values by group and treatment (also see Table 5, p. 64).

The analysis of perceived relaxation ratings (R-VAS) was performed first. Tests of between-subjects effects revealed no main effects for patient group \[F(2, 64) = 2.38, p = .10\] or order of relaxation induction presentation \[F(1, 64) = 0.81, p = .37\] and no interaction between group and order of induction \[F(2, 64) = 0.53, p = .59\]. Tests involving the within-subject effect for experimental treatment revealed no main effect for treatment \[F(3, 192) = 0.68, p = .57\] and no interaction between order of induction and treatment \[F(3, 192) = 0.57, p = .64\]; however, a significant group x treatment interaction was found \[F(6, 192) = 2.96, p = .009\]. The three-way interaction between group, order of induction, and treatment was not significant \[F(6, 192) = 1.45, p = .20\].

Post hoc analysis of the significant group x treatment interaction was conducted using paired t-tests to compare the mean R-VAS ratings of each group between baseline and relaxation induction conditions. Table 7 shows the R-VAS effect sizes (ES) for both the verbal and nonverbal relaxation inductions by group, along with the t values of baseline-to-induction paired comparisons and their significance level (two-tailed tests of significance). Significant baseline-to-induction simple effects were found for the patients with
Figure 3. Experimental outcome data by group (R = right-hemisphere dysfunction; L = left-hemisphere dysfunction; and O = orthopedic/medical).
## Table 7

**Results of Post Hoc Analysis: Effect Sizes and Paired Comparisons**

<table>
<thead>
<tr>
<th></th>
<th>Verbal Relaxation</th>
<th>Nonverbal Relaxation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Effect Size</td>
<td>t value</td>
</tr>
<tr>
<td><strong>R-VAS:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>0.62</td>
<td>-2.94**</td>
</tr>
<tr>
<td>Left</td>
<td>-0.33</td>
<td>1.77</td>
</tr>
<tr>
<td>Ortho</td>
<td>-0.11</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>EMG (µV):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>0.01</td>
<td>N/A&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Left</td>
<td>0.15</td>
<td>N/A</td>
</tr>
<tr>
<td>Ortho</td>
<td>0.21</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Skin Temp (°F):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>0.01</td>
<td>N/A&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Left</td>
<td>0.15</td>
<td>N/A</td>
</tr>
<tr>
<td>Ortho</td>
<td>0.01</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Note.**<sup>a</sup>No post hoc paired comparisons were performed on the EMG and skin temperature data. *p < .05. **p < .01. ***p < .001 (two-tailed tests of significance).

right-hemisphere brain dysfunction in the verbal relaxation treatment condition [\(ES = 0.62, t(19) = -2.94, p = .008\)] and for the patients with left-hemisphere dysfunction in the nonverbal relaxation treatment condition [\(ES = 0.36, t(19) = -2.35, p = .03\)]. No other significant simple effects were found. These results
indicate that right-hemisphere dysfunction patients rated significantly higher levels of perceived relaxation relative to baseline after verbal relaxation induction, whereas both left-hemisphere dysfunction patients and orthopedic/medical patients showed no change in R-VAS ratings between baseline and verbal relaxation induction. Conversely, patients with left-hemisphere dysfunction made significantly higher R-VAS ratings after nonverbal relaxation induction, with orthopedic/medical patients and right-hemisphere dysfunction patients showing no change. These findings are consistent with hypotheses one and two. In addition, the absence of order effects in the R-VAS data supports hypothesis five. Hypothesis four, predicting greater relaxation effects for the orthopedic/medical patients, is not supported.

A second repeated measures ANOVA was performed on the EMG data. Tests of between-subjects effects revealed no significant main effects for group \( F(2, 64) = 0.48, p = .62 \) or order of induction \( F(1, 64) = 1.98, p = .16 \) and no group x order interaction effect \( F(2, 64) = 0.83, p = .44 \). Tests involving the within-subject effect for treatment revealed a significant main effect for treatment \( F(3, 192) = 3.63, p = .014 \), but no significant group x treatment \( F(6, 192) = 0.79, p = .58 \), order x treatment \( F(3, 192) = 2.00, p = .12 \), or group x order x treatment \( F(6, 192) = 1.07, p = .38 \) interactions were found.

Post hoc analysis of the significant main effect for treatment was conducted using planned contrasts (univariate F-tests) between baseline and relaxation induction levels of average integrated EMG activity for the verbal and nonverbal treatment conditions. Significant simple effects were found for the baseline-to-induction contrasts in both the verbal \( F(1, 64) = 4.87, p = .03 \) and nonverbal treatment conditions \( F(1, 64) = 5.42, p = .02 \). Due to the absence of a main effect for group and insignificant interactions involving
group, paired t-tests were not used to compare the mean EMG levels of each group between baseline and relaxation induction conditions. Effect sizes are shown in Table 7. The mean effect sizes for groups in the verbal and nonverbal treatment conditions were 0.12 and 0.28, respectively. These average effect sizes are small (Cohen, 1992). These results indicate that participating patients, regardless of diagnostic group, showed small increases in forehead EMG activity during both the verbal and nonverbal relaxation inductions. Thus, for the EMG data, hypotheses one, two, and four are not supported. In addition, the notion that order effects for EMG activity might be found is not supported (hypothesis five).

The final repeated measures ANOVA was performed on the skin temperature data. Tests of between-subjects effects revealed no significant main effects for group \( F(2, 64) = 0.33, p = .72 \) or order of induction \( F(1, 64) = 2.15, p = .15 \) and no group x order interaction effect \( F(2, 64) = 0.03, p = .97 \). Tests involving the within-subject effect for treatment revealed no main effect for treatment \( F(3, 192) = 1.88, p = .13 \). Similarly, no significant group x treatment \( F(6, 192) = 1.77, p = .11 \), order x treatment \( F(3, 192) = 0.86, p = .46 \), or group x order x treatment \( F(6, 192) = 0.46, p = .84 \) interactions were found. Consequently, no post hoc analyses were conducted, but treatment effect sizes are offered in Table 7. These results indicate that participating patients, regardless of group, showed no change in digital skin temperature during both the verbal (mean ES = 0.06) and nonverbal relaxation inductions (mean ES = 0.09). For the skin temperature data, hypotheses one, two, four, and five are not supported.
Correlational Analysis

Prior to conducting the correlational analysis to test hypotheses three and six (see pp. 27-28), two sets of derived scores were calculated: (a) composite scores from the neuropsychological tests, and (b) difference scores reflecting change in outcome measures between resting baseline and relaxation induction intervals. A verbal cognitive composite score (COGV) was derived from the two neuropsychological tests of verbal ability (AVLT and COWAT). Likewise, a nonverbal cognitive score (COGNV) was derived from the JOLO and VFD. In addition, a total cognitive composite score (COGTOT) was derived from all four measures. Raw scores from the neuropsychological measures were transformed into standardized (z) scores and summed to create the composite scores (Sattler, 1988).

In order to control for the initial levels of relaxation outcome variables during the resting baseline intervals, difference scores were calculated for R-VAS, forehead muscle tension, and digital skin temperature by subtracting baseline data from relaxation induction data. These derived data allowed for examination of correlations between changes in outcome variables and demographic, subject screening/internal validity, and predictor variables. For all correlational analyses conducted in this study, two-tailed tests of significance were used ($\alpha = .01$). This conservative stance was taken because (a) a very large number of correlations were computed and (b) the directions of the relations between every pair of variables could not be confidently predicted in advance.

To test hypotheses three and six, intercorrelation matrices were calculated between the experimental outcome variable difference scores (baseline data subtracted from relaxation induction data) and the
demographic, subject screening/internal validity, and outcome predictor variables. Table 8 shows the significant correlations by group (α = .01, two-tailed tests). Correlational analysis demonstrated that neuropsychological test scores indicating cognitive impairment were not associated with the two significant baseline-to-induction R-VAS rating increases for (a) the right-hemisphere dysfunction patients during the verbal induction or (b) the left-hemisphere patients during the nonverbal induction. In addition, no relation was found between the health locus of control and treatment expectancy predictor variables and the verbal and nonverbal induction effects on the R-VAS ratings of right- and left-hemisphere patients, respectively. Thus, hypotheses three and six failed to gain support from the results of this study.

Table 8 shows that among patients with right-hemisphere brain dysfunction during the verbal relaxation induction, decreases in EMG levels (increased relaxation) tended to occur in patients who demonstrated a strongly socially desirable response style ($r = -.71, p < .001$); increases in skin temperature (increased relaxation) tended to be present in patients with lower levels of reported trait anxiety ($r = -.59, p = .006$). During the nonverbal relaxation induction, increases in ratings of perceived relaxation (R-VAS) were present in the right-hemisphere dysfunction patients with higher MMSE scores ($r = .60, p = .006$) and socially desirable response tendencies ($r = .66, p = .001$). Among patients with left-hemisphere brain dysfunction during the nonverbal relaxation induction, decreases in EMG levels were found among patients who expected to get more relaxed during the experiment ($r = -.73, p < .001$). Among orthopedic/medical patients during the verbal relaxation induction, those who had more formal education ($r = .48, p = .01$) and higher estimated WAIS-R IQ ($r = .46-.47, p = .01$) tended to show more increase in
Table 8

Pearson Product Moment Correlation Coefficients (r) between Outcome Variables and Select Demographic, Subject Screening/Internal Validity, and Predictor Variables by Group

<table>
<thead>
<tr>
<th></th>
<th>Verbal Relaxation&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Nonverbal Relaxation&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ΔR-VAS</td>
<td>ΔEMG</td>
</tr>
<tr>
<td><strong>Right</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMSE</td>
<td>-.15</td>
<td>-.43</td>
</tr>
<tr>
<td>M-C SDS</td>
<td>.18</td>
<td>-.71**</td>
</tr>
<tr>
<td>STAI Trait</td>
<td>.09</td>
<td>.10</td>
</tr>
<tr>
<td><strong>Left</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected relax.</td>
<td>.16</td>
<td>-.28</td>
</tr>
<tr>
<td><strong>Ortho</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>.48*</td>
<td>-.23</td>
</tr>
<tr>
<td>Performance IQ</td>
<td>.47*</td>
<td>-.18</td>
</tr>
<tr>
<td>Full Scale IQ</td>
<td>.46*</td>
<td>-.18</td>
</tr>
</tbody>
</table>

Note. <sup>a</sup>Outcome variables reflect change between resting baseline and relaxation induction. *p < .01. **p < .001 (two-tailed tests of significance).

R-VAS ratings. The lack of consistent correlations between any one variable and all three outcome measures is further evidence that perceived state of relaxation and physiological responding were largely independent in this investigation.

Given the significant group x treatment interaction for R-VAS ratings among patients with neurological impairment, multiple regression analysis
was considered in order to determine what patient variables best predict increases in ratings of perceived relaxation after the verbal and nonverbal inductions. Of primary interest were the variables that predict baseline-to-induction change in R-VAS ratings for (a) the right-hemisphere dysfunction patients during the verbal relaxation induction, and (b) the left-hemisphere patients during the nonverbal induction. Upon examination of Table 8, an important finding was made: no patient demographic, subject screening/internal validity, or hypothesized outcome predictor variables were found to correlate with R-VAS difference scores for these two conditions. Due to the absence of significantly correlated predictor and outcome variables, multiple regression analysis was not pursued.

Examination of the intercorrelation matrix between the demographic and subject screening/internal validity measures revealed high to very high positive correlations between years of education and estimated WAIS-R IQ scores \((r = .83-.96, p < .001)\) and within estimated WAIS-R Verbal, Performance, and Full Scale IQ scores \((r = .987-.998, p < .001)\) for all three patient groups. This finding is not surprising because years of education was included in the regression equations used in this study to estimate premorbid intellectual functioning (Barona et al., 1984; see Appendix A). For both the left-hemisphere brain dysfunction and orthopedic/medical groups, MMSE performance showed low to moderate positive correlations with estimated WAIS-R scores \((r = .48-.61, p = .007-.004)\). Patients from the orthopedic/medical group with higher education levels also tended to perform better on the MMSE \((r = .50, p = .005)\).

Turning to the intercorrelations between other subject screening/internal validity measures, level of depressive symptoms (CES-D) and level of
physical complaints (WPSI) were moderately to highly related for all three groups \((r = .55-.73, p < .005)\). For both groups of patients with neurological impairment, the tendency to respond to self-report items in a socially desirable manner was associated with lower levels of reported depressive symptoms \((r = -.68 to -.76, p < .001)\) and physical complaints \((r = -.61 to -.67, p = .005-.001)\). Treatment expectancy ratings were considered next. Patients with left-hemisphere dysfunction who made higher ratings of expected difficulty in becoming relaxed tended to have less of a socially desirable self-reporting style \((r = -.60, p = .005)\). Orthopedic/medical patients who showed more of a socially desirable response style expected both higher levels of relaxation during the experiment \((r = .60, p < .001)\) and less difficulty becoming relaxed \((r = -.61, p < .001)\). The association between expected level of relaxation during the experiment and expected level of difficulty in becoming relaxed was only significant for the orthopedic/medical patients \((r = -.67, p < .001)\).

In order to examine the interrelations between variables used to predict experimental (relaxation) outcome, intercorrelation matrices were calculated for the neuropsychological tests and for the self-report measures of health locus of control (MHLC) and anxiety (STAI). For the orthopedic/medical patient group, the neuropsychological test scores were all significantly intercorrelated \((r = .54-.70, p < .002; \alpha = .05, \text{two-tailed tests})\). This finding did not hold for the patients with neurological dysfunction. Among the right-hemisphere dysfunction patients, JOLO and VFD were moderately correlated \((r = .68, p = .002)\) and the AVLT and COWAT were highly correlated \((r = .84, p < .001)\). VFD and JOLO were not significantly correlated with either of the tests of verbal ability. Among the patients with right-hemisphere dysfunction, strong correspondence existed between the two tests of verbal ability \((r = .63, p < .001)\).
p = .003) and between the two tests of nonverbal ability (r = .80, p < .001). The AVLT showed high positive correlations with the nonverbal tests (r = .71-.79, p < .001); whereas, the COWAT was not significantly correlated with them (r = .33-.39, p = .16-.09). These results demonstrate good correspondence between tests with similar diagnostic specificity; however, derived summary scores were highly intercorrelated (r = .83-.95, p < .001) for all three groups.

Examination of the intercorrelation matrix between self-report predictors of experimental outcome revealed that STAI measures of state and trait anxiety were moderately to highly correlated for each of the three patient groups (r = .58-.83, p < .005), consistent with Spielberger's (1983b) report of a median correlation of .65 for seven normative samples (r = .59-.75). Analysis of the MHLC data revealed no significant scale intercorrelations for any of the patient groups. Normative data (N = 115; Wallston et al., 1978) on MHLC scale intercorrelations showed no correlation between the two external scales (r = .06, p > .05) and between IHLC and PHLC (r = .15, p > .05); however, IHLC and CHLC showed low negative correlation (r = -.34, p < .001). Due to these results, interpretation of the MHLC data from this study warrants caution.

Reliability

Table 9 presents the internal consistency coefficients for each of the self-report instruments used in this study. Coefficient alpha was calculated for all of the measures with Likert-type scaling; however, Kuder-Richardson formula 20 was required for the M-C SDS due to its true-false scoring system (Anastasi, 1988; Cronbach, 1984). Normative internal consistency coefficients are provided for easy comparison. A number of notable weaknesses in internal consistency emerge from examination of Table 9. Both scales from
Table 9

Reliability (Internal Consistency) of Self-Report Measures by Group

<table>
<thead>
<tr>
<th></th>
<th>Right</th>
<th>Left</th>
<th>Ortho</th>
<th>Normative</th>
</tr>
</thead>
<tbody>
<tr>
<td>CES-D</td>
<td>.87</td>
<td>.88</td>
<td>.37</td>
<td>.85-.90&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>WPSI</td>
<td>.94</td>
<td>.91</td>
<td>.84</td>
<td>.85-.94&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>M-C SDS</td>
<td>.75</td>
<td>.83</td>
<td>.44</td>
<td>.88&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>STAI State</td>
<td>.54</td>
<td>.70</td>
<td>.70</td>
<td>.90-.94&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>STAI Trait</td>
<td>.41</td>
<td>.57</td>
<td>.48</td>
<td>.89-.96&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>MHLC Internal</td>
<td>.81</td>
<td>.37</td>
<td>.52</td>
<td>.77&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>MHLC Chance</td>
<td>.76</td>
<td>.58</td>
<td>.36</td>
<td>.75&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>MHLC Powerful others</td>
<td>.80</td>
<td>.42</td>
<td>.30</td>
<td>.67&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note. Normative coefficient alpha sources: <sup>a</sup>Corcoran & Fischer (1987); <sup>b</sup>Wahler (1983); <sup>c</sup>Crowne & Marlowe (Kuder-Richardson formula 20; 1960); <sup>d</sup>working adults ages 50-69 (Spielberger, 1983b); <sup>e</sup>Wallston et al. (1978).

the STAI had lower than expected reliability for all three patient groups. All three MHLC scales had low to moderate internal consistency for the left-hemisphere dysfunction and orthopedic/medical groups. Among orthopedic/medical patients, the CES-D and the M-C SDS showed low reliability. These findings are important given the modifications that were made in item administration. Caution is needed in interpreting the data obtained from these self-report measures. It appears that both the modified item administration and the presence of cognitive impairment among the participating subjects compromised the internal consistency of these
measures. Overall, reliability was least disrupted among the patients with right-hemisphere dysfunction.
DISCUSSION

The major objectives of this study were (a) to develop a nonverbal relaxation induction protocol for use with rehabilitation inpatients who have language impairment secondary to left-hemisphere brain dysfunction, (b) to measure both the psychological (self-report of perceived relaxation) and physiological (forehead muscle tension and digital skin temperature) aspects of clinically-induced relaxation among three rehabilitation inpatient groups (right-hemisphere brain dysfunction, left-hemisphere brain dysfunction, and orthopedic/medical), and (c) to discover better ways to meet the relaxation needs of each rehabilitation inpatient with respect to their individual capability/disability pattern and personal preferences. Overall, this study fulfilled its objectives, producing results largely consistent with its guiding hypotheses.

Hypothesis one stated that patients with right-hemisphere brain dysfunction would demonstrate significantly better relaxation (i.e., lower forehead muscle tension, warmer digital skin temperature, and higher ratings of perceived relaxation) in response to the verbal relaxation induction. This hypothesis was tested using separate repeated measures ANOVAs for each of the three dependent measures of relaxation. Post hoc analysis of a significant \((p = .009)\) group \times treatment interaction in the R-VAS rating data provided the strongest support for hypothesis one. Upon paired \(t\)-test comparison of pre- and post-verbal relaxation induction mean R-VAS ratings, a significant simple effect was found \((p = .008)\). This simple effect size was 0.62, well above the moderate level of 0.50 operationally defined by Cohen (1992). In this study,
patients with right-hemisphere dysfunction made significantly higher ratings of perceived relaxation on the R-VAS after undergoing the verbal induction (audiotaped forest-walk guided imagery script). On the other hand, both the left-hemisphere dysfunction patients and the orthopedic/medical patients failed to make significantly higher R-VAS ratings after the verbal induction.

Despite a solid effect for R-VAS ratings in the direction stated in hypothesis one, patients with right-hemisphere dysfunction showed a significant increase in forehead EMG activity (more muscle tension), but no significant change in skin temperature during the verbal relaxation induction. This finding is not consistent with hypothesis one, which assumed there would be significant intercorrelation between the three dependent measures of relaxation given their common conceptual basis (Borkovec et al., 1984). Correlational analysis firmly showed that the perceived state of relaxation, forehead EMG activity, and digital skin temperature of patients in all three groups were largely independent. Four possible reasons for the dissociation of these variables in this study are considered below.

First is the issue of treatment potency. The verbal and nonverbal relaxation induction protocols used in this study are not considered to be clinical treatments. Merely playing an audiotape or videotape for a patient has not been documented as a viable method of clinical relaxation. In fact, several studies have documented the clinical superiority of live versus taped relaxation induction (Lehrer, 1982; Lehrer & Woolfolk, 1984). Thus, it is possible that the inductions employed in this study did not have enough treatment potency to elicit a full physiological relaxation response, but they did have enough potency to effect perceived relaxation.
The verbal and nonverbal relaxation inductions used in this study were designed and implemented solely as laboratory-based clinical trials. The inductions were not intended to stand alone as arousal reduction interventions to be used in a clinical setting. The successful application of clinical relaxation involves numerous therapeutic considerations that apply across the many different forms of relaxation. These considerations include (a) basic clinical elements such as establishing rapport and a therapeutic alliance; (b) careful introduction of the rationale for relaxation and negotiation of arousal reduction goals; (c) physical setting; (d) number of training sessions; and (e) amount and form of home practice (Lichstein, 1988). The experimental design of this study necessarily sacrificed some of these clinical elements in order to maintain internal validity. Perhaps more robust treatment findings in terms of physiological responding will emerge as future studies implement the full array of clinical techniques used to elicit relaxation.

A second possible explanation for the lack of correlation between dependent measures of relaxation concerns the issue of inter- and intraindividual differences in relaxation response patterns. Although proponents of a "general relaxation" response pattern maintain that EMG activity and digital skin temperature tend to move in the same direction (i.e., arousal or relaxation; Stoyva & Budzynski, 1974), other investigators have established that this relation does not always hold up over time in healthy subjects during biofeedback training (Montgomery, 1988) and resting baseline conditions (Lichstein, Sallis, Hill, & Young, 1981). Rehabilitation inpatients, both neurologically impaired and orthopedic/medical groups, often have numerous physical complications that may act to add variability to an already quite variable interrelation among dependent measures of relaxation.
The third possible reason why this study revealed minimal association between EMG activity, skin temperature, and R-VAS ratings emerged from the repeated measures ANOVA that was performed on the EMG data. Post hoc analysis of the significant main effect for treatment ($p = .014$) revealed that patients who participated in the experiment, regardless of group, showed small increases in forehead EMG activity from baseline to induction for both the verbal ($p = .03$, mean $ES = 0.12$) and nonverbal treatment conditions ($p = .02$, mean $ES = 0.28$). This finding is considered artifactual, possibly related to the presence of (a) pain and general discomfort among patients during the experiment; (b) failure to remain still; and/or (c) mild deficits in vision and/or hearing in these elderly patients, resulting in small increases in forehead muscle tension.

The fourth possible explanation for the lack of correlation between dependent measures of relaxation involves the stringent criteria used to identify potential subjects (pp. 32, 34) and the proportion of recruited subjects that refused to participate in the study (approximately 50% at OLOL Rehabilitation Center). Taken together, these selection features possibly resulted in the exclusion of patients who might have shown a more robust generalized response to the relaxation inductions, and therefore, a convergence of R-VAS ratings and physiological measures. All patients with clinically-elevated psychological distress (e.g., anxiety, depression, and somatoform disorder) were excluded from the sample. It is quite possible that greater relaxation effects could be found among patients with higher arousal levels prior to experimental participation. Similarly, recruited subjects who refused to participate may have had characteristics associated with higher arousal levels (e.g., social anxiety) or dysphoric mood. The patients who
refused to participate in the study might actually have been the ones who would respond best to relaxation, again resulting in higher correlation between the three dependent measures.

Hypothesis two stated that patients with left-hemisphere brain dysfunction would demonstrate significantly better relaxation in response to the nonverbal relaxation induction. Like hypothesis one, this hypothesis was tested using separate repeated measures ANOVAs for R-VAS ratings, EMG activity, and skin temperature. Again, post hoc analysis of the significant group x treatment interaction in R-VAS ratings clearly supported hypothesis two. Paired t-test comparison of pre- and post-nonverbal induction mean R-VAS ratings revealed a small- to moderate-sized significant simple effect (ES = 0.36, p = .03). In this study, patients with left-hemisphere dysfunction made significantly higher R-VAS ratings after undergoing the nonverbal relaxation induction (forest walk video). Once again, both of the other patient groups failed to make significantly higher R-VAS ratings after the nonverbal induction. Analysis of left-hemisphere dysfunction patients’ EMG and skin temperature data yielded results very similar to those of right-hemisphere dysfunction patients: forehead EMG increased and skin temperature did not change during the nonverbal relaxation induction. The previously discussed possible explanations for this dissociation between dependent relaxation variables are germane.

Taken together, the results of testing hypotheses one and two provide compelling evidence to support the use of verbal and nonverbal relaxation techniques that match the pattern of residual strengths and weaknesses of neurologically impaired inpatients. Patients with unilateral right-hemisphere dysfunction who demonstrate measurable neurological and
neuropsychological sequelae including contralateral sensory-motor deficits and impaired visuospatial cognitive processes, but not severe hemispatial neglect, reported more relaxation after the verbal induction than after the nonverbal induction (R-VAS ratings). The verbal induction allowed these patients to use their preserved language ability to process the relaxation stimulus (audiotaped forest-walk guided imagery script). Despite the significant baseline-to-induction increases in ratings of perceived relaxation, the right-hemisphere dysfunction patients reported no differential preference for the verbal induction in terms of simple liking and overall relaxing effects.

After the nonverbal relaxation induction, the highest level of relaxation (R-VAS ratings) was reported by patients with left-hemisphere brain dysfunction who had measurable neuropsychological deficits including right-sided sensory-motor impairment and language difficulties. These patients did not report increased relaxation after the verbal relaxation induction. On the other hand, the nonverbal induction allowed these patients to rely on their preserved visuospatial ability to process the relaxation stimulus (forest walk video). A significant majority (85%) of the patients with left-hemisphere dysfunction also reported a preference for the nonverbal relaxation induction in terms of both simple liking and overall relaxing effects ($p = .002$).

Hypothesis three stated that the right- and left-hemisphere brain dysfunction patients with the least neuropsychological impairment would tend to demonstrate better relaxation in response to the verbal and nonverbal relaxation inductions, respectively. Unlike hypotheses one and two, this hypothesis failed to gain support from the results of this study. Correlational analysis demonstrated that neuropsychological test scores indicating cognitive impairment were not associated with the two significant baseline-to-induction
R-VAS rating increases for (a) the right-hemisphere dysfunction patients during the verbal induction or (b) the left-hemisphere patients during the nonverbal induction. It may be that only mild specific verbal or nonverbal cognitive deficits are required to cause the unimpaired half of the system to assert itself in response to the appropriate modality-specific relaxation stimuli. For example, in the presence of mild left-hemisphere dysfunction and associated language difficulties, the unimpaired right-hemisphere nonverbal processing system may respond quite actively to nonverbal relaxation stimuli. More severe left-hemisphere impairment (within the range measured in this study) may not compromise the right-hemisphere response to nonverbal relaxation induction stimuli. Further research is warranted.

These findings do not appear to be the result of poor sensitivity to cognitive impairment or weak specificity for side of lesion among the neuropsychological tests. Patients with right-hemisphere dysfunction scored significantly lower than orthopedic/medical patients on both tests of nonverbal, visuospatial function (\(p = .0023-.0018\)); whereas, patients with left-hemisphere dysfunction performed significantly worse than orthopedic/medical patients on both measures of verbal ability (\(p = .0014-.0003\)). In addition, the data from all four neuropsychological measures showed adequate score ranges from severely impaired to near-normal performance, dispelling the notion of restricted range problems in the test score data.

Although adequately measured in this study, neuropsychological tests scores did not significantly correlate with the baseline-to-induction changes in R-VAS ratings of right- and left-hemisphere dysfunction patients during the verbal and nonverbal relaxation inductions, respectively. The clinical implications of these findings are important in the relaxation treatment of
neurologically impaired rehabilitation inpatients. Such patients, with levels of
cognitive functioning comparable to the ones reported in this study, should not
be excluded from clinical relaxation therapy based on neuropsychological test
performance alone. Rather, attempts should be made to provide relaxation
treatment in the form of modality-specific input that matches the information
processing capabilities of the neurologically impaired individual.

Hypothesis four stated that the orthopedic/medical patients would
demonstrate the greatest relaxation response for both inductions, compared to
the neurologically impaired patients. It was expected that the orthopedic/
medical patients would not show a differential relaxation response to the
verbal and nonverbal inductions or a differential preference for one induction.
This hypothesis was not supported by the results from the three repeated
measures ANOVAs or by chi-square analysis of preference data. Post hoc
analysis of the significant group x treatment interaction revealed no significant
simple effects for the baseline-to-induction changes in perceived relaxation
during both inductions. In addition, no between-subjects effects involving
group were found for the EMG activity or skin temperature data. It is possible
that the failure of orthopedic/medical patients to report baseline-to-induction
changes in perceived relaxation is due to their relatively high level of
perceived relaxation prior to induction. If they were already substantially
relaxed during resting baseline, little change was possible upon
administration of the relaxation induction. This problem may be addressed in
future research by designing subject selection criteria to include patients with
higher levels of resting arousal (e.g., anxiety, pain).

Despite the lack of reported changes in relaxation level during both
inductions, the orthopedic/medical patients showed an unexpectedly strong
treatment preference for the nonverbal relaxation induction in terms of both simple liking (81%; \( p = .001 \)) and overall relaxing effects (71%; \( p = .001 \)). These findings about relaxation treatment preference among the orthopedic/medical patients were not expected, but they are quite interesting. Three possible reasons to explain these findings are offered. First, the nonverbal induction may have had more stimulus value than the verbal induction, maintaining the patients' interest without being arousing. It is possible that it took more focused attentional effort for the orthopedic/medical patients to listen to the audiotaped forest-walk guided imagery script than for them to watch the forest-walk video. Second, the prospect of watching a forest-walk video may have had more face validity than listening to an audiotaped description. The question may have been asked, "If I can watch it, why go to the trouble of listening to it?" Third, the growing predominance of video entertainment in our culture may have biased the orthopedic/medical patients toward this form of relaxation induction. Future research on video relaxation must compare it with the effect of simply watching television.

The possibilities of using nonverbal induction in clinical relaxation treatment with other elderly patient populations (e.g., dementia) are promising. The simple finding of a strong preference for the nonverbal induction among elderly (mean age of 72.5 in this study) orthopedic/medical rehabilitation patients will be helpful in designing more useful forms of relaxation. Presumably, if a patient prefers a given treatment, then he or she will be more likely to use it; thus, the probability of positive treatment outcome is increased.

Hypothesis five stated that no significant order of relaxation effects would be seen for ratings of perceived relaxation or preference data; however, significant order effects for the physiological data might be found. This
hypothesis was tested using repeated measures ANOVAs and frequency analysis (chi-square). Tests of between-subjects effects involving order of induction were not significant for R-VAS ratings, EMG activity, or skin temperature data. Similarly, order of induction did not effect reported treatment preference. The absence of order effects suggests that counterbalancing the presentation of verbal and nonverbal inductions across subjects in this experiment was successful, permitting full statistical benefit of using a repeated measures design in which each patient served as his or her own control.

Hypothesis six stated that patients with (a) higher internal health locus of control scores would respond better to the verbal relaxation induction, whereas patients with (b) higher external health locus of control scores would respond better to the nonverbal relaxation induction. In addition, patients with (c) higher ratings of anticipated level of relaxation and (d) lower ratings of anticipated difficulty in becoming relaxed would show better responses to both forms of relaxation induction when variables such as age, severity of damage, and time since injury were statistically controlled. Correlational analysis revealed no relation between these predictor variables and the verbal and nonverbal induction effects on R-VAS ratings of right- and left-hemisphere patients, respectively. Hypothesis six was not supported.

The failure of hypothesis six may be partly explained by psychometric problems that developed in this study. Calculation of the internal consistency (alpha) coefficients of the MHLC scales revealed compromised reliability, probably associated with the modified oral administration developed for this study. In addition, the MHLC scale intercorrelations found in this study were not consistent with what was reported by the developer (Wallston et al., 1978).
seriously calling into question the use of these scales (as administered in this study) to predict relaxation effects.

Due to the overall lack of correlation between predictor variables and relaxation outcome variables, it appears that side of brain lesion is the single best predictor of response to relaxation in this study. The best predictor of right-hemisphere dysfunction patients' ratings of perceived relaxation during the verbal induction was side of lesion. The converse is true for patients with left-hemisphere dysfunction: side of brain best predicted R-VAS ratings during the nonverbal induction.

Despite the ability of the side of lesion to predict ratings of perceived relaxation during verbal and nonverbal relaxation inductions, very little else can be gleaned about the possible mechanisms of this brain-hemisphere x induction modality interaction. Due to the heterogeneity of the unilateral brain lesions among the patients in this study, no attempt can be made to localize a "relaxation center" of the brain. However, some useful information has been gathered in this study about the positive effects of matching the modality of relaxation induction (verbal/nonverbal) with the preserved capabilities of the unimpaired brain hemisphere. The primary conclusion of this study is that rehabilitation inpatients with right-hemisphere brain dysfunction tended to report increased relaxation after a verbal induction, whereas patients with left-hemisphere brain dysfunction tended to report increased relaxation after a nonverbal induction. This data serves as an empirical basis upon which to design further research.
REFERENCES


APPENDIX A:

REGRESSION FORMULA ESTIMATES OF WAIS-R PERFORMANCE
BASED ON DEMOGRAPHIC INFORMATION
REGRESSION FORMULA ESTIMATES OF WAIS-R PERFORMANCE
BASED ON DEMOGRAPHIC INFORMATION:

Estimated Verbal IQ = 54.23 + .49(Age) + 1.92(Sex) + 4.24(Race) +
5.25(Education) + 1.89(Occupation) + 1.24(Residence).

Estimated Performance IQ = 61.58 + .31(Age) + 1.09(Sex) + 4.95(Race) +
3.75(Education) + 1.54(Occupation) + .82(Region).

Estimated Full Scale IQ = 54.96 + .47(Age) + 1.76(Sex) + 4.71(Race) +
5.02(Education) + 1.89(Occupation) + .59(Region).

Sex: Male = 2, Female = 1.
Race: Black = 1, Other = 2, White = 3.
Region: Southern = 1, North Central = 2, Western = 3, Northeast = 4.
Residence: Urban = 2, Rural = 1.
Occupation: Profession & Technical = 6; Manager, Officials, Proprietors,
Clerical, & Sales Workers = 5; Craftsmen & Foremen = 4; Not in Labor
Force = 3; Operatives, Service Workers, Farmer, & Farm Manager
(Semi-skilled) = 2; Farm Laborers, Farm Foremen, & Laborers = 1.
Age: 16-17 = 1; 18-19 = 2; 20-24 = 3; 25-34 = 4; 35-44 = 5; 45-54 = 6;
55-64 = 7; 65-69 = 8; 70-74 = 9.
Education: 0-7 years = 1; 8 years = 2; 9-11 years = 3; 12 years = 4; 13-15
years = 5; 16+ years = 6.

(Barona, Reynolds, & Chastain, 1984)
APPENDIX B:

INFORMED CONSENT FORMS
INFORMED CONSENT FORM

Rehabilitation Center: Our Lady of the Lake Regional Medical Center
Rehabilitation Relaxation Project

Purpose

In this study, we are interested in trying to find out in what ways Patients relax best while they are in Rehabilitation.

What Participants Do

You will take part in two or three sessions that consist of filling out paper-and-pencil self-report measures, participating in a structured interview, taking a short battery of neuropsychological tests that assess your verbal and nonverbal mental abilities, and undergoing two experimental relaxation procedures. One type of relaxation involves listening to a description of a peaceful walk in a beautiful forest. The other type of relaxation consists of watching a videotape of what you might see during such a walk in the forest. During the experimental relaxation procedures, you will be asked to rate how relaxed you feel. In addition, your muscle tension and skin temperature will be measured using biofeedback equipment that attaches to the skin of your finger and forehead or neck with paper tape or adhesive rings.

Potential Risks

There is minimal risk to any participant in this study. The EMG and thermal physiological recording is painless and should not cause you any distress, beyond that associated with a novel experience. The apparatus is not power line operated; rather, the EMG and thermal units are each powered by four C-size 1.5 V batteries. Hence, the risk of dangerous electrical faults developing is small. All equipment used in the study has been recently inspected by the OLOL biomedical engineering staff (Safety Check passed on
Also be informed that YOU WILL NOT MISS ANY OF YOUR REHABILITATION THERAPIES WHILE PARTICIPATING IN THIS STUDY.

Benefits

The benefits of this study include (a) the development of alternative relaxation induction protocols to use with patients who have language problems associated with a neurological condition, (b) the measurement of relaxation responses demonstrated by patients undergoing inpatient rehabilitation, and (c) better matching of treatment type to the needs of each individual rehabilitation patient.

Compensation

There will be no monetary compensation for participating in this study. If you are injured by taking part in this study, you will be financially responsible for your own medical care.

Cost

You will not be charged for the tests and procedures that you undergo as part of this study. You will not incur any additional costs as a result of your participation in this study. You will be responsible directly or through your insurance company for all hospital costs, inpatient and outpatient, that may occur during the routine course of evaluation and treatment of your disease, regardless of your involvement in this study.

Participant's Rights

Your participation in this study is completely voluntary. You have the right to withdraw from the study at any time. Your answers will be totally confidential. Your name will never appear in the analyses or results of the study. You have the right to ask questions about the procedure of the study at
any time. Your questions will be answered. In addition, you may request to be
informed about the final results of the study (see below). If you would like
additional information about your rights as a research subject, you may contact
Sister Magdalen O'Donovan at OLOL Skilled Care (765-6565).
We thank you very much for your cooperation. This research is being
conducted by Psychology Service under the supervision of Drew Gouvier,
Ph.D., Phil Brantley, Ph.D., and John Green, M.D. If you have any questions,
you may contact the project director, Warren Jackson, M.A. in the Rehab
Psychology Service office (765-7862).

I HAVE READ AND UNDERSTOOD THIS CONSENT AND AGREE TO
PARTICIPATE IN THIS RESEARCH PROJECT.

Signed: ___________________________________ Date: ________________

Please list your name and address on the back of this page if you would like to
receive a copy of the final results.
PROTOCOL FOR A COMPARISON OF VERBAL AND NONVERBAL
RELAXATION INDUCTION TECHNIQUES IN
NEUROLOGICALLY IMPAIRED REHABILITATION PATIENTS

INFORMED CONSENT

Explanation of Procedures

You are being asked to participate in a research study designed to find out in what ways Patients relax best while they are in Rehabilitation. This research study is being conducted at the University of Alabama at Birmingham (UAB) Spain Rehabilitation Center. If you decide to participate, you will take part in two or three sessions that consist of filling out paper-and-pencil self-report measures, participating in a brief structured interview, taking a few short tests of your verbal and nonverbal mental abilities, and undergoing two experimental relaxation procedures. Your total time commitment will not exceed three hours.

One type of relaxation involves listening to a description of a peaceful walk in a beautiful forest. The other type of relaxation consists of watching a videotape of what you might see during such a walk in the forest. During the experimental relaxation procedures, you will be asked to rate how relaxed you feel. In addition, your muscle tension and skin temperature will be measured using biofeedback equipment that attaches to the skin of your finger and forehead with paper tape and adhesive rings.

Risks or Discomforts

There is minimal risk to any participant in this study. Measurement of muscle tension and skin temperature is painless and it should not cause you any distress, beyond that associated with any new experience. The device is not power line operated; rather, the biofeedback equipment is powered by
eight C-size 1.5 V batteries. Hence, the risk of dangerous electrical faults developing is very small. Also be informed that YOU WILL NOT MISS ANY OF YOUR REHABILITATION THERAPIES WHILE PARTICIPATING IN THIS STUDY.

Benefits

The benefits of this study have to do with potentially improving future Rehabilitation treatment through (a) the development of alternative relaxation induction protocols to use with Patients who have language problems associated with a neurological condition, (b) the measurement of relaxation responses demonstrated by Patients undergoing inpatient Rehabilitation, and (c) better matching of treatment type to the needs of each individual Rehabilitation Patient.

Alternative Procedures

The relaxation procedures described above are not yet available as a formal treatment; however, standard types of relaxation therapy may be obtained through the Rehabilitation Psychology staff at Spain Rehabilitation Center.

Confidentiality

The information gathered in this research study will be kept confidential. The findings of this study may be published for scientific purposes; however, your name will never appear in the analyses or results of the study. Your name will only appear on two copies of this Informed Consent form, but not on any of the other test materials. If you agree to participate in this study, you will be assigned a subject number that cannot be matched to your Informed Consent.
Withdrawal from Study

Your participation in this study is completely voluntary. You are free to withdraw your consent and discontinue your participation in the study at any time without prejudice against future medical care that you may receive at this institution.

Costs to Subject from Participation in Research

You will not be charged for the tests and procedures that you undergo as part of this study. You will not incur any additional costs as a result of your participation in this study. You will be responsible directly or through your insurance company for all hospital costs, inpatient and outpatient, that may occur during the routine course of evaluation and treatment of your disease, regardless of your involvement in this study.

Payment for Participation in the Research

There will be no monetary compensation for participating in this study.

Injury Compensation Clause

UAB has made no provisions for monetary compensation in the event of physical injury resulting from the research, and in the event of such injury, medical treatment is provided, but it is not free of charge. If you are injured by taking part in this study, you will be financially responsible for your medical care.

Questions

If you have any questions about the research, you may contact the project director, Warren T. Jackson, M.A. at 934-4364. Mr. Jackson is a student doctoral candidate currently completing his clinical training at UAB. He is supervised by Dr. Tom Novack (934-3454) and Dr. Frank A. Brotherton (801-8250). If you have any questions about compensation, medical treatment for
research-related injuries, or your rights as a research subject, you may contact Ms. Tucker Slaughter, Patient Representative, at 934-2273. In addition, you may request to be informed about the final results of the study (see below).

**Legal Rights**

You will receive a copy of this Informed Consent form. You are not waiving any of your legal rights by signing this consent form. Your signature below indicates that you agree to participate in this research study. We thank you very much for your cooperation.

_I HAVE READ AND UNDERSTOOD THIS CONSENT AND AGREE TO PARTICIPATE IN THIS RESEARCH PROJECT._

______________________________
Signature of Subject Date

______________________________
Signature of Investigator Date

______________________________
Signature of Witness Date

Please write your name and address below if you would like to receive a copy of the final results.
Thank you very much for your participation in the REHABILITATION RELAXATION PROJECT. Now that you have completed your participation in this experiment, let me tell you a bit more about it. Clinical psychologists often use therapeutic relaxation techniques to make their patients feel better. The problem is that no one knows very much about the best way to help people in rehabilitation relax.

Chances are that not everybody finds the same things relaxing. This is especially true of people who have experienced a stroke or another type of neurological illness that affects one half of the brain more than the other. For most people, the left side of the brain mostly controls verbal abilities, such as speech and language; whereas, the right side of the brain mostly controls nonverbal abilities, such as visual imagery and depth perception.

It makes sense, then, that people who have experienced a stroke in the left side of their brain might find a nonverbal form of relaxation (like the forest walk video that you watched) most relaxing. On the other hand, people who have had a stroke in the right side of their brain might relax most when given a verbal form of relaxation (like the tape you listened to that described a walk in the forest). You just experienced both verbal and nonverbal ways of creating a relaxed feeling. The instruments that were attached to you measured your body's response to the relaxation. You also marked how relaxed you became on that vertical scale.

Right now, I don't know the final results of this study. I have to test a lot more people who are Rehabilitation patients. I will send you the results if you like. Once again, thanks for taking part in this study.
APPENDIX D:

EXPECTED LEVEL OF RELAXATION
EXPECTED LEVEL OF RELAXATION

1  Not relaxed at all  1
2
3
4  Moderately relaxed  4
5
6
7  Completely relaxed  7
APPENDIX E:
EXPECTED DIFFICULTY IN BECOMING RELAXED
EXPECTED DIFFICULTY IN BECOMING RELAXED

1  Not difficult at all 1
2
3
4  Moderately difficult 4
5
6
7  Very difficult 7
STANDARDIZED EXPERIMENTAL INSTRUCTIONS

Expected Level of Relaxation

"Look at this poster. At the top it says 'Not relaxed at all,' in the middle it says 'Moderately relaxed,' and at the bottom it says 'Completely relaxed.' To each side are numbers ranging from '1, (Not relaxed at all)' to '7, (Completely relaxed).' Please estimate how relaxed you think you will get during this procedure using any number between 1 and 7."

"Now, how relaxed do you think you will get?"

Expected Difficulty in Becoming Relaxed

"Now look at this poster. At the top it says 'Not difficult at all,' in the middle it says 'Moderately difficult,' and at the bottom it says 'Very difficult.' To each side are numbers ranging from '1, (Not difficult at all)' to '7, (Very difficult).' Please estimate how difficult it will be for you to relax during this procedure using any number between 1 and 7."

"Now, how difficult will it be for you to relax?"

Relaxation Visual Analogue Scale (R-VAS)

"Good. Look at this scale [present R-VAS]. This is a vertical line between two shaded circles. The top circle is labeled 'Very Tense.' The bottom circle is labeled 'Completely Relaxed.' Think of this line between the circles as kind of a 'stress thermometer' with the upper parts of the scale having to do with increasing tension and the lower parts of the scale having to do with increasing relaxation. Make a mark on this line to show me where you are right now between 'Very tense' and 'Completely relaxed.' Do you understand? That's right."
Treatment Preference

"Which did you like best, the tape you listened to or the video you watched? Why?"

"Which did you find to be the most relaxing? Why?"

Leisure Interests Checklist (Form B)

"I'd like to find out about your interest in free-time activities. I'm going to read a list of activities that people do for fun. Please look at this poster and decide how interested you are in each activity, when you are your normal, typical self. Decide your amount of interest in each activity: 'Very much,' 'Much,' 'A bit,' or 'Not at all.' Any questions?"

Example Orientation to a Self-Report Measure Response Poster (CES-D)

"Look at this poster. At the top it says 'Rarely or none of the time (less than 1 day).’ There is a ‘0’ next to this statement on both sides. The next statement is 'Some or little of the time (1 to 2 days).’ There is a ‘1’ next to it on both sides. The next statement is 'Occasionally or a moderate amount of the time (3 to 4 days).’ There is a ‘2’ next to it on both sides. Finally, at the bottom it says 'Most or all of the time (5 to 7 days).’ There is a ‘3’ next to it on both sides."

"I am going to read some sentences out loud to you. Think about how often you have felt this way during the past week. Then, tell me the number or point to the statement which best describes how often you felt this way during the past week."

"During the past week . . ." [read before each item].
Resting Baseline

"As you sit there, (please/once again) find a comfortable position with both feet on the floor or on the footrests of your wheelchair. Keep your eyes open, look straight ahead, and keep your body still for the next few minutes."

Verbal Relaxation Induction

"Now, (please/again) allow yourself to become relaxed while you listen to a tape describing a walk through the forest. Please keep your eyes open and look straight ahead while you listen."

Nonverbal Relaxation Induction

"Now, (please/again) allow yourself to become relaxed while you watch a video showing a walk through the forest."
APPENDIX G:
RELAXATION VISUAL ANALOGUE SCALE (R-VAS)
RELAXATION VISUAL ANALOGUE SCALE (R-VAS)

Very Tense

Completely Relaxed
APPENDIX H:
VERBAL RELAXATION INDUCTION PROTOCOL

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Scene 1
Imagine a peaceful forest, where rolling hills mix gently with the clouds. As you approach, from a distance--
--you find yourself--
Scene 2
--slowly moving along the floor of the forest, where the sun mingles with the lush vegetation and creates a mixture of colors from soft greens to brilliant golds. And as you move slowly through the patterns of sunlight gently peeking between the trees you emerge into a clearing, and feel the warmth of the sun. And as you continue to move, you once again notice the shades of green and gold as the light is reflected from the leaves of the trees.
Scene 3
And even in some areas the sun shines like a prism through the trees creating colors unique in their richness, yet ever-changing and ever-moving.
Scene 4
And as you continue on, you notice that the bark of the trees is old and weather-worn, yet part of the majesty of the trees as they reach gently to the sky, each with their own unique pattern of growth and beauty contrasting dramatically with the lush greens of the ferns on the forest floor.
Scene 5
Continuing on, you notice the shades of green mixed with the shadows and leaves in harmony with the roughness of the wood: the presence of fresh growth as evidence of continued new life.
Scene 6
And as you continue on, you notice that the quietness of your movement disturbs nothing of the beauty of this forest, whose age is the testament to the continuation of life--
--even in the older places--

Scene 7
--as the trees reach to the sky to begin again. Where the pattern of the forest floor is alive with several vivid, yet different shades of green. And as you proceed, you begin to enter the deeper forest, where the coolness reflects the richness of life, and the patterns of the leaves, the growth of the forest floor, the dampness in the shadows seem to fit together in some natural and peaceful way that goes beyond your understanding. It seems that the coolness, and the quietness mix comfortably everywhere you look. You are also aware of the presence and the heaviness of the air as the sense of age and the green-ness of new life that springs forth blend together. The quietness, the deepness, the richness of this part of the forest are the source of new life all around you.

Scene 8
And as you continue to look up, you can see the sky against the boldness of the tall, slender growth of the trees reaching up past their leaves to the air above. Like the floor of the forest, the pattern against the sky shows its own order, complex, and yet simple in its harmony.

Scene 9
And as you continue to move, you notice that the depth of the forest begins to lighten. The greens begin to be mixed with browns as if moving somewhere, continuing in yet another pattern, another variety of color and order until--
--finally--
Scene 10
--in its own time, leading to the presence of the river, the stream--

Scene 11
--where the trees and the forest crowd down to the bank in an effort to be nearer the nourishment of the water that gives them all life. And in the quietness you can notice tiny droplets of sprinkling rain--
--falling gently--

Scene 12
--on the still surface of the stream, restoring the water supply, nourishing the life of the stream as it begins and continues to nourish the forest. Life from the water to the forest, evermore.
VITA

Warren Turner Jackson, III was born in Atlanta, Georgia in 1965. He received his B.S. in Applied Psychology (with Honor) from the Georgia Institute of Technology in 1988. He then moved to Baton Rouge, Louisiana where he studied in the American Psychological Association (APA)-approved Clinical Psychology Training Program at Louisiana State University. In 1990, he received an M.A. in Psychology after defending his thesis entitled, "A Recognition Trial for the Tactual Performance Test: Analysis of Construct Validity." He obtained doctoral candidacy in 1992, upon passing the General Examination in Psychology which included a paper entitled, "Frontal Lobe Dysfunction following Traumatic Brain Injury," and successful completion of a minor sequence of coursework in Developmental Psychology (Aging). Portions of his paper on frontal lobe dysfunction will appear in the forthcoming text, Handbook of Health and Rehabilitation Psychology (in press), in a chapter entitled, "Traumatic Brain Injury." Following an APA-approved predoctoral internship in Clinical Psychology at the University of Alabama at Birmingham (UAB), he completed his doctoral dissertation and received his Ph.D. in 1994. He was awarded a two-year postdoctoral fellowship through the UAB Department of Rehabilitation Medicine to pursue advanced training in medical rehabilitation research and clinical neuropsychology (NIH National Research Service Award). He plans for an academic career in rehabilitation psychology and clinical neuropsychology.
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Warren T. Jackson, III

Major Field: Psychology

Title of Dissertation: A Comparison of Verbal and Nonverbal Relaxation Induction Techniques in Neurologically Impaired Rehabilitation Patients

Approved:

[Signatures]

Major Professor and Chairman
Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

10/25/94