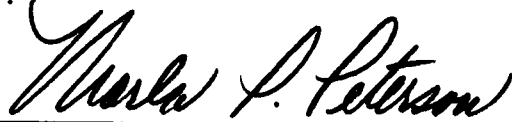


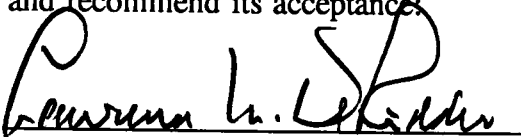
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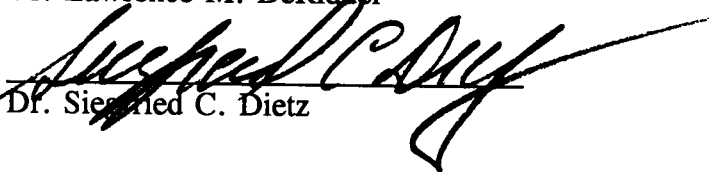


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**PHYSIOLOGICAL CORRELATES OF THERAPEUTIC RAPPORT:
AN ANALYSIS OF BRAINWAVE PATTERNS**

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Janis K. Strous

December 1992

DEDICATION

This thesis is dedicated to my mother and my children, Stacy and Stephen: Thanks for your understanding and your support. It is also dedicated to my father, who did not live long enough to see me complete this endeavor. Thanks.

ACKNOWLEDGEMENTS

This thesis has been become a reality as a result of the kind and generous assistance of many people.

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ABSTRACT

The purpose of this pilot study was to determine whether there were recognizable similarities in the electroencephalograph (EEG) patterns of a client and a counselor during times of self-reported rapport in a therapy session. Study participants (one counselor and three female senior psychology student volunteers) were connected to an EEG machine which simultaneously recorded brain wave activity for both client and counselor during an individual counseling session. Data were analyzed with a one-way analysis of variance (ANOVA) to assess each frequency band (delta, theta, alpha, and beta) for both left and right brain activity, giving eight ANOVA results for each session. Tukey's Studentized Range (HSD) was used to clarify significant finding. Results indicated general overall patterns; however, session-to-session results differed. Significant findings focused around the theta band in Session 1, the alpha band in Session 2, and the beta band in Session 3. Suggestions for further research are given.

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CHAPTER I

Introduction

Background

The art of the psychotherapeutic process is continually evolving; new theories and procedures emerge, and old ones fade away. However, no matter how short lived or enduring the approach, one process surfaces as pivotal. That process is the development and maintenance of a positive therapeutic relationship, or therapeutic rapport. For the purposes of this thesis, therapeutic rapport will be used as a generic term to describe any and all components of a positive therapeutic relationship. This definition will be further clarified in later chapters.

In Raymond Corsini's first and fourth editions of Current Psychotherapies (1973, 1989), 18 different psychotherapeutic systems were reviewed. Without exception, every system emphasized the importance and necessity of establishing and maintaining "good" therapeutic rapport between therapist and client.

Research findings concerning this phenomenon will be dealt with in greater detail in Chapter II. However, in the articles and papers reviewed for this thesis, the consensus on therapeutic rapport or the therapeutic alliance is succinctly expressed by Raimy (Goldfried, 1980):

The jugular is that complex of misconceptions that accounts for the client's problems....Since the jugular is often embedded in an emotional morass of defensive and conflicting misconceptions that may take weeks to disentangle, warmth and acceptance are the every day workhorses needed to cement the therapeutic alliance. (p. 106)

The study of therapeutic rapport has been of interest for decades, but the inherently subjective and internal nature of this phenomenon makes accurate measurement difficult at best.

Currently, the methods of measuring relationship in a therapeutic setting consist of various scales and inventories. Scofield and Yoxtheimer (1983) and Ponterotto and Furlong (1985) critically reviewed the psychometric accuracy of popular scales and inventories over 5.5- and 11-year periods, respectively, and found the psychometric rigor of these scales and inventories to be inadequate. Authors of both articles questioned the continued use of these instruments until future refinements could provide evidence of appropriate reliability and validity measures.

The validity and reliability issues could be alleviated if a more objective measure were available for analysis. Recent advances in computerized electroencephalograph (EEG) technology offer the capacity to simultaneously record the brain wave patterns of client and counselor during a session. If it was found that specific brain wave activity could be associated with therapeutic rapport, this would provide a more objective measure.

Purpose

The purpose of this study was to investigate whether a physiological correlate to a self-reported feeling of rapport can be detected in the electroencephalograph (EEG) patterns of a counselor and/or a client during a therapy session.

Problem Statement

The focus of this study was to collect and analyze the simultaneous EEG patterns of a client and a counselor during a therapy session to determine whether similarities in brain wave pattern were detectable during times of self-reported feelings of rapport. The null hypothesis (H_0) for this study was: There are no differences in similarity indices between times of client-reported rapport, times of counselor-reported rapport, or randomly chosen periods.

Assumptions

This study assumed the following:

1. Both client and counselor were honest and accurate in their self-reports of rapport with the other.
2. The experimental equipment and its implementation were sophisticated enough to detect similarities in EEG patterns if, in fact, they exist.

Limitations of the Study

This study was exploratory in nature. Clients were not randomly selected. Subject A, the counselor, was instructed to select clients from his existing practice with whom the counselor felt a high level of therapeutic rapport. This selection process, coupled with the use of only one counselor and three clients, limits the

ability to generalize findings. Any number of variables can affect the outcome of rapport, for example, the number of previous sessions between counselor and client, the content of the session, or the skill level of the therapist; however, variables that affect rapport were not the focus of this study. The state of rapport itself was the focus; therefore, variables of the nature described above were not considered.

Another limitation of the study was that during the post-session interview, the subjects found it difficult to pinpoint exactly when they felt a sense of rapport. Therefore, an arbitrary interval of five seconds was chosen as a standard index for a rapport point. This arbitrary interval may have affected the results and is discussed in greater detail in Chapters III and IV.

Definition of Terms

Alpha: The electrical activity of the brain which varies between 8 and 13 Hz.

Beta: The electrical activity of the brain which varies between 13 and 25 Hz.

Conducting Gel: Also referred to as gel, facilitates reception of the electrical impulses from the scalp.

Connection: Connection was accomplished by the subjects donning an electrode cap. Once the cap was on, the researcher injected conducting gel around the electrodes to enhance the electrode connection. An impedance check was performed to ensure good electrode contact with the scalp. If the impedance check was successful the connection was complete.

Delta: The electrical activity of the brain which varies between 0.5 and 4 Hz. Delta is primarily associated with deep sleep.

Electrode Cap: An elastic mesh cap with electrode leads connected to it. The cap fits snugly over the head bringing the electrodes into contact with the scalp. These electrodes pick up the electrical activity generated by the brain.

Electroencephalogram (EEG): A biofeedback instrument which monitors the electrical activity of the brain.

Hertz (Hz): A unit of frequency. One Hz is equal to one cycle per second.

Left Brain Activity (LB): Activity occurring in the left hemisphere of the cerebral cortex.

Left Hemisphere: The left half of the cerebral cortex. Also see left brain activity.

LENS: Learning Enhancement through Neurological Sensitization. LENS was the cadre of hardware and software programs that make up the computerized EEG equipment used in this study.

Record: The numerical recording of a subject's EEG pattern. Each record displays the averaged brain wave activity for 28 different frequencies per subject per second.

Rapport: Any and all relational aspects occurring between a client and a counselor which support and/or maintain the therapeutic alliance.

Rapport Point: The self-reported point in time at which the client or the counselor felt rapport with the other.

Right Brain Activity (RB): Activity occurring in the right hemisphere of the cerebral cortex.

Right Hemisphere: The right half of the cerebral cortex. Also see right brain activity.

RRP: This acronym stands for reported rapport.

Similarity Index: A similarity index was calculated for each brainhalf frequency band by averaging the amplitude scores in each band and then subtracting the client score from the counselor score. The absolute value of this result become the similarity index score.

Theta: The electrical activity of the brain which varies between 4 and 7 Hz.

In Chapter II, pertinent literature on therapeutic rapport, rating scales and inventories, and the EEG are reviewed.

CHAPTER II

Literature Review

Therapeutic Rapport

As was stated in Chapter I, a positive therapeutic relationship or therapeutic rapport is the "every day workhorse" used to hold the therapeutic alliance together while change takes place. For the purposes of this thesis, therapeutic rapport was defined as any and all relational aspects occurring between a client and a therapist that support and/or maintain the therapeutic alliance.

It is axiomatically understood, across all therapeutic-school-of-thought boundaries, that therapeutic rapport is foundational to the success of the therapeutic process. Raymond Corsini, in each of the four editions of Current Psychotherapies, has provided a comprehensive review of the 12 most important contemporary schools of psychotherapeutic thought.

In evaluating two of these editions (1973, 1989) , it was found, without exception, that each school emphasized the importance and necessity of developing and maintaining a "warm," "accepting," "nonjudgmental," "good," "trusting," "accurately empathetic," "authentic," "genuine," etc., relationship with the client. The adjectives used to modify "relationship" vary and change depending on the balance of cognitive, affective, and behavioral factors in the system. However, regardless of the adjective used, the importance of establishing and maintaining some

type of generic or specific therapeutic rapport between client and therapist unanimously surfaces as a critical concomitant quality of the psychotherapeutic process.

The foundational and infrastructural quality of therapeutic rapport and its positive relationship to the change process is substantially supported in the literature. In an article written for a special issue of Cognitive Therapy and Research, associate editor Marvin Goldfried (1980), asked a number of prominent therapists representing different backgrounds and theoretical orientations to comment on their observations of what they believed to be the underlying principles or clinical strategies associated with the therapeutic change process. These professionals were asked, "In what way do you see the therapist-patient/client relationship as contributing to the change process?" (p. 227). Their responses, reminiscent of Corsisi's reviews, are of particular interest for a discussion of therapeutic rapport. Table 1 summarizes the more cogent comments.

Researchers have also noted the correlation between successful therapeutic outcome and the presence of positive therapeutic rapport. In an article designed to derive a provisional list of "good moments" in the psychotherapeutic process, Mahrer and Nadler (1986) reviewed psychotherapy research literature, including all theoretical approaches, to identify what researchers chose as good moments. Good moments were defined as "...epochs of a few seconds or more wherein the client is manifesting therapeutic process, movement, improvement, progress, or change" (p. 14). Their list was designed to identify and describe good therapeutic process in a research-

Table 1

Comments on Therapeutic Rapport^a

Davison, G. C., University of Southern California	This aspect of therapy is of the utmost importance. Clients have to believe in the therapist to try new things...A relationship that is not a strong one will not encourage the client to explore alternatives. (p. 286)
Egan, G., Loyola University of Chicago	This relationship does not exist for itself but for the work that is to be done...(it) provides a relatively safe forum in which the client can face the issues of relating to others. (p. 287)
Frank, J. D., Johns Hopkins University, School of Medicine	This is the cornerstone of all psychotherapy. Without a good therapeutic relationship, any procedure will fail...a good (therapeutic) relationship provides a suitable soil for personal growth. (p. 288)
Rotter, J. B., University of Connecticut	The patient-therapist relationship is crucial to the patient's developing an expectancy that alternative behaviors will be more satisfying...the willingness of clients to...give up the hidden satisfactions of maladaptive behaviors is often dependent upon their trust of the therapist. (p. 290)

^a Goldfried, M. R. et al. (1980). Some views on effective principles of psychotherapy. *Cognitive Therapy and Research*. 4(3), 269-306.

usable language in order to open the lines of research inquiry across a broad set of therapeutic approaches.

The list of good moments that resulted contained "a good working relationship with the therapist" (p. 12) as an attractive research avenue. Components of the therapeutic relationship, identified as good moments, were described as including expressions of a high level of trust, reliance, and confidence in the therapist's helping intent and motivation; value of the client-therapist working bond; active cooperation in the search for significant material; and acceptance of responsibility for effecting personal change. In her 1978 study, "Effective Ingredients in Psychotherapy: Prediction of Outcome from Process Variables," Gomes-Schwartz found the outcome of the therapy process was most consistently predicted by the patient's positive attitude toward the therapist and the patient's commitment to work toward change.

Psychiatrists and psychologists of differing theoretical orientation, as well as untrained, "inherently helpful" individuals (professors who were frequently approached by students for personal counseling), were used in the Gomes-Schwartz (1978) study. Neither theoretical orientation nor professional status of the therapist were found to influence patient attitudes. In her conclusions, Gomes-Schwartz stated, given this finding, that one of the aims of future research should be to determine if and how positive involvement in therapy could be increased.

Truax (1966), in a study of patients receiving outpatient psychotherapy from psychiatrists offering high and low levels of therapeutic conditions (empathy, genuineness, and nonpossessive warmth), found that results confirmed the importance

of the high therapeutic conditions. Therapists providing high levels of therapeutic conditions produced a 90% patient improvement rate, but therapists providing lower levels of therapeutic conditions produced only a 50% rate of patient improvement.

However, Truax suggested caution should be used in interpreting the significance of the difference between high and low therapeutic conditions because the data came from a self-report scale filled out at the completion of therapy by the therapist. Truax stated that "...therapists high in accurate empathy and genuineness might tend to see greater improvement than do therapists who are lower on these conditions. Although there is no evidence that this is actually the case, the possibility cannot be excluded" (p. 399).

Rating Scales and Inventories

The research cited above was but a small portion of the number of studies that support the value of therapeutic rapport and its positive correlation to successful therapeutic outcome. However, attention must now focus on the issue alluded to in Truax's note of caution.

During the early 1960s and '70s, numerous scales and inventories (Truax, 1961 & 1962; Barrett-Lennard, 1962; Linden, Stone, & Shertzer, 1965; Carkhuff, 1969; Barak & LaCrosse, 1975; Ivey, 1971; Atkinson & Carskaddon, 1975) were developed to evaluate skills, abilities, and characteristics associated with therapeutic rapport and effective counselor performance. These scales and inventories attempted to measure such constructs as attractiveness, trustworthiness, empathic understanding, congruence, unconditionality, willingness to be known, client satisfaction, counseling

climate, counselor comfort, and counselor effectiveness (Ponterotto & Furlong, 1985). These constructs fall well within the definition of therapeutic rapport, and much of the research conducted on the topic during the 60s, 70s, and 80s used such measures.

In the late 70s and early 80s (Ford, 1979; Atkinson & Wampold, 1982; Heesacker & Heppner, 1983; Scofield & Yoxtheimer, 1983; Ponterotto & Furlong, 1985; Gelso & Carter, 1985) increasing focus was brought to bear on the psychometric rigor of these various measures. In an extensively researched (120 references) review, focused on the efficacy of counselors' and clinicians' training methods, Ford (1979) stated that "Clearly, training researchers must devote more attention to developing or procuring validated measures rather than continue to conduct studies that, no matter how sophisticated the methodology in other respects, are invalidated by this measurement flaw" (p. 94).

Scofield and Yoxtheimer (1983) had similar concerns. This article examined the reliability and validity associated with counselor competency measures by reviewing all studies in four journals over a 5.5-year period that included measures of counselor competencies. They identified 145 different instruments and procedures used to make 235 measurements of such traits as empathy, expertness, interpersonal behavior, and overall effectiveness. In reviewing the psychometric properties of these 235 measurements, they found that only 43% of the studies reviewed were accompanied by reliability data. Of that 43%, 81% represented instances of interrater reliability, 15% represented instances of reference to prior evidence, and 4% made claims of reliability but cited no evidence.

Information on validity measures was far more scarce; 85% of the studies reviewed made no references to validity. Of the 15% that did, 11% were citations of previous validity research, 3% claimed various forms of validity but offered no evidence, 0.4% established face validity by agreement of expert judges, and 0.4% offered measures of concurrent validity (the remaining 0.2% were unaccounted for).

Ponterotto and Furlong (1985) extended Scofield and Yoxtheimer's work by critically examining the validity, reliability, and pragmatic utility of six of the more commonly used counselor rating scales as cited over an 11-year period across three counseling journals. A total of 152 studies were reviewed, and the conclusions supported Scofield and Yoxtheimer's findings. Several concerns were brought forth in this article, one being that "many rating scales have been developed solely on the basis of face validity" (p. 597); that is, if "it looked appropriate and had been used reliably in the past, it could be used to measure counselor competency with much the same confidence as when using a ruler to measure length." (Scofield & Yoxtheimer, 1983, p. 418). Research measures with sound psychometric properties must offer an empirical basis for confidence in the resulting data. Face validity is not a sound psychometric measure (Aiken, 1979; Ford, 1979). When the rigor of research methodology is weak, the utility of the findings is severely limited.

A second consideration noted in both Ponterotto and Furlong, and Scofield and Yoxtheimer was that, in most of the studies reviewed, researchers supported the use of their respective scales and/or inventories by citing validity or reliability measures from prior research. This practice, referred to as generalization, is a common and

legitimate approach provided the instrument is used in the same way as in the cited validity/reliability study, the demand characteristics are similar, and the assesseees and assessors come from the same populations (Scofield & Yoxtheimer, 1983, p. 416).

Huck, Cormier, and Bounds (1979), in discussing when the results of an experiment can be generalized, describe 6 possible sources of variance to consider when assessing internal validity and 11 possible sources of variance to consider when assessing external validity. These variables, when left uncontrolled, produce confounding effects that skew the data. Strict standards must be met for generalization to be appropriate. Scofield and Yoxtheimer stated that what they found to be the norm with counselor competency assessment instruments was "a far cry" (p. 416) from meeting strict standards. Ponterotto and Furlong stated that, "In most of the studies reviewed, the validity generalizations were inappropriate" (p. 611).

A third issue of concern was the use of interrater reliability as a support of instrument reliability. Interrater reliability does offer a degree of certainty to the researcher that observed variance between the conditions under study is caused by something other than fluctuations in interrater agreement. However, it offers no information about validity of the construct being observed or the stability of the performance being rated.

Performance stability will be examined first. The therapeutic interview is a highly dynamic interaction between a client and a counselor. The assumption of reliability data based on interrater consistency (even if the construct under study has a meticulous operational definition) is that the "counselor behavior being rated is a

representative sample of the clinician's typical performance... However, without repeated observations of the same people across situations... this is an unproven assumption" (Scofield & Yoxtheimer, 1983, p. 416).

Stability of performance offers an entire avenue of research possibilities as do the numerous issues concerning rater orientation and rater skill level (consumer vs. unskilled vs. expert observers) (see Jacobs & Williams, 1983; Scofield & Yoxtheimer, 1983; Gurman, 1973; Mintz & Luborsky, 1971). These issues will not be considered in this thesis. However, at this point in our discussion certain questions beg to be asked. How much rapport is enough? Exactly what is the observer observing? How is therapeutic rapport operationally defined? Can such a dynamic process be defined in operational terms?

This brings us to the essence of the problem: construct validity. Aiken (1979) defines construct validity as the extent to which the scores on a test designed to measure a certain trait are related to measures of behavior in situations where the trait is thought to be an important variable. For measurement to be possible we must be able to describe (operationally define) the phenomenon in terms of measurable activity (observable behavior, action, etc.). This means that, when a construct is defined in operational terms, the exact steps or operations whereby cause leads to effect and methods lead to results are capable of being reproduced exactly from one experiment to the next (Thorne, 1973).

There is considerable agreement (Gelso & Carter, 1985; Jacobs & Williams, 1983; Ford, 1979) that current scales and inventories do not meet the operational standards described above:

...nor has empirical evidence yet been reported to conclusively demonstrate that any such rating scale is validly related to any specific therapist behaviors, to the client's perception of the therapist's effectiveness, or to any other validated measure of therapist performance. This limitation applies even to the most frequently utilized and best researched rating scales.... (Ford, 1979, p. 92)

Carl Rogers' (1957) attempt at an "if-then" hypothesis was set forth in his theoretical proposition that, given the therapeutic relationship, if the therapist is (a) congruent with the client, (b) experiences unconditional positive regard for and empathetic understanding of the client, and (c) endeavors to communicate this experience to the client, if this communication is to a minimal degree achieved then no other conditions are necessary for constructive personality change to occur in the client. Rogers' "necessary and sufficient" conditions generated more than two decades of further theory development and research — testimony to its import. Most of the studies cited above are based in Rogerian theory. However, Parloff, Waskow, and Wolfe (1978) state that researchers are finding that:

Evidence for the hypothesis that judged accurate empathy, warmth, and genuineness of the therapist to represent the "necessary and sufficient" conditions of effective treatment has become increasingly clouded. Many investigators concede that more complex relationships exist among therapist, patient and techniques. (p. 273)

Gelso and Carter (1985) state that, in spite of the general agreement that the therapeutic relationship is important, sound theoretical and empirical work on relationship factors is virtually at a standstill in counseling psychology.

Is the recent reduction in research on the topic purely the result of inadequate construct definition or are there other limiting factors? An interesting premise argued by Jacobs and Williams (1983) proposes that the background doctrines of operationism and empiricism are themselves the main obstacle to meaningful study. Jacobs and Williams analyzes how current research methods hopelessly distort the subject area; they also question whether a concept such as empathetic understanding can be explored fruitfully within these confines.

Numerous authors (Horvath & Greenberg, 1989; Orlinsky & Howard, 1986; Garfield & Bergin, 1986; Gelso & Carter, 1985; Corcoran, 1981; Schuster, 1979; Hackney, 1978; Lesh, 1970) would agree with Jacobs and Williams that current measurement techniques do not adequately capture the experiential essence of rapport in the therapeutic relationship. Even Truax and Carkhuff (1967), authors of one of the "most frequently utilized... and best researched rating scales" (Ford, 1979),

acknowledged that their operational definition of accurate empathy relies heavily on effective communication. Communication taps only the secondary component of empathy. As stated above, Rogers' (1957) description of the therapeutic relationship was a twofold process: (a) the counselor's experience of sensing "the client's private world as if it were [his/her] own, but without ever losing the 'as if' quality..." (p. 99), and (b) the counselor's endeavor to communicate this experience to the client.

Hackney (1978) states that:

Both researchers and trainers should remind themselves that empathy is not a communication process. It is not words and statements. These are (we hope) the manifestations of empathy, and we can't be altogether sure that they are that...[T]he use of Likert scales and other communication strategies to demonstrate the 'product' (levels of empathy) is like using courting techniques to measure the level of love between two people. (p. 38)

Corcoran (1981) suggests that the experience of empathy in the therapeutic relationship is separate from the communication of that experience. He states that empathy is an inner, subjective experience — the sensitivity of the therapist to the client's felt meaning or experience. He goes on to suggest that empathy is not an intellectual-analytic process, but an affective process, a phenomenon of the mind-

body. Schuster (1979) describes empathy as a direct intuitive moment-to-moment experiential understanding of the client.

Gendlin's (1978) theory of the phenomenology of experience describes two separate levels of experience that are strikingly similar to Rogers' description of the counselor's process. The first level is the internal body experience of feeling; this is the "felt level" of experience. The second level of experience is the symbolic level; here the "felt level" is conceptualized and thus able to be verbalized.

Current methods of examining therapeutic rapport focus almost exclusively on communication. These methods do not assess the first step in the counselor's experience of therapeutic rapport, the "felt level" of experience. If a psychological fluctuation or measure could be associated with the first step, the "body/mind" or "felt level" experience of rapport, perhaps mapping a clearer picture of this quality may be possible.

Recent advances in computerized EEG technology offer an opportunity to study the real-time, simultaneous shifts in counselor and client brain wave activity during a counseling session. If specific shifts can be associated with this more internal experience of rapport, then EEG technology can offer a physiological basis for the study of rapport.

The Electroencephalograph

The human brain emits a continual output of complex and minute bioelectrical signals. The EEG is an instrument designed to record these signals.

Shortly after the turn of the century, Dr. Hans Berger, a psychiatrist, became fascinated with the functioning of the brain. Building on the work of Canton, who in 1875 first recorded electrical activity from the exposed brains of rabbits, Berger was able to demonstrate a low-amplitude rhythmic waveform with a frequency of about 10 cycles per second. This waveform was recorded from the occipital area while the subject was resting with eyes closed.

Berger named this waveform alpha to distinguish it from other, faster (beta) activity. He also discovered that alpha disappeared with mental effort, with loud noises, and if the eyes were opened. Determined to find a physiological basis for psychiatric illness, Berger studied this phenomena for nearly 30 years, publishing numerous papers between 1929 and 1938. In these papers he described such important phenomena as the abnormal paroxysmal brain activity seen during epileptic seizures (Binnie, 1982).

Berger's work was generally dismissed, partly because of the primitive nature of his recording equipment and partly because of the belief that the waves he discovered were not cerebral in origin. It was not until 1934, when Adrian and Matthews confirmed his work using a far more sophisticated amplification system, that Berger received the credit he deserved for having laid the foundation of human electroencephalography (Empson, 1986).

Advances in computer and data processing technology have greatly simplified and expanded the use of the EEG. A review of current research using EEG technology reveals a multitude of highly specialized and esoteric studies.

An extended review of existing EEG literature revealed no meta-analyses on any associated EEG topic. However, in the more traditional areas of EEG research, a number of reviews were available. These various reviews considered the relationship of brain wave patterns to brain injuries, states of consciousness including sleep, dreaming, hypnagogic (entering sleep) , hypnopompic (coming out of sleep), hypnotic, meditative, and higher states of consciousness; and psychiatric illnesses such as schizophrenia, borderline personalities, affective disorders, panic disorders, depression, late-life psychosis, and alcoholism. The EEG has also been used as a biofeedback tool in the study and remediation of academic achievement, intelligence, attention deficit disorders, the hyperactive and learning disabled, and autistic disorders.

There was general agreement across disciplines (psychiatric, medical, psychological, educational, etc.) on what the basic brain wave frequency bands are and when the rhythms in each band are most active and inactive. Perhaps the most succinct accounting of these principles appeared in a book by Geoffry Blundell (1984), *The Meaning Of EEG: A study in depth of brain wave-patterns and their meaning:*

Brain wave patterns are measured in cycles per second, called hertz.

Beta is the fastest at 13-30Hz., followed by alpha at 8-13Hz., and theta at 4-7Hz., and the slowest rhythm is delta at 0.5-4Hz. There are certain points where clearly defined states of consciousness and brain

waves always coincide: delta is present in deep dreamless sleep, theta accompanies dreaming sleep, theta and alpha appear in hypnagogic and hypnopompic imagery as the person is just coming out of or going into sleep, and beta is there when the person is wide awake and doing something. Often, however, all four frequencies are present when the person is awake and doing, or not doing, anything, and this is when we should remember how little we have to go on and yet how far it can lead us if we allow our original building blocks to become metaphors of states of mind. (p. 38)

Information on the four frequency bands appearing in the various research studies and literature sources reviewed for this topic (Green & Green, 1977; Calloway, 1975; Yates, 1980; Matthews, 1981; Binnie, 1982; Cade & Coxhead, 1983; Vilenskaya, 1983; Blundell, 1984; Kassel, 1986; Empson, 1986) was synthesized. The following provides a summary of that material:

Beta: Beta, 13-30Hz, is the normal waking EEG rhythm. A person showing high levels of output in beta frequency bands is usually occupied in seeking information from the external environment, computing, arranging, organizing, sorting out. Beta is characterized by active thinking and active attention addressed toward problem solving/survival. Beta increases with stress and anxiety and decreases with muscular activity. A person who is anxious,

thinking intensely, or trying to solve a specific problem will produce continual beta even with eyes closed.

Alpha: Alpha, 8-13Hz, is the most prominent activity in the EEG of healthy adults. Alpha can be experienced as a feeling of relaxation, slowing down (as compared to beta) or a loosening of focus on outer events. However, alpha has little meaning unless associated rhythms (beta, theta, delta) are also known. Alpha alone denotes an empty mind rather than a relaxed one, a mindless state rather than a passive one. Relaxed detached awareness, feelings of wellbeing, and inwardly directed attention require alpha and the simultaneous presence of beta and/or theta (Cade & Coxhead 1983). Alpha generally appears when the eyes are closed; this is the easiest way to shift attention away from the outer world. If you notice someone's "eyes glaze while you are speaking, you can assume that person has slipped into alpha and no longer hears what you are saying, though they may hear the sound of your voice" (Green & Green, 1977).

Theta: Frequencies in this band, 4-7Hz, are rarely present on their own except during the dream state. Theta appears at the conscious/unconscious border and has been associated with access to unconscious material, creative inspiration, reverie, and deep meditation. All these states, however, are found in association with other frequencies in the alpha and beta bands. Hypnagogic

and hypnopompic images, bright sharp images that appear to pop up from nowhere, are associated with a theta-alpha combination. These elusive images (projections of impulses from unconscious sources, Green & Green, 1977, p. 120), seem to come out of nowhere in accordance with a law of the self as yet unknown to the conscious personality (Blundell, 1984, p. 33).

Delta: The long slow frequencies in the delta band range from 0.5 to 4Hz. When delta is produced in any significant amount it is associated sleep or otherwise unconscious states. There is very little information available on this frequency, perhaps because most researchers do not record it, thinking it is associated mainly with sleep states (Yates, 1980). However, in more esoteric areas of study, researchers report large flares of delta on its own, occurring in episodes of paranormal experiences and in dowsers during dowsing (Vilenskaya, 1983; Blundell, 1984).

Most of what is known and accepted about brain wave activity has been gained by simultaneously observing a "state" of being (e.g., physiological, psychiatric, psychological, emotional, consciousness) while recording the associated brain wave activity. Given a large enough number of observations, certain patterns of brain wave activity can be predicted, given a specific "state". Very little of this type of basic research has been done on the "state" of rapport. Most of the research reviewed for this thesis that fell within the discipline of psychology involved biofeedback studies.

Biofeedback is short for "biological feedback control." This procedure uses an instrument to monitor a bodily function that, although believed involuntary, can nevertheless, through the use of immediate feedback signals, be adjusted or changed by a person.

Although few researchers have used the EEG to study brain wave patterns during interpersonal or intrapersonal states of rapport, two research studies and two literature sources, peripherally associated to this thesis topic were found. In a pilot study on brain wave synchrony, Johnston and Millay (1983) used biofeedback to train couples who were "already in a state of rapport" (long-time friends or marriage partners) to increase their alpha synchrony. In this study synchrony referred to a kind of "resonance" between two alpha band EEG frequencies where both signals are at nearly the same frequency, with the electrical oscillations moving nearly in unison. During several tests sessions, each team, at the request of researchers, attempted to communicate telepathically.

In a previous study, Millay reported a statistically significant correlation in couples between alpha band synchronization and free response telepathy scores. It was the researcher's intent to observe if specific EEG patterns could be tagged during successful attempts in the process of "choosing" a telepathic response. Subjects reported that during training sessions they would notice some kind of inner change that was associated with synchrony and then try to "stay with" this change. Findings indicated that, when a couple was able to do this, a consistent elevation of synchronous alpha would result. Once learned, however, these strategies were not

always consistent across sessions. Subjects stated that synchrony intervals were characterized by a sense of "allowing" rather than "doing" and were associated with a clear and continuous focus on some "inner quality." Subjects also noticed that mental or physical discomfort, stress, and distractions were generally associated with lower synchronicity scores.

Johnston and Millay were surprised to find the EEG synchronicity scores were much lower during the telepathic trials than during biofeedback sessions. Strong asymmetries in individual subject's left and right brain hemispheres were also noted during telepathy trials. Their conclusions were that alpha band synchronicity scores indicated some relevant "general trait" brought to the telepathy process, rather than a tag of specific aspects of the telepathy process itself.

In an interesting study by Don (1977), the left brain EEG activity was monitored while subjects were engaged in a psychotherapeutic process called "focusing." The process of focusing will be briefly examined before reviewing Don's findings.

Focusing, developed by Gendlin (1978), involves:

...becoming quiet with one's self, looking within in a receptive and nonjudgmental manner, and attending to the "felt-sense" of one's state of being. This process leads to a "felt shift," a psychophysical release and opening up which is the necessary precursor of insight. (Don 1977, p. 147)

In this quote, the phrase "one's state of being" is what Gendlin calls the "felt level" of experience; an internal body experience of feeling (this concept was briefly discussed above p. 16-17). Gendlin describes focusing in the following manner: "Usually one thinks 'from the outside in, at oneself.' In 'focusing,' one shifts to 'from the inside out, from oneself'. Rather than trying to say or think what the trouble is, what the answer is, one must keep quiet and listen" (Don 1977, p. 148). This process, when successful, leads to a "felt-shift" or the psychophysical release and opening up that lead to insight. Insight is the bridge to the second level of experience, or the symbolic level. As we stated above, in Gendlin's second level of experience the "felt level" is conceptualized and thus can be verbalized.

Returning now to Don's study, five individuals (three men and two women) who had been instructed in focusing as part of their graduate studies or involvement in psychotherapy training and who claimed to have had success with the method were chosen as subjects for this study. Subject's left brain EEG patterns and verbal reports were synchronously recorded during sessions. While reviewing audio tapes of their sessions, subjects were asked to select moments of unusual insight and psychological movement (a "felt shift") and moments when they experienced the least amount of psychological movement (a "negative shift"). During one session, Subject 2 "slipped into an altered state of awareness" (Don, 1977, p. 159); the EEG patterns associated with this occurrence was also assessed. Results indicated that subjects EEG patterns associated with felt shifts, negative shifts, altered states, and typical frequency spectrums for a resting EEG exhibited characteristically different patterns. In this

study, amplitude was the distinguishing feature. (Amplitude is to EEG frequencies what volume is to sound.)

Characteristically, a felt-shift pattern exhibited higher amplitudes in alpha, theta, and delta frequencies than the resting EEG pattern. A negative shift exhibited lower amplitudes of these three frequencies as compared to the resting EEG. In all three patterns (felt shift, negative shift, and resting EEG) the differences among the frequency bands remained constant, with alpha amplitudes approximately 100% higher than theta and 200% higher than delta amplitudes. During the altered state, all three frequencies exhibited very high amplitudes. However, during this state, amplitudes for theta and delta were 15% higher than that of alpha. Beta frequencies were not reported in Don's study. Figure 1 presents simplified versions of graphs appearing in Don's study.

Cade and Coxhead (1983) and Blundell (1984) also reported high alpha amplitudes with related lower amplitudes of beta and theta associated with healing experiences. Green and Green (1977) reported the presence of this same triad during episodes of insight.

Blundell, recounting Cade's work, stated that by combining the information gathered in over 34,000 pupil hours of recorded classroom observation with the studies of healers and parapsychological phenomena conducted for the College of Psychic Studies and the Survival Research Trust, Cade found the presence of a frequency triad consisting of a continuous high amplitude alpha wave and two lower amplitude side bands in the theta and beta ranges. Cade noticed the presence of this

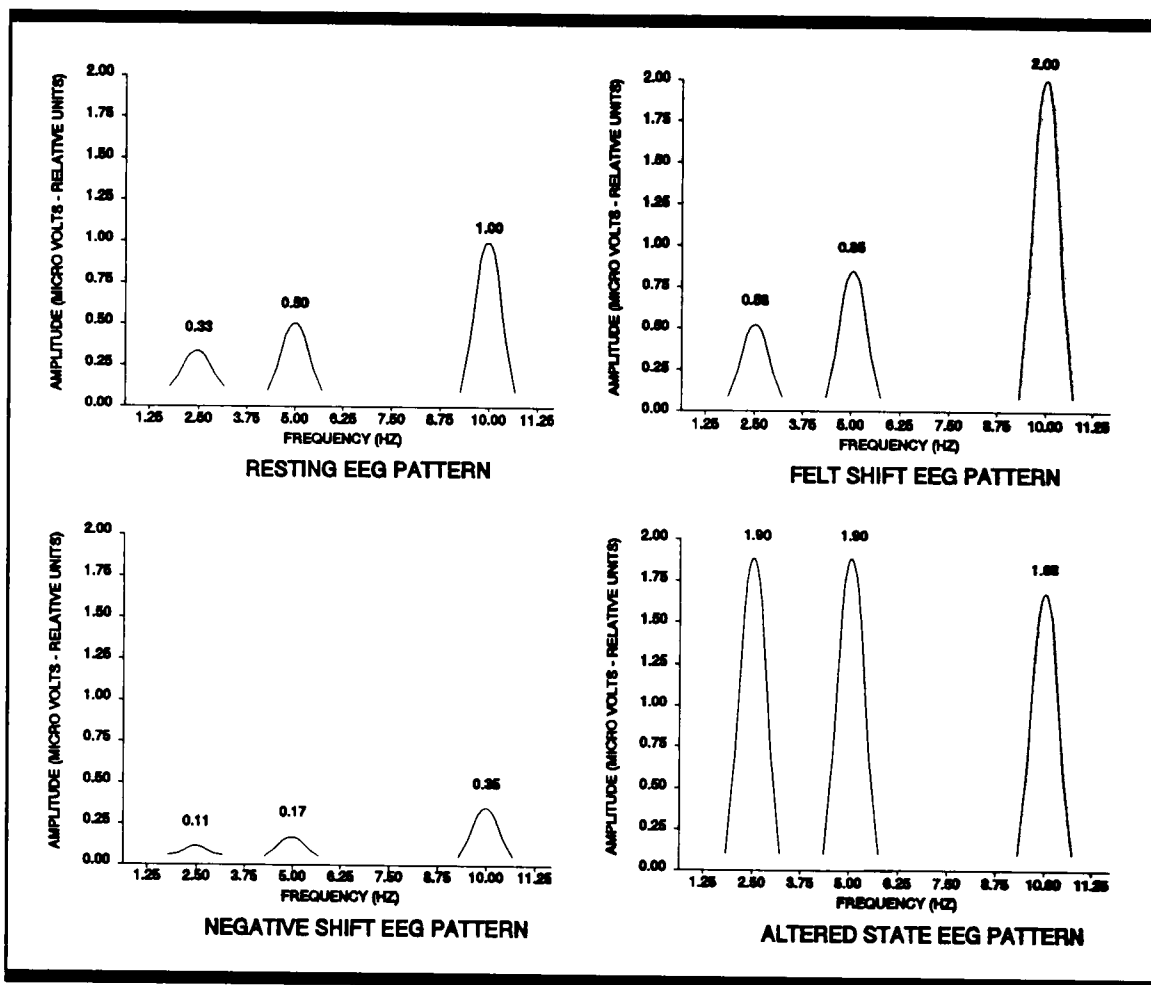


Figure 1. Frequency spectrums for resting, felt shift, negative shift, and altered state EEG patterns. Adapted from Don N.S., 1977. The transformation of conscious experience and its EEG correlates. *The Journal of Altered States of Consciousness*. 3(2), 1977-78.

triad during studies of hands on healers, first appearing in the healer and, at varying times afterward, the patient would exhibit the same frequency triad pattern. The pattern was invariably bilaterally symmetrical, even though the normal pattern of patient and healer was predominantly unilateral. Cade and Coxhead (1983) describe one session in particular where healing took place only after the client exhibited the bilateral "fifth-state" of consciousness pattern, the same pattern the healer displayed.

There are striking similarities in the Cade and Coxhead description of a "fifth-state" pattern and Don's felt shift patterns. Both patterns exhibit alpha amplitude being almost twice that of theta. Cade and Coxhead's triad contains beta rather than delta with beta attenuation just slightly lower than theta. Extrapolating from diagrams contained in the article, delta levels in the fifth-state pattern would correspond to delta levels in Don's study, being roughly one-third of alpha levels.

The differences in these patterns are: (a) Cade and Coxhead do not report specific frequency attenuation levels in that their interest is in bilateral hemispheric symmetry of the patterns; (b) however, Cade and Coxhead report frequency levels for both halves of the brain. Don's study reported only left brain activity; and (c) The Cade and Coxhead triad is concerned with beta, alpha, and theta frequencies, although information on delta frequencies is provided. Don offers no information on the frequencies outside the alpha, theta, delta triad.

During a conference for physicists, mathematicians, and engineers, held by the Central Scientific Organization of India, Green and Green (1977) connected a physicist to an EEG machine. Within two minutes, the physicist produced an alpha,

theta, beta triad. Green questioned the physicist; the following are Green's comments:

He said that he had meditated most of his life and that the state that he had just demonstrated was of special importance to him....that particular state was one that he had used to solve his doctoral research problem in physics....He said that throughout his professional life, whenever he was stuck on a problem, he would put himself in this state and examine the images. He described almost word for word the procedure that I, too, had developed for solving problems.
(p. 255-256)

We can only wonder if this frequency triad had the same characteristics as the pattern described by Don. Certainly the psychological states of the individuals experiencing it were comparable, inward focus with insight as a result. Similarly, this frequency triad is the same triad reported by Cade, but Cade offer no subjective information on the patient or the healer, and Green and Green offered no numerical information on the frequency pattern.

We begin to see that all four sources (Johnston & Millay, 1983; Don, 1977; Cade & Coxhead, 1983; and Green & Green, 1977) report very interesting and peripherally similar results; yet, no generalizations can be made due to difference in the methodology of data collection and reporting: Johnston and Millay focus on alpha frequencies to the exclusion of all other frequencies; Don reports only left brain

activity; Cade & Coxhead, in their discussions of symmetry, report only relative amplitudes for the various frequencies; and Green & Green mention a frequency triad with no information as to brain half, symmetry, or amplitude.

Still, as different as these studies are, when held up to the light of our original discussion of the four "building blocks" (beta, alpha, theta, and delta), the similarities between what the subjects are experiencing subjectively and the related brain wave patterns are easily observable. Perhaps Blundell's statement "there are certain points where clearly defined states of consciousness and brain wave activity always coincide" (p. 38) may not be so far from the truth.

In summary, although the importance of rapport in the therapeutic process has been documented in the literature for decades, researchers are still in search of a measure that will allow accurate and objective assessment of therapeutic rapport. The various scales and inventories constructed to measure and study rapport are currently under fire for less-than-rigorous attention to validity and reliability issues. The apparent lack of an inherently objective measure in this field of research lead to the examination of EEG technology as a possible answer to this problem.

This pilot study, exploratory in nature, analyzes the simultaneous EEG patterns of a client and a counselor during a therapy session to determine whether similarities in brain wave patterns were detectable during times of self-reported rapport. The study was designed to answer the following question: Are there recognizable similarities in the respective EEG patterns of a client and a counselor during times of self-reported rapport during a therapy session?

A description of the methods, equipment, procedures, and statistical design used for this study are discussed in Chapter III.

CHAPTER III

Methods

This chapter describes the research subjects; the EEG equipment; various software programs developed to collect, organize, and display the EEG data; the auxiliary equipment; the procedures; and the statistical design used in this study.

Research Subjects

Permission (approval number CRP#: 2995 B) was received from the University of Tennessee Committee on Research Participation to use humans as the subjects of this study. Subjects participating in this study included a counselor certified to practice in the state of Tennessee and three of his clients. The counselor, an associate professor of Psychology in a private liberal arts college located in the southeastern United States, was chosen because of his therapeutic skill and his understanding of and familiarity with the specific EEG equipment employed in this study.

This counselor (Subject A_i) was briefed on the research project's intent and was requested to select clients (Subject B_i) from his existing practice with whom he felt a high level of therapeutic rapport. He was to enlist the volunteer participation of prospective participants in the following manner:

"I am assisting a University of Tennessee Masters student in a research project. This project involves a client and a counselor being connected to a computerized EEG during a therapy session. The EEG will record both client and counselor brain wave activity. The purpose of the research is to study EEG patterns associated with the therapeutic process. The session will also be video taped. At the completion of the session, the researcher will review the video and associated EEG readings with both the client and the counselor individually. Any questions either participant may want to ask will be answered during this review session."

All three B subjects were female seniors enrolled at the private liberal arts college where the counselor was employed. Their ages were 21, 22, and 30. Private sessions were scheduled with each subject. To maintain confidentiality, specific content discussed in the sessions was not reviewed in this study. General topics of discussion included family, significant-other relationships and difficulties experienced in meeting the economic demand of a bachelor's degree.

Equipment

The EEG monitoring equipment used in this study was the LENS (Learning Enhancement through Neurological Sensitization). The LENS is capable of simultaneously monitoring, recording, and displaying the brain wave output of both the left and right cerebral hemispheres of two subjects.

The LENS uses electrodes in contact with the scalp to pick up the voltages generated by the brain. A standard medical electrode cap is used to position the electrodes in close contact with the scalp at positions O1 and O2 (occipital) and Fz (frontal) and A1 and A2 (ear lobes) of the 10-20 International Electrode Placement System (see Yates, 1980, for further discussion of this system). The cap is constructed from soft elastic mesh material and fits snugly over the head, fastening under the chin. Small, donut-shaped fittings that attach the electrode leads to the cap protrude from the inside of the cap, bringing the three cap electrodes into snug contact with the back of the head (2 electrodes) and the forehead (1 electrode). A standard medical conducting gel is injected through the "donut-hole" in the cap electrode to facilitate a good connection.

Electrodes are also attached to the left and right ear lobes. These electrodes resemble "clip" earrings, with a small pocket for conducting gel. Electrode lead wires, approximately five feet long, connect to a single coupling that can be plugged into the LENS hardware box. The LENS hardware box contains impedance testers and an amplifier. A row of buttons with corresponding light-emitting diodes (LED) is located on the outside of the box. When a button is depressed the related LED will glow red if the respective electrode connection is good (low impedance). If the LED does not glow, the connection is faulty (high impedance). Conducting gel is added to the respective electrode connection until the LED indicates an effective contact.

As stated above, the electrodes pick up the voltages generated by the brain. These signals, after being amplified, are sent via ribbon cable to a standard IBM

compatible PC loaded with the LENS basic software program. The software program sends the amplified signals to an analog-to-digital converter (ADC). When the signals have been digitized, the data can be treated by the computer as a series of numbers, and subsequent analyses are entirely on a numerical basis.

When the analog to digital conversion is complete, the data are then sent through fast Fourier transform (FFT), an algorithmic procedure which gives an approximation of Fourier analysis. FFT allows the quantification of data within particular frequency bands (for instance, the alpha band, between 8-11 Hz). This step provides the raw data for the LENS graphics and the off-line detailed data analysis program.

LENS Data Conversion Software Programs

The software programs used in this study were the LENS basic graphics program (LENS-BG) and an off-line detailed data analysis program (LENS-DA).

LENS-BG: This software package runs the visual display on the computer monitor. It displays the brain wave output of both left and right hemispheres of the brain simultaneously for Subject A and Subject B. The computer screen is split, with EEG data for Subject 1 appearing at the top of the screen and data for Subject 2 displayed at the bottom. The display for each Subject consists of 14 frequency rows labeled top to bottom; 38Hz, 30Hz, 24Hz, 19Hz, 15Hz (beta range frequencies); 12.5HZ, 10.5Hz, 9Hz, 7.5Hz (alpha range frequencies); 6Hz, 4.5Hz, 2.75Hz (theta range frequencies); and 1.5HZ, and 0.75Hz (delta range frequencies). Each frequency row is divided in the center. To the left of center, left hemisphere EEG

patterns are displayed, while right hemisphere EEG patterns are displayed to the right. The amplitude of a signal is identified by colored dots moving away from center. Movement of the colored dots along a frequency row away from the center to the left, shows the amplitude of a left hemisphere signal, and from the center to the right, a right hemisphere response. The greater the amplitude the farther from center the dots will flow. Each row represents the output of left and right hemisphere activity for one frequency.

The hardware and software programs described above store and average the EEG data for display. Each display is a snapshot that represents approximately one second in elapsed time. This snapshot is called a record. At the bottom of the screen real time and elapsed time are shown. The elapsed time monitor can be set for any period up to 60 minutes.

LENS-DA: This program provides a graphic and numerical hardcopy readout for each record of EEG activity. Figure 2 is an example of rapport point B₁6 (the notation system is described below) from the first research session. EEG Records are numbered sequentially with the record number appearing in the top left hand corner, followed by the date and time of the recording (record #667, 08/05, 17:49:33.29). The subject and brain half are identified; for example, Subj A Left is the graphic representation of the counselor left brain activity for this rapport point. Rows, numbered 1-14, represent the frequencies 0.75Hz through 38Hz respectively. Amplitude for the various frequencies is represented by the number of asterisks appearing in that row. Beneath these are the numerical frequency readouts for each

Record #677 08/05 17:49:33.29

Hz		Subj A Left				Subj B Left									
0.75	1	*									*			1	
1.5	2	**									*			2	
2.75	3	*									**			3	
4.5	4	****									**			4	
6.0	5	**									****			5	
7.5	6	*									**			6	
9.0	7	*									***			7	
10.5	8	*									*			8	
12.5	9	**									*****			9	
15.0	10	*									*			10	
19.0	11	*****									*****			11	
24.0	12	*									*****			12	
30.0	13	*									*****			13	
38.0	14	*									*****			14	

Hz		Subj A Right				Subj B Right									
0.75	1	*									**			1	
1.5	2	*									***			2	
2.75	3	*									****			3	
4.5	4	**									*****			4	
6.0	5	*									***			5	
7.5	6	****									*****			6	
9.0	7	**									****			7	
10.5	8	*									*****			8	
12.5	9	**									*****			9	
15.0	10	*									*****			10	
19.0	11	*****									*****			11	
24.0	12	**									*****			12	
30.0	13	*									*****			13	
38.0	14	***									*****			14	

	Delta		Theta			Alpha				Beta				
AL:	1	2	1	4	2	1	1	1	2	1	8	1	1	1
BL:	1	1	2	2	4	2	3	1	7	1	19	7	12	5
LDiff:	0	1	-1	2	-2	-1	-2	0	-5	0	-11	-6	-11	-4
AR:	1	1	1	2	1	4	2	1	2	1	8	2	1	3
BR:	2	3	4	5	3	9	4	6	30	14	23	8	11	11
RDiff:	-1	-2	-3	-3	-2	-5	-2	-5	-28	-13	-15	-6	-10	-8

Figure 2. Hardcopy Readout of Rapport Point B₁₆

subject and both brain halves. The graphic representation is based on this numerical data. The LDiff (left brain differences) was calculated by subtracting client amplitude from counselor amplitude.

Auxiliary Equipment

A standard VHS video camera was used to record counseling sessions. A clock displaying real time (hours, minutes, and seconds) was put in view of the video screen and synchronized with the LENS-BG real-time monitor. To confirm synchronization throughout the session, real time synchronization of the visible wall clock and the computer clock was checked right before and immediately after a session.

Procedures

The counselor, with the client's consent, scheduled a session for the research to take place. There were three research sessions, one per client. During a session, both counselor and client were "connected" to the LENS. Before the researcher connected the client and the counselor to the EEG equipment, the client was asked to sign the Informed Consent form (Appendix A). Connection to the EEG equipment was accomplished by both subjects donning an electrode cap, after which, the researcher injected the conducting gel and performed the impedance check to ensure good electrode contact with the scalp and ears. When the connection was complete the client was given a brief opportunity to watch the LENS monitor as it displayed both her own and the counselor's oscillating left and right brain EEG patterns.

Subjects were not able to view the monitor during the counseling session. The researcher then stated:

"The LENS will record and store your brain wave activity second by second. We will be using this data to study EEG patterns associated with the therapy process. As you can see this session will also be videotaped. At the completion of the session, I will review the videotape with both you and the counselor individually. Any questions you may want to ask will be answered during this review session. You have the right to discontinue participation at any point, if you so desire."

Directly following the session, individual interviews were held with the counselor and with each client. During these interviews, subjects reviewed the videotape of their session. During this viewing, each subject was asked to identify specific points in time when they felt a sense of rapport with the other; rapport was defined as "a close understanding relationship, agreement, or harmony."

When a subject reported feeling a sense of rapport, the time (minutes and seconds) was marked. This time marker, or "rapport point," was later matched to its corresponding LENS-DA record. For example, if Subject B stated that at 1:23:47 pm, she was feeling a sense of rapport, the LENS-DA record corresponding to 1:23:47 pm was retrieved and labeled as a rapport point. Subscripts were added to the labeling system to distinguish sessions. For example B₁8 and A₃4 translated are

client, first session eighth rapport point, and counselor third session fourth rapport point, respectively.

Statistical Design

Originally the purpose of this study was to determine through observation if there were characteristic similarities in brain half patterns during times of reported rapport. The original intent was difficult to meet because at present there are no accepted criteria for similarity. In the absence of an accepted quantitative definition of similarity, the question then became relative: Is there a greater degree of similarity in brain wave patterns between counselor and client during times of rapport than at other times? In such relative comparisons, the application of statistical methods is used to determine whether apparent patterns are merely chance happenings or can be relied upon as demonstrating characteristics of rapport.

To apply statistical methods, it was necessary to choose a quantitative measure that would show comparative brain wave activity between counselor and client. It was decided to call this measure a similarity index. The procedure employed to obtain the similarity index will be discussed below, along with the methods employed to analyze it.

There were three independent variables in this study: the counselor, Subject A_i ; the client, Subject B_i ; and the control, C_i , where the subscript i can take on values 1, 2, or 3 to denote the session being analyzed. The number of counselor and client observations was determined by the number of rapport points experienced during the respective counseling sessions. Observations used for the control group

were randomly chosen from respective sessions (excluding rapport points) using a random numbers table (Mueller, Schuessler, & Costner, 1970). In Session 1 there were 29 observations; 10 counselor rapport points, 9 client rapport points, and 10 random observations. In Session 2, there were 33 observations; 12 counselor rapport points, 11 client rapport points, and 10 random observations. Finally, in Session 3 there were 28 observations; 10 counselor rapport points, 8 client rapport points, and 10 random observations.

The dependent variables in this study were amplitude within each of the four frequency bands; beta, alpha, theta, and delta. For each brain half and for each rapport (or random) point in each session, a similarity index score was calculated for each frequency band by averaging the amplitude scores in each band, and then subtracting the client score from the counselor score. The absolute value of this result became the similarity index score. For example, Figure 2 (p. 33) represents data collected for rapport point B₁6 (Client, Session 1, 6th rapport point,). Using the information from B₁6, the calculation of the similarity index for delta right brain activity is shown in Table 2 (AR = counselor's right brain results, BR = clients right brain results). Continuing with this example, the right brain similarity indices for the remaining frequencies in Figure 2 would be: theta = 2.67; alpha = 10; and beta = 10.4. It was decided to conduct statistical tests using the absolute value of these differences because the primary interest was in degree of overall similarity or difference, not in whether a particular subject had higher brain half levels of activity.

Table 2

Calculation of the Similarity Index for B₁₆ Delta

Subject Right Brain	Delta 0.75Hz 1.5Hz		Calculation of the Mean	Obtaining the Difference	Absolute Value of the Difference
AR:	1	1	$1 + 1 / 2 = 1$	1 Counselor	Similarity Index 1.5
BR:	2	3	$2 + 3 / 2 =$	Mean	
			2.5	- 2.5 Client Mean -1.5 Difference	

Smaller values of the similarity index denote more similarity between counselor and client brain half patterns; conversely, larger values of the similarity index denote less similarity. A value of 0.0 would indicate that the counselor and client had the same level of brain half activity in that respective frequency band. Larger values of the similarity index indicate that either the counselor or the client had substantially greater brain half activity, but the similarity index does not indicate which subject.

During the post-session interview it was difficult for subjects to pinpoint, to the second, a rapport point. The strongest feelings of rapport most commonly lasted about five seconds. Therefore, to maintain statistical integrity, it was decided to use five seconds as the standard rapport point time interval. This means that each observation represents the difference in the average of ten (five counselor, five client) records of brain half activity.

The analytical method chosen to evaluate the results was the one-way analysis of variance (ANOVA). The analysis used the Statistical Analysis System (SAS, version 6.04). Since the number of observations (rapport points) varied from subject to subject and group to group, Levene's test was used to examine the assumption of equal variances. In cases where Levene's test showed a lack of homogeneity (Sessions 1 and 3), a Log_{10} was applied to the similarity indices before performing the ANOVAs. Because similarity indices of 0.0 sometimes occurred, a constant of 0.1 was added prior to transformation. Tukey's Studentized Range (HSD) Test, a fairly conservative post hoc comparison procedure, was chosen to clarify any significant findings.

The null hypothesis (H_0) for this study, in general, was: There are no differences in similarity indices between times of client-reported rapport, times of counselor-reported rapport, or randomly chosen periods. The H_0 would not be rejected if the probability associated with the F value were greater than 0.05. Tukey's Studentized Range (HSD) Test would show $\underline{A_i C_i B_i}$, or $\underline{C_i A_i B_i}$ or any ordering combination thereof, where the line extended unbroken under all three letters. This connecting line indicates the lack of any statistically significant differences among group means. In showing the results of the Tukey's test, the similarity indices (means) are always ordered from greatest (*least* similarity) to least (*most* similarity).

The particular alternative hypothesis that was the focus of this study was: There are greater counselor-client similarities in brain half activity during times of counselor-reported rapport and client-reported rapport than at randomly chosen

periods. If this particular alternative hypothesis was correct, the H_0 would be rejected (i.e., the probability associated with the F value would be less than 0.05). If the similarity in counselor and client EEG pattern during times of rapport were strong enough, Tukey's HSD results would be ordered in the following manner: $C_iA_iB_i$, or $C_iB_iA_i$, where the magnitude of the mean similarity index for C_i (random observations) was significantly greater than that of the means for A_i or B_i . Again, the reader is reminded that a smaller value of the similarity index denotes *greater* similarity between the counselor's and the client's brain half patterns. Such a statistically significant result would indicate that client-counselor brain half activity was most different during the random periods and more similar during times of reported rapport.

The H_0 could also be rejected with other results (patterns) from Tukey's HSD test in addition to the one that was the main focus of the study. This, in fact, happened, and is discussed in relation to the findings in Chapter IV.

CHAPTER IV

Results

This chapter contains four sections. The first three sections present the results of the counselor-client-random left brain and right brain ANOVAs for the three counseling sessions. To simplify the discussion of results, the following acronyms were used: left brain (LB), right brain (RB), and reported rapport (RRP). In each of these three sections, findings for each brain half are discussed first followed by a more global discussion of session results. The last section provides a brief summary.

The primary purpose of this study was to determine if there were characteristic similarities in brain half patterns between client and counselor during times of reported rapport in a counseling session. The null hypothesis (H_0) was: There are no differences in similarity indices between times of client-reported rapport, times of counselor-reported rapport, or randomly chosen periods.

Session 1

Session 1: Left Brain Results

Table 3 summarizes left brain, Session 1, $\log_{10}$ ANOVA results for the four similarity indices. The H_0 was rejected for the LB theta frequency band with $P = 0.0001$. The H_0 was not rejected for LB delta, alpha, and beta frequencies.

Tukey's HSD result for LB theta frequencies revealed that B_1 differed significantly from A_1 and C_1 ; however, A_1 was not significantly different from C_1 . It

Table 3

Left Brain Data: Session 1 ANOVA Results for Log¹⁰ (Similarity Indices + 0.1)^a

Frequency Bands	Mean Square Between Groups ^b	Mean Square Error ^c	F Value	Pr > F	Tukey's Studentized Range (HSD) ^d		
					A ₁	B ₁	C ₁
Delta	0.9200	0.3606	2.55	0.0973	0.22	-0.39	-0.02
					A ₁	C ₁	B ₁
Theta	2.2708	0.1625	13.97	0.0001*	0.64	0.19	-0.34
					A ₁	C ₁	B ₁
Alpha	0.2241	0.1406	1.59	0.2224	0.44	0.39	0.15
					A ₁	C ₁	B ₁
Beta	0.1546	0.3755	0.41	0.6667	0.80	0.55	0.67

^a Similarity Indices are absolute values of the difference in brainwave frequency amplitude

A₁ - similarity index for counselor-reported rapport points

B₁ - similarity index for client-reported rapport points

C₁ - similarity index for randomly selected nonrapport points

^b $df = 2$

^c $df = 26$

^d Groups not underlined by the same line differ significantly from each other ($P = 0.05$).

* Judged significant with $P < 0.05$

is interesting to observe that the general ordering of mean similarity indices in Tukey's results is $A_1 > C_1 > B_1$, with LB delta showing a slight difference ($A_1 > B_1 > C_1$). Again, the reader will remember that larger similarity indices denote *less* similarity in brain wave patterns between counselor and client and smaller similarity indices denote *greater* similarity in brain wave patterns.

However, the only frequency where this pattern ($A_1 > C_1 > B_1$) reached significance was LB theta. For LB theta, it can be stated with confidence that when the client was feeling a state of rapport, the counselor's and client's brain wave patterns were, on average, *more* similar than during times of counselor RRP or randomly chosen times. Conversely, this result indicates that when the counselor was feeling a state of rapport and during randomly chosen times, the counselor's and client's brain wave patterns were, on average, *less* similar than during times of client RRP.

Session 1: Right Brain Results

Table 4 summarizes right brain, Session 1, $\log_{10}$ ANOVA results for the four similarity indices. The H_0 was rejected for RB delta frequency bands with $P = 0.0260$, for RB theta with $P = 0.0006$, and for RB beta with $P = 0.0205$. The H_0 was not rejected for RB alpha frequency bands.

Tukey's HSD results for RB data in Session 1 revealed three different significant findings. The ordering in the Tukey's patterns were similar for RB delta, theta, and alpha ($A_1 > B_1 > C_1$): indicating *less* similarity in brain wave patterns during counselor RRP and *greater* similarity during randomly chosen times. The

Table 4

Right Brain Data: Session 1 ANOVA Results for Log¹⁰ (Similarity Indices + 0.1)^a

Frequency Bands	Mean Square Between Groups ^b	Mean Square Error ^c	F Value	Pr > F	Tukey's Studentized Range (HSD) ^d		
Delta	1.0613	0.2520	4.21	0.0260*	A ₁	B ₁	C ₁
					0.57	0.13	0.06
Theta	0.4227	0.0419	10.07	0.0006*	A ₁	B ₁	C ₁
					0.80	0.49	0.41
Alpha	0.2434	0.0979	2.49	0.1028	A ₁	B ₁	C ₁
					0.81	0.79	0.53
Beta	0.7570	0.1671	4.53	0.0205*	A ₁	C ₁	B ₁
					1.32	0.86	0.82

^a Similarity Indices are absolute values of the difference in brainwave frequency amplitude

A₁ - similarity index for counselor-reported rapport points

B₁ - similarity index for client-reported rapport points

C₁ - similarity index for randomly selected nonrapport points

^b $df = 2$

^c $df = 26$

^d Groups not underlined by the same line differ significantly from each other ($P = 0.05$).

* Judged significant with $P < 0.05$

ordering was significant in both RB delta and theta, however the significance patterns differed. This pattern ($A_1 B_1 C_1$) was not significant in RB alpha.

For RB delta, A_1 and B_1 were significantly different than C_1 , and B_1 and C_1 were significantly different than A_1 . These results indicate, with significance, that when the counselor was feeling a state of rapport, the counselor's and client's brain wave patterns were, on average, *less* similar than during times of client RRP or randomly chosen times. Conversely, during randomly chosen times the counselor's and client's brain wave patterns were, on average, *more* similar than during times of counselor RRP or client RRP.

RB theta results indicated that A_1 differed significantly from both B_1 and C_1 ; however, B_1 and C_1 were not significantly different from each other. This result indicates that when the counselor was feeling/sensing a state of rapport the counselor's and client's brain wave patterns were, on average, *less* similar than during times of client RRP or randomly chosen times. The converse is also indicated.

The ordering pattern was slightly different in RB beta; $A_1 C_1 B_1$. For the RB beta frequencies, A_1 and C_1 were significantly different than B_1 and B_1 , and C_1 was significantly different than A_1 . This pattern indicates that when counselor RRP the counselor's and client's brain wave patterns were, on average, significantly *less* similar than during times of client RRP. Again, the converse is also indicated, meaning that during periods of client RRP, the counselor's and client's brain wave patterns were, on average, significantly *more* similar than during times of counselor RRP.

Session 1: Summary

When the results for Session 1 are considered on a more global level, two main patterns emerge. First, without exception, A_1 consistently ranked first in the ordering pattern for Tukey's results ($A_1 > X_1 > X_2$). Although in many cases this was a non-significant finding, the placement was consistent. This pattern suggests that, during times of counselor RRP, the brain wave patterns exhibited by the diad were generally *less* similar than during times of client RRP. Secondly, this general overall pattern showed a rigorous level of significance in the theta frequencies band (LB theta, $P = 0.0001$; RB theta, $P = 0.0006$) during times of both counselor RRP and client RRP. Tukey's also indicated that A_1 and B_1 were significantly different from one another for both LB and RB findings, again with A_1 exhibiting the higher mean (*less* similarity in brain wave patterns for the diad).

Stated differently, this indicates that it was the general pattern for counselor's and client's brain wave patterns to exhibit, on the average, *less* similarity during times of counselor RRP and *greater* similarity during times of client RRP and the general finding showed a significant level of difference in the theta frequencies.

Session 2

Session 2: Left Brain Results

Table 5 summarizes left brain, Session 2, ANOVA results for the four similarity indices. The H_0 was rejected for LB alpha frequency bands with $P = 0.0342$. The H_0 was not rejected for LB delta, LB theta, and LB beta frequency bands.

Table 5

Left Brain Data: Session 2 ANOVA Results for Similarity Indices^a

Frequency Bands	Mean Square Between Groups ^b	Mean Square Error ^c	F Value	Pr > F	Tukey's Studentized Range (HSD) ^d		
					<u>B₂</u>	<u>C₂</u>	<u>A₂</u>
Delta	29.938	14.617	2.05	0.1466	5.95	4.65	2.75
					<u>B₂</u>	<u>C₂</u>	<u>A₂</u>
Theta	12.935	7.170	1.80	0.1821	5.45	4.27	3.33
					<u>B₂</u>	<u>C₂</u>	<u>A₂</u>
Alpha	37.939	10.020	3.79	0.0342*	8.27	5.33	4.88
					<u>B₂</u>	<u>C₂</u>	<u>A₂</u>
Beta	307.758	162.624	1.89	0.1683	22.36	17.36	12.02

^a Similarity Indices are absolute values of the difference in brainwave frequency amplitude

A₂ - similarity index for counselor-reported rapport points

B₂ - similarity index for client-reported rapport points

C₂ - similarity index for randomly selected nonrapport points

^b $df = 2$

^c $df = 30$

^d Groups not underlined by the same line differ significantly from each other ($P = 0.05$).

* Judged significant with $P < 0.05$

Tukey's HSD results for LB alpha frequencies revealed that B_2 and A_2 differed significantly from each other; however, neither B_2 nor A_2 were significantly different from C_2 . The general pattern for the ordering of similarity indices in Session 2 shows LB B_2 consistently ranking the highest magnitude for similarity indices (least degree of similarity) followed by C_2 , then A_2 , with the lowest similarity index (highest degree of similarity between counselor and client brain wave patterns).

This general pattern exhibited a level of significance for LB alpha. Tukey's result for LB alpha frequencies showed that when the client reported a sense of rapport, the counselor's and client's LB alpha amplitudes, on average, were significantly *less* similar than during times of counselor RRP. The converse is also indicated. Neither counselor nor client differed significantly from randomly chosen times for LB alpha frequencies.

Session 2: Right Brain Results

Table 6 summarizes right brain, Session 2, ANOVA results for the four similarity indices. The H_0 was not rejected for LB delta, LB theta, LB alpha, or LB beta frequency bands. It should be noted that RB Alpha was close to significance with $P = 0.0580$.

The ordering of similarity indices for RB results was less consistent than for LB results. B_2 continued to rank the highest magnitude for similarity indices (least degree of similarity), however A_2 and C_2 were inconsistent in their ranking.

Table 6

Right Brain Data: Session 2 ANOVA Results for Similarity Indices^a

Frequency Bands	Mean Square Between Groups ^b	Mean Square Error ^c	F Value	Pr > F	Tukey's Studentized Range (HSD) ^d		
					<u>B₂</u>	<u>C₂</u>	<u>A₂</u>
Delta	17.666	6.055	2.94	0.0695	4.9	3.0	2.54
					<u>B₂</u>	<u>A₂</u>	<u>C₂</u>
Theta	16.369	7.379	2.22	0.1263	5.64	4.14	3.17
					<u>B₂</u>	<u>A₂</u>	<u>C₂</u>
Alpha	60.976	19.442	3.14	0.0580	9.14	5.42	4.73
					<u>B₂</u>	<u>C₂</u>	<u>A₂</u>
Beta	145.980	89.796	1.63	0.2136	15.25	10.62	8.20

^a Similarity Indices are absolute values of the difference in brainwave frequency amplitude

A₂ - similarity index for counselor-reported rapport points

B₂ - similarity index for client-reported rapport points

C₂ - similarity index for randomly selected nonrapport points

^b $df = 2$

^c $df = 30$

^d Groups not underlined by the same line differ significantly from each other ($P = 0.05$).

* Judged significant with $P < 0.05$

Session 2: Summary

The global view of Session 2 results revealed patterns similar to those in Session 1, with a few interesting differences. In Session 2, again without exception, B_2 ranked first (largest mean) in the ordering pattern for the Tukey's results ($B_1 > X_1 > X_2$). This spot was held by A_1 in Session 1. It must be noted that seven out of eight possible times, this ranking was not significant. However, in LB alpha the same general pattern proved to be a significant finding and RB alpha exhibited the same first rank ordering for B_2 , approaching significance with $P = 0.0580$. The ordering of means for counselor RRP and randomly chosen periods was inconsistent.

These findings indicate that it was generally the pattern for counselor's and client's brain wave patterns to be, on average, *less* similar during times of client RRP than during times of counselor RRP or randomly chosen periods. This pattern exhibited significance in LB alpha and approached significance in RB alpha. The general pattern of counselor's and client's brain wave patterns being, on average, more similar during times of counselor RRP and randomly chosen periods than during times of client RRP, was also indicated.

Session 3

Session 3: Left Brain Results

Table 7 summarizes left brain results for Session 3, $\log_{10}$ ANOVA results for the four similarity indices. The H_0 was rejected for LB beta frequencies ($P = 0.0343$). In that Tukey's results revealed no significant findings, the ANOVA result is considered to be marginal.

Table 7

Left Brain Data: Session 3 ANOVA Results for Log¹⁰ (Similarity Indices + 0.1)^a

Frequency Bands	Mean Square Between Groups ^b	Mean Square Error ^c	F Value	Pr > F	Tukey's Studentized Range (HSD) ^d		
					<u>A₃</u>	<u>C₃</u>	<u>B₃</u>
Delta	0.1778	0.2994	0.59	0.5597	0.21	-0.04	-0.002
					<u>A₃</u>	<u>C₃</u>	<u>B₃</u>
Theta	0.6590	0.2971	2.22	0.1289	0.44	0.06	-0.7
					<u>A₃</u>	<u>C₃</u>	<u>B₃</u>
Alpha	0.2687	0.2217	1.21	0.3145	0.53	0.35	0.18
					<u>A₃</u>	<u>C₃</u>	<u>B₃</u>
Beta	0.7364	0.1903	3.87	0.0343*	1.05	0.56	0.59

^a Similarity Indices are absolute values of the difference in brainwave frequency amplitude

A₃ - similarity index for counselor-reported rapport points

B₃ - similarity index for client-reported rapport points

C₃ - similarity index for randomly selected nonrapport points

^b $df = 2$

^c $df = 25$

^d Groups not underlined by the same line differ significantly from each other ($P = 0.05$).

* Judged significant with $P < 0.05$

Session 3: Right Brain Results

Table 8 summarizes right brain, Session 3, $\log_{10}$ ANOVA results for the four similarity indices. The H_0 was not rejected for frequencies in this brain half. However, there was a marginal finding in the Tukey's results for LB beta frequencies. In that the ANOVA results were not significant ($P = 0.0605$), this finding is also considered not significant.

Session 3: Summary

The same general pattern of findings in Sessions 1 and 2 were also found in Session 3, but to a lesser degree of significance. B_3 consistently ranked the lowest similarity index ($X_1 > X_1 > B_1$) for Session 3 results. However, this was not a significant finding. This particular ordering pattern indicates that it was the general pattern for counselor's and client's brain wave patterns, on an average, to show *greater* similarity during times of client RRP. This pattern showed marginal significance in LB and RB beta frequencies.

Synopsis

Findings for the three counseling sessions did reveal similarities in the broad overall patterns of counselor and client brain wave activity during times of reported rapport. However, the session-to-session differences in these patterns are considerable. The similarities and differences revealed in the results are discussed in greater detail in Chapter V.

Table 8

Right Brain Data: Session 3 ANOVA Results for Log¹⁰ (Similarity Indices + 0.1)^a

Frequency Bands	Mean Square Between Groups ^b	Mean Square Error ^c	F Value	Pr > F	Tukey's Studentized Range (HSD) ^d		
Delta	0.0998	0.2867	0.35	0.7092	A ₃	C ₃	B ₃
					0.54	0.36	0.35
Theta	0.0287	0.0994	0.29	0.7520	C ₃	A ₃	B ₃
					0.76	0.73	0.65
Alpha	0.1767	0.2106	0.84	0.4443	C ₃	A ₃	B ₃
					1.07	0.89	0.79
Beta	0.5204	0.1655	3.14	0.0605	C ₃	A ₃	B ₃
					1.57	1.33	1.09

^a Similarity indices are absolute values of the difference in brainwave frequency amplitude

A³ - Similarity index for counselor-reported rapport points

B³ - Similarity index for client-reported rapport points

C³ - Similarity index for randomly selected nonrapport points

^b $df = 2$

^c $df = 25$

^d Groups not underlined by the same line differ significantly from each other ($P = 0.05$).

* Judged significant with $P < 0.05$

CHAPTER V

Summary, Conclusions, and Recommendations

Summary

The purpose of this pilot study was to determine whether there were recognizable similarities in the respective EEG patterns of a client and a counselor during times of self-reported rapport in a therapy session. Counseling session participants (one counselor and one of three volunteer clients with whom the counselor felt a high level of rapport) were connected to an EEG machine, which simultaneously recorded the left and right brain activity for both client and counselor. The data were analyzed using a one-way analysis of variance to assess each frequency band (delta, theta, alpha, and beta) for each brain half, giving a total of eight ANOVA results for each session. Where groups failed to meet the assumption of homogeneity of variance, a logarithmic transform was used on the data before performing ANOVAs. Tukey's Studentized Range (HSD) was used to analyze findings. Findings did not support the alternative hypothesis; however, EEG patterns exhibited during times of counselor-reported rapport, client-reported rapport, and randomly chosen periods differed significantly. General overall patterns were observable and require further study to clarify.

Conclusions

In their discussion of interpersonal synchrony between telepathy team members, Johnston and Millay (1977, p. 70) stated that "individual EEG records can be as different as personal signatures." The results of this study, given the limitations discussed in Chapter I, seem to reflect a similar finding of "uniqueness." Although the results hint at the possibility of an overall pattern associated with rapport, the differences from session to session are considerable. We are, therefore, left with more questions than answers.

It is appropriate, now, to restate that this study is seminal and therefore exploratory in nature. At present, meaningful interpretations are difficult to make because accepted criteria for characteristic similarities in brain half patterns during states of rapport are nonexistent. Earlier, Blundell was quoted (1984, p. 38) as suggesting that there are "certain points where clearly defined states of consciousness and brain wave patterns coincide." The fact that some of the findings in this study were significant (at fairly rigorous levels) suggests that one of these "points" may have been observed. However, it must be remembered how little is available in the form of accepted, based-in-fact knowledge, to interpret what different frequency patterns mean.

Blundell goes on to say that, although we know very little, we can use what is known "if we allow our original building blocks to become metaphors of states of mind" (p. 38). Although metaphor is not the same as meaning, its cautious application can help clarify the data until the data are substantial enough to clearly

point to what approaches reality. These caveats should be kept in mind in the following discussion.

The H_0 (there are no differences in similarity indices between times of client-reported rapport, times of counselor-reported rapport, or randomly chosen times) was rejected, at levels of significance varying from $P = 0.0001$ to $P = 0.03$, in at least one frequency band in all three sessions.

The alternative hypothesis that was the focus of this study was that there are greater similarities in brain half activity during counselor-client reported rapport than during randomly chosen times. If this hypothesis was correct, Tukey's HSD would have resulted in either of the following patterns: $C_iA_iB_i$, or $C_iB_iA_i$. Results did not confirm the alternative hypothesis.

When study results are viewed globally, two patterns surface. First, there are global similarities in the general ordering of the means (similarity indices). The reader will recall that larger means denote *less* similarity in brain wave patterns between counselor and client and smaller means denote *greater* similarity. Although there are consistencies in the overall patterns, the ordering takes on a different characteristic in each session. In Session 1, the similarity index for periods of *counselor* reported rapport consistently exhibited the highest mean ($A_1 > X_1 > B_1$). In Session 2, the similarity index for periods of *client* reported rapport consistently exhibited the highest mean ($B_2 > X_2 > A_2$). In Session 3, the similarity index for periods of client RRP consistently exhibited the *lowest* mean ($X_3 > A_3 > B_3$).

The activity that caused a similarity index to be high or low was the amount of discrepancy in the frequency band amplitudes between counselor and client. Larger amounts of amplitude discrepancy would result in a larger similarity index (less similarity) and smaller amounts of amplitude discrepancy would result in a smaller (more similarity) similarity index. In Don's (1977) study, higher amplitudes were associated with higher degrees of internally experienced insight. Self-reported "negative shifts," or moments when subject's experienced the least amount of psychological movement, were associated with lower amplitude levels in delta, theta, and alpha frequency bands. Self-reported "felt shifts," or moments when subjects felt unusual insight and psychological movement, were associated with higher amplitude levels. The highest overall amplitude levels were recorded during one subject's spontaneously experienced altered state.

It is difficult to interpret the meaning of amplitude differences in the patterns observed in this study given the available information. The relationship between higher levels of discrepancy in amplitude between counselor and client and lower levels of discrepancy is unknown. Two additional forms of information that would help to clarify these results are nonsession baseline data on subjects' normal amplitude levels and background information on subjects' diagnoses and session content.

Baseline data on subjects normal amplitude levels would help in defining whether these specific patterns of amplitude discrepancy were the result of normal brain wave activity for these individuals or were associated with the rapport experience. There was a small pool of recorded pre- and post-session records that

were not part of the data used in the analysis. These records were recorded during times when the researcher was either leaving the counseling room after having turned the auxiliary equipment on or reentering the room to turn the equipment off. The experimental design of this study did not encompass these periods; and therefore, it is inappropriate to statistically analyze this data. However, it was observed that amplitude levels for the various clients and the counselor were well above levels exhibited during counseling sessions. If there is a difference between baseline amplitudes exhibited by a diad during in-session times and baseline amplitudes exhibited by a diad during nonsession times, the results of this study may be very different if nonsession baseline data were used as the control (C;) group.

Background information on subjects diagnoses and session content would also help to clarify the meaning of amplitude differences. As in the Don (1977) study, particular types of subjective reports were consistently associated with specific EEG patterns. Any consistent association of EEG patterns with subjects' reports would lend clarity to the results.

The second global similarity observed in the results was that, in each session, significant findings tended to focus around one frequency band. In Session 1 several frequency bands exhibited significant findings (RB delta, LB and RB theta, and RB beta), however LB & RB theta frequency band showed the most highly significant results in this session (LB theta, $P = 0.0001$; and RB theta, $P = 0.0006$). In Session 2, findings centered around the alpha bands; LB alpha with $P = 0.0342$ and RB alpha approaching significance with $P = 0.0580$. Session 3 findings were

marginally significant, as described in Chapter IV, but it is interesting to note that the marginal findings centered around the beta frequencies (LB beta, $P = 0.0343$; and RB beta, $P = 0.0605$).

Returning to what is known about the "building blocks," the three frequency bands where findings tended to focus (theta, alpha, and beta) have very different state-of-consciousness characteristics. It is unclear why amplitude discrepancies in the diads' brain wave frequencies were centered around these various bands. Why were the deeper, theta levels of consciousness affected in Session 1, and the more outward-focused, waking consciousness, beta levels affected in Session 3? Again, nonsession baseline data and subjective reports would help clarify these results.

Some final observations should be noted. First, it should be remembered that the counselor was the same individual in all three sessions. It cannot be assumed that an individual's EEG patterns will be consistent from session to session or even from one rapport experience to another. The results of this study would suggest that the findings were "unique" to the respective session. It is unclear whether the counselor's EEG patterns were consistent from session to session or whether there were subtle changes in the counselor's EEG activity from client to client. The design of this study used the differences between counselor and client EEG activity as the measure of choice. However, this measure offers no information on individual patterns. Individual EEG patterns would provide another level of interpretation for these results.

Second, during all six post-session interviews, when a subject picked a rapport point (times they felt a heightened sense of rapport with the other), it was usually associated with times when the subject was talking. This suggests that rapport was felt more strongly by the subjects in this study after they had communicated something. Does a client's or a counselor's EEG pattern and sense of rapport change during times of initiated communication, times of silence, and times spent listening?

Third, during the post-session interviews, two of the three clients stated that there were times when they felt uncomfortable about the topics being discussed and that they intentionally directed the discussion away from the uncomfortable topic area. It would be interesting to compare the EEG records associated with times of discomfort and the EEG records associated with rapport.

Finally, the reason for choosing five seconds as the standard time interval for the rapport point was discussed in Chapter III. It is advisable to analyze EEG data in relatively short periods so as not to average out significant patterns that may be present only momentarily (Don, 1977; Johnston & Millay, 1983). Transient bursts of amplitude within frequency bands were noticeable in the individual records. However, these bursts of activity were somewhat less obvious in the averaged rapport point records. Averaging five seconds of information may have affected the results of this study. Reducing the standard time interval, would reduce the number of records to be averaged and therefore provide more accurate results.

Recommendations for Further Research

The following list provides a summary of the recommendations for further research.

1. This study could be broadened to include the analysis of session content and subjective reports. The consistent association of specific EEG patterns with specific subjective reports may clarify the EEG pattern.
2. The collection of baseline nonsession EEG information would help to clarify whether patterns observed in the results were similar to normal EEG activity or the consequence of the independent variable.
3. Methods to pinpoint the exact moment under study must be improved to reduce the effect of averaging on the data.
4. Normalization of the data would help to adjust for the possibility that amplitude may partially depend on extrinsic factors (e.g., quality of electrode connection).
5. Studying larger pools of subjects in a more generalized study may help to identify metapatterns.

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APPENDIX

University of Tennessee at Knoxville
Research Project Informed Consent

1. This research project is designed to explore the relationship between brainwave patterns and the therapeutic process. You will be asked to participate for a maximum of 3 hours. Each participant will be "hooked-up" to the LENS, an EEG machine, which will record your brainwave patterns. Before the research begins you will have gone through a familiarization process, seen the LENS in operation, and have an opportunity to ask questions to assist you in understanding its functioning.
2. During one scheduled session, you and your counselor will both be hooked-up to the LENS and the session will be video taped.
3. Immediately following the session, you and the project director will privately view the video tape.
4. All tapes and records will be kept in a confidential manner protecting the identity of each subject. All research records and tapes will be stored under lock and key and be under the direction of the Project Director. All tapes will be destroyed three (3) months after completion of the study.
5. At the completion of the project you will be invited to view your respective EEG readout. This readout will be discussed in terms of beta, alpha, theta, and delta amplitudes, frequencies, and patterns. Terms will be defined and any questions answered. At this time results of the research project will also be shared.
6. If there are any questions during or after the research project, please contact Jan Strous at 675-3367.
7. It is understood that participation in this project is strictly voluntary and if you, the subject, refuse to participate or decide at any time to discontinue participation, you will not be penalized.
8. It is understood that the subject does not wave any of his/her legal rights.

I have read the above information and my rights have been explained to me.

Witness

Subject's Name

Date

VITA

Janis K. Strous completed this thesis in December 1992 as the final requirement for her M.S. in Educational Psychology from the University of Tennessee. In 1971, she received a B.A. from Southern California State University at Northridge where she majored in Sociology.

As of this writing, the author is Senior Training Specialist at Radian Corporation, in Oak Ridge Tennessee, where she has authored environmental training programs for the U.S. Department of Energy (DOE), Headquarters; Westinghouse Savannah River Company, Columbus, GA, and Allied-Signal, Inc., Kansas City Division, Kansas City, MO, (DOE subcontractors); and Headquarters, Strategic Air Command and Headquarters, Air Combat Command of the U.S Air Force.