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THE UNIVERSITY OF ALBERTA

The Perception of Emotion, Monaurally and Binaurally

by

(C) Gladys M.J. Severson

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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ABSTRACT

Thirty-two psychiatric patients were tested on research measures of speech comprehension and perception of emotional tone of voice under monaural and binaural listening conditions. In terms of verbal content, results indicated that the psychiatric patients (a) were significantly impaired in their comprehension of speech (b) produced significantly larger left-right ear differences and (c) showed a greater mean deficit in binaural relative to monaural comprehension than did the group of 36 normal controls. With perception of emotional tone of voice, the results indicated that the psychiatric patient group was significantly less accurate in their ability to judge emotion than a group of 28 normal controls. Specifically, 53% of the psychiatric patients as opposed to only 4% of the control group produced impaired scores. No significant differences existed between the groups in terms of left-right ear differences or binaural deficits. Unlike dichotic listening studies, a left-ear superiority was not found in the identification of emotional tone of voice under monaural stimulation for the group of psychiatric patients. Finally, the measure of emotional perception tended to correlate with tests considered to be associated with right hemisphere function. These correlations were not significantly different from the

correlations produced between the same right hemisphere tasks and the measure of speech comprehension. However, the correlation between the measure of emotional perception and a test considered to be associated with left hemisphere function was significantly lower than the correlation between the same left hemisphere test and the measure of speech comprehension. These findings support the contention that the measure of speech comprehension is more left hemisphere oriented while the measure of emotional perception is more sensitive to right hemisphere functioning.

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CHAPTER ONE

INTRODUCTION

All individuals in daily life, are confronted with numerous social interactions. How efficiently individuals handle such interactions determines their social adjustment. Successful social adjustment is largely dependent upon how accurate people become in the perception and the understanding of others.

Since verbal communication or speech is a primary method of interaction, it becomes clear that one should be able to understand speech in order to get along socially. In order to understand speech, one must not only understand the actual verbal content of what is being said, but also be able to judge the emotional tone of voice in which the verbal content is framed. In other words, both verbal and nonverbal messages are portrayed in speech. If one misperceives the verbal content and/or the emotion in which it is being expressed, one then misunderstands or misinterprets the intent of the other person. Misunderstanding can have deleterious effects. For example, suppose a patient misinterprets the instructions of a physician as to the daily dosage of medication and takes twice the recommended amount?

As long ago as 1974, Nash described a major difficulty of psychiatric patients as being their inability

to communicate with others, as well as the inability of others to communicate with them. It seems reasonable to assume that one reason this occurs is because the patients misinterpret the intent of the speaker, either by misinterpreting the verbal content and/or the emotional tone of voice of the speaker. By misinterpreting what others say, the patient, himself, would then have difficulty conversing with others as well. A study by Green (1987a) confirmed that many psychiatric patients do have difficulty understanding the verbal content of what others say to them. In the Green study, 72% of a total of 386 psychiatric patients had impaired speech comprehension, based on their scores on the Auditory Comprehension Test (ACT).

Barring a hearing problem, we typically believe that each of our ears is just as valuable as the other in comprehension of speech. However, in the above research, Green found that 39% of the 386 psychiatric patients had an abnormally large ear difference in terms of comprehension of speech. In addition, we also think that we are able to understand speech as well as, if not better, with both ears together than with either ear alone. However, Green has found that for some individuals, the ability to comprehend speech is superior when speech stimuli are presented to one ear alone than when presented to both ears simultaneously. Green described these patients as

having a binaural deficit. In the above research, Green found that 39% of the 386 psychiatric patients had such a binaural deficit. He hypothesized that these binaural deficits occur because of some form of interhemispheric interference.

The above research has focused upon the understanding of verbal content but not on the understanding of the emotional qualities of the speech presentation. Since speech consists of not only verbal content but also an emotional tone, it seems logical to assume that the patients who had a speech comprehension difficulty for verbal content, would also have difficulty in judging tone of voice. Nash (1974) found that psychiatric patients were significantly less accurate in their ability to perceive, identify, and label tape recordings of vocal expressions than were hospital-care staff. However, Nash acknowledged that her nonpatient, sample members were somewhat younger, probably of higher intelligence, and better educated than her patient sample, and that these factors would account for some of the variance between the ability of the two groups to judge emotion. If one were to control for most of these latter factors, would the patient sample still be less accurate in their emotional perception?

A further assumption would be that those patients with a binaural deficit for verbal content would have a

similar binaural deficit for judgement of emotional tone. This assumption could be seriously questioned, however, since verbal content and emotional tone are believed to be predominantly represented by opposite brain hemispheres. The left hemisphere is preferentially involved in the production and integration of language, while the understanding of emotional tone in speech is thought to be a right hemisphere task (Woodruff & Baisden, 1986). The mechanism operating for one hemisphere may not necessarily be operating for the other. This assumption can only be supported or disconfirmed by further research.

Furthermore, since dichotic listening studies (Haggard & Parkinson, 1971; Ley & Bryden, 1982) have found a left-ear superiority in the identification of emotional tone in speech, would a left-ear superiority also be found in identification of emotional tone in speech under monaural stimulation? Again, further research is required to answer this question.

Therefore, if one were to control for most of the factors that were uncontrolled for in the study by Nash (1974), and monitor both monaural and binaural ear conditions (via both measures of speech comprehension and emotional perception) some new understandings might accrue. In moving toward these new understandings, the following research questions form the basis of the inquiry.

1. Do psychiatric patients have difficulty understanding the verbal content of what others say to them?
2. In terms of speech comprehension, will psychiatric patients have a larger left-right ear difference than a group of normal controls?
3. Will psychiatric patients have greater binaural deficits in speech comprehension than a control group?
4. Do psychiatric patients have difficulty judging emotional tone of voice?
5. If one has a binaural deficit in speech comprehension, will one also have a binaural deficit in emotional perception?
6. Will psychiatric patients have a left-ear superiority in the identification of emotional tone in speech under monaural stimulation?
7. Will results on a measure of emotional perception correlate significantly with results on other right hemisphere tasks?
8. Will correlations between the results on an emotional perception measure and other right hemisphere tasks be significantly higher than a correlation between the same right hemisphere tasks and a measure of speech comprehension?
9. Will a correlation between the results of a

measure of speech comprehension and a left hemisphere task be significantly higher than a correlation between the same left hemisphere task and the results of an emotional perception measure?

CHAPTER TWO

REVIEW OF THE LITERATURE

The cerebral hemispheres appear synchronized in producing all types of behavior, including speech. With speech, the left hemisphere appears responsible for the production and integration of language, while the right hemisphere regulates the interpretation and production of emotional tone (Woodruff & Baisden, 1986). The use of dichotic listening tests, which assess auditory asymmetries for verbal and nonverbal stimuli, has contributed to the understanding of these hemispheric differences. The research by Green (1987a) investigated the impact these ear asymmetries have on everyday speech comprehension, in terms of verbal content. This research indicated, that for some patients, speech comprehension is less accurate in the binaural listening condition than when speech stimuli are presented monaurally. Green postulated that interhemispheric interference is responsible for such a deficit. Since speech consists of both verbal content and the emotional tone of voice in which it is framed, it is possible that binaural deficits also occur with respect to interpretation of emotional tone of voice.

Green (1983b) developed an instrument to measure speech comprehension, in terms of verbal content. This

test is called the Auditory Comprehension Test (ACT). Administration of the test requires the subject to listen to thirty tape-recorded stories, resembling news items, by means of headphones. These stories are broken down into five sets of six stories. The sets become progressively more difficult, since each successive set contains more items of information than the one before it. Ten stories of equal difficulty are presented to the left ear, to the right ear, and to both ears simultaneously. After each story, the subject is asked to recall as much of the story as possible, in his own words. The number of correct items are recorded. For each ear condition, a total of 160 is the maximum correct score. Green (1983a) has found that for normal subjects, of average intelligence, no significant difference exists between the ear conditions, in the amount of information recalled. No ear differences in recall were found on a similar test with normal and neurotic subjects (Green, Hallett & Hunter, 1983; Green & Kotenko, 1980).

However, for some patients, in other psychiatric groups, it was found that the ability to comprehend speech was superior when speech stimuli were presented to one ear alone than when presented to both ears simultaneously (Green, 1987a; Green, Hallett & Hunter, 1983; Green & Kotenko, 1980). As a result, misinterpretation would occur in the more natural listening (binaural) condition.

These patients were described by Green as having a binaural deficit.

In the Green, Hallett & Hunter (1983) study with a group of schizophrenic patients (N=70), a mean increase of 54% was observed in speech comprehension using the superior ear as opposed to the more natural listening condition (binaural stimulation). Binaural comprehension deficits have been replicated by Elizabeth Green (1985) for adult schizophrenics and by Hallett, Quinn & Hewitt (1986) in children of schizophrenics.

Occluding the inferior ear by means of an earplug in patients with a binaural deficit produced significant increases in speech comprehension relative to comprehension without an earplug (Green, 1984, 1987a). In the Green (1987a) study using 386 psychiatric patients and 61 normal adult controls, 47% of cases were found to have a binaural deficit. By using an earplug in the inferior ear, story recall was found to increase by 39% over the binaural listening condition in 97 of these patients.

If there are ear differences in the comprehension of verbal content, could there also be ear differences in the comprehension of emotional tone of voice? It appears that literature in this area is either very scant or nonexistent. However, research has been done in the area of recognition of emotion from vocal cues with both dichotic listening tasks and the natural listening condition

(Haggard & Parkinson, 1971; Johnson, Emde, Scherer & Klinnert, 1986; Ley & Bryden, 1982; Nash, 1974). Even a monaural listening task was done (Safer & Leventhal, 1977), but it had certain limitations. These studies are discussed hereafter.

Ley and Bryden (1982) presented dichotically paired sentences to subjects, one sentence spoken in either a happy, sad, angry, or neutral tone of voice, and the other, different sentence, spoken in a neutral tone of voice. On each trial, subjects were told to listen with a prespecified ear, and to categorize both the affect and the content of the sentence they heard. The results of this study indicated that under conditions of dichotic competition, subjects were most accurate in judging the affect of the sentence when they listened with the left ear. At the same time, they were more accurate in categorizing the content of the sentences, when listening with the right ear.

Haggard and Parkinson (1971) also used a dichotic listening task, pairing short sentences with speech babble. They used the four emotional tones of voice, angry, bored, happy, and distressed. Subjects had to identify both the sentence and the emotion they heard. Again, greater accuracy in identification of the expressed emotion was found with the left ear condition. In fact, when only those trials where the subject correctly

identified the sentence were analyzed, it was found that 9 out of 10 subjects showed a left-ear advantage in identification of emotion.

These latter two studies support the postulate that a dichotic left-ear advantage exists for the identification of emotional tone in voice and that this reflects a right hemisphere specialization for judgement of emotion from tone of voice.

Safer and Leventhal (1977) used a monaural presentation of short passages which were either positive, negative, or neutral in content and were spoken in either a positive, negative, or neutral tone of voice. Subjects were not instructed whether to attend to the verbal content or the emotional tone of voice. They were only asked to judge whether the passage was pleasant, unpleasant, or neutral. The results indicated that those subjects who listened with their left ear tended to make judgments based on the tone of voice of the speaker, while those who listened with the right ear tended to make judgments using verbal content of the passages. A subsequent study showed that when asked to judge the affect and content separately, the subjects who listened with their right ear were more accurate on both judgments. Bryden and Ley (1983) comment that although these findings are significant, interpretation is obscured by the fact that separate groups of subjects were tested on left-ear

and right-ear presentations. Thus, it is not possible to determine the percentage of subjects who actually possessed a left-ear superiority on the task.

In the present study, however, the same group of subjects are tested on left-ear and right-ear presentations of emotional tone of voice, enabling one to determine if a left-ear superiority exists in terms of monaural listening. Given the above research, it is expected that in the present study, a left-ear superiority will also be found in the identification of emotion in tone of voice.

In the Johnson et al (1986) study, an actress spoke a semantically neutral sentence "The green book is lying on the table" in four emotional tones: joy, sadness, anger and fear. The subjects were first and second year psychiatric residents and clinical psychology interns (N=21). The task of the subject was to judge the emotion of the speaker, using a forced choice format. Judgement of emotion was almost perfect. Only one error occurred among 336 responses, indicating greater than 99% accuracy.

An interesting question arises. Would subjects be as accurate if the statement were not semantically neutral? One may argue that in reality one often receives mixed messages. That is, the verbal content and the emotional tone of voice in which it is spoken are often not congruent. In the experiment in the present thesis, three

different forms of speech are utilized, a statement, a request, and an interrogation. Subjects are asked, however, to pay attention to how the sentence is spoken, and not to what is being said. One could rank order the emotions as to their ease in identification, as well as analyze which emotions are better understood under the various sentence structures. However, such analyses are for extended research beyond the present thesis.

While the Johnson et al (1986) study focused on normal subjects in terms of perception of emotion, Nash (1974) was interested in determining the relationship between psychiatric staff, general medical staff, psychiatric patients, and general medical patients in their ability to identify emotional meaning of vocal expressions, independent of verbal content. She was also interested in studying the effectiveness of hospital treatment in influencing the skill of the patient over the course of hospitalization. The hypotheses put forth by Nash and some of the results of her study are considered hereafter.

Nash hypothesized that both categories of staff would be more accurate than both patient groups in identification of emotional meaning. She further believed that psychiatric staff would be better than general medical staff at this task. She also hypothesized that upon admission, psychiatric patients would be less skilled

than general medical patients in identification of emotional meaning, but that at discharge, would show greater improvement than the general medical patients.

The present study also involves a comparison of hospital-staff (the vast majority of which were involved in direct patient care) and psychiatric patients on a measure of emotional perception. As in the Nash study, it was also hypothesized that the hospital-staff would be more accurate in their perception of emotion than the psychiatric patients.

Nash (1974) used the Conn-Edwards Measure of Emotional Perception. This test consisted of a tape-recording of vocal expressions of ten emotions and two neutral expressions. The emotions were as follows: despair, boredom, surprise, affection, fear, anger, disgust, admiration, impatience, and amusement. The paragraph "You've come back. You've been gone a long time. Are you going to stay with me now?" was the tape-recorded stimulus.

Treatment for the psychiatric patients included milieu therapy and the use of the Human Development Institute (HDI). The HDI was a self-training device used to increase accuracy of the expression and perception of emotion. For the general medical patients, no attempt was made to help increase their ability to identify emotion.

Results of the Nash (1974) study were most inter-

esting. As was expected, hospital-staff were superior to patients in their ability to identify the emotional meaning of vocal expressions. However, the hospital-staff were somewhat younger, probably of higher intelligence, and better educated than the patient samples. As previously mentioned, Nash believed that these factors would account for some of the variance between groups in their ability to judge emotion. These factors also prevented her from making certain generalizations from her data.

In the present study, the age and Verbal IQ of the patients are not significantly different from that of the staff, enabling further generalizations to be made.

Nash (1974) found that the psychiatric staff were not superior to the other hospital staff in their perception of emotion. Further, upon admission, the general medical patients were not superior to the psychiatric patients in this ability. At discharge, some surprising results were found. The psychiatric patients did not improve in their ability to perceive emotion but actually tended to become worse. This was especially pronounced for the female patients. Discharge for the general medical patients found the males becoming somewhat worse in emotional perception, while the females became a little better in this ability.

One of the conclusions from the Nash study was a

practical one. Since patients respond poorly to emotional stimuli, at least in terms of vocal expression, they may be unreliable in receiving verbal information. Nash, therefore recommended, that instructions or orders pertaining to the health of a patient be either written down or shared with the patient while other family members are present.

This discussion will now return to the concept of binaural speech comprehension deficits. How does a person with one ear occluded, comprehend speech better than when using both ears together? Green (1987a) hypothesized that interhemispheric interference is responsible. More specifically, he assumed "that the messages arriving at opposite temporal lobes, predominantly from the contralateral ear, interfere with each other at a cortical level" (p. 287). In the present study, it was hypothesized, that compared to a sample of normal controls, psychiatric patients would be less accurate in speech comprehension/recall and would produce significantly greater binaural speech comprehension deficits.

Since emotional tone of voice is part of speech, one could logically assume that binaural deficits would also occur in regard to emotional perception, as well. However, this may be too simplistic. Since verbal content and emotional tone of voice originate from opposite brain hemispheres, different principles might apply in each

case. The present study is an attempt to further add to information in this area.

The present author used two allegedly right hemisphere tasks as a check to ascertain whether the developed measure of emotion was actually a right hemisphere task. The two tests employed were the WAIS-R Block Design subtest and the Benton Visual Retention Test (BVRT).

Research is somewhat discrepant as to whether these tests only involve the right hemisphere, however. Benton (1974) stat[illegible] that patients with parietal-occipital lesions are most likely to prod[illegible]fective performance on the BVRT, and that those pat[illegible]ith right hemisphere lesions are particularly defecti[illegible] terms of performance on visuoperceptive and visuoconstructive tasks. Benton cited a study by Heilbrun (1956) where patients with right hemisphere lesions performed more poorly than those with left hemisphere lesions on the BVRT. However, the difference between the two groups was not statistically significant. De Renzi (1978) cited a study by Arigoni and De Renzi (1964) which found that patients with right hemisphere damage scored lower on the Block Design subtest than did patients with left hemisphere damage. Again, however, the difference between the two groups was not statistically significant. Benton (1985) cited one of his earlier studies done in 1967, where it was determined that approximately equal numbers of patients with left and

right hemisphere disease performed defectively on the WAIS Block Design subtest. Benton (1985) argued that the reason a number of studies have not found significant differences between the two cerebral hemispheres in terms of visuoconstructive abilities is due to many factors. Among the factors he listed were the size of the brain lesion, the task used in the study, and the intrahemispheric focus of the lesion.

De Renzi (1978) hypothesized that whenever perceptual processing involves intellectual analysis, (for example, deduction of relationships), "the contribution of the left hemisphere to performance increases and tends to attenuate the right hemisphere's superiority" (p. 67).

An allegedly left hemisphere task, the WAIS-R Vocabulary subtest, was also used in the present research as a validity check to determine if the measure of emotional perception was more correlated with right hemisphere tasks than with a left hemisphere task. As previously mentioned, the production and integration of language appears to be a predominantly left hemisphere task (Woodruff & Baisden, 1986). However, as with the right hemisphere tasks, the literature does provide some discrepancies. For example, Dean (1986) cited a study by Hecaen (1962), as providing evidence for some differences in lateralization of language, depending upon the handedness of the individual.

In the present study, research measures of both speech comprehension and emotional perception were used with hospital-staff and with psychiatric patients. Age and verbal intelligence were held constant for both groups. The test of emotional perception included both semantically neutral (a statement) and emotionally-laden sentences (a request and an interrogation). As a check to ascertain whether the developed measure of emotion was a right hemisphere task, other allegedly right and left hemisphere tasks were administered.

Several pointed questions emerge from the overview of the related literature. These questions reformulated as hypotheses follow. Please note that in the present thesis, speech comprehension is defined as "recall of verbal content" while emotional perception is defined as "judgment of emotional tone of voice".

STATEMENT OF THE HYPOTHESES

Hypothesis I

It was hypothesized that psychiatric patients would be significantly less accurate in speech comprehension than a sample of hospital-staff (normal controls).

Hypothesis II

In terms of speech comprehension, it was hypothesized

that the psychiatric patients would have a larger left-right ear difference than the group of normal controls.

Hypothesis III

In terms of speech comprehension, it was hypothesized that significantly greater binaural deficits would be found in the psychiatric group than in the group of normal controls.

Hypothesis IV

It was hypothesized that psychiatric patients would be significantly less accurate in emotional perception than the hospital-staff, barring differences in verbal intelligence and age.

Hypothesis V

It was hypothesized that individuals with a binaural deficit in speech comprehension would also have a similar binaural deficit in emotional perception.

Hypothesis VI

It was hypothesized that psychiatric patients would have a left-ear superiority in the identification of emotional tone in speech.

Hypothesis VII

It was hypothesized that results on the measure of emotional perception will significantly correlate with results on other right hemisphere tasks.

Hypothesis VIII

It was hypothesized that correlations between the results on a measure of emotional perception and results on other right hemisphere tasks would be significantly higher than correlations between the results of a measure of speech comprehension and the results of the same right hemisphere tasks.

Hypothesis IX

It was hypothesized that the correlation between the results on a measure of speech comprehension and the results on a left hemisphere task would be significantly higher that the correlation between the results of the measure of emotional perception and the results on the same left hemisphere task.

CHAPTER THREE

METHOD AND PROCEDURE

This chapter contains a description of the subjects, research instruments, and procedures utilized in this study. A brief mention of data analysis procedures are also included.

SUBJECTS

NORMAL CONTROLS

Control Group I

Of the Alberta Hospital Edmonton staff who volunteered for a study of emotional perception, fifty individuals were utilized in the study, those who did not report previous head injuries leading to unconsciousness, neurological conditions, psychotropic medication, psychiatric history, or hearing loss. A questionnaire was administered to each individual to check for these exclusion criteria (see Appendix 1). Data from only twenty-eight of the fifty staff were utilized in the final analysis, in order that their mean Verbal IQ would not be significantly different from the mean Verbal IQ of the experimental group. In order for this to occur, individuals with a Verbal IQ less than or equal to 101 were selected. The sex composition and means, standard devia-

tions, and range of scores for the age and Verbal IQ of the twenty-eight controls are shown in Table 1. The Emotional Perception Test (EPT) and the WAIS-R Vocabulary subtest were administered to this control group. The data from Control Group I are listed in Appendix 4.

Control Group II

Data from fifty-two Alberta Hospital Edmonton staff from a previously conducted study (Green, 1984) was utilized to obtain control norms for the Auditory Comprehension Test (ACT). In addition, their WAIS-R Vocabulary subtest scores were also utilized as an estimate of Verbal IQ. Data from only thirty-six of the fifty-two staff were utilized, those with a Verbal IQ less than or equal to 101, in order that their mean Verbal IQ would not be significantly different from the mean Verbal IQ of the experimental group. The sex composition and means, standard deviations, and range of scores for age and Verbal IQ of the thirty-six controls are shown in Table 1. The data from Control Group II are listed in Appendix 5.

EXPERIMENTAL GROUP

The experimental group consisted of thirty-five psychiatric patients, those who did not report a hearing loss/problem. They were being treated at Alberta Hospital

Edmonton and represented a wide variety of psychiatric diagnoses (see Appendix 7). The vast majority were on medication at the time of testing (see Appendix 8 for a detailed list of medications at the time of the Emotional Perception Test). One staff member with a neurological disorder, due to a stroke, was also included. Three patients were excluded from the final analysis, one who had an extremely low Verbal IQ (IQ = 57), one who was extremely uncooperative during test administration, and another who completed an insufficient amount of testing. This group was administered the Auditory Comprehension Test (ACT), the Emotional Perception Test (EPT), and the Benton Visual Retention Test (BVRT). Both the Vocabulary subtest and the Block Design subtest from the WAIS-R were also administered. In one case, the equivalent Wechsler Intelligence Scale for Children (WISC-R) subtests were utilized due to the subject's young age. The sex composition and means, standard deviations and range of scores for age and Verbal IQ of the thirty-two subjects are displayed in Table 1. The data from the experimental group are listed in Appendix 6.

TABLE 1

The Sex Composition and Means, Standard Deviations, and Range of Scores for the Age and Verbal IQ of Control Group I, Control Group II, and the Experimental Group

Sex Composition

Group	Male	Female
Control Group I	4	24
Control Group II	2	34
Experimental Group	12	20

Age

Group	Mean	S.D.	Min.	Max.	N
Control Group I	31.786	8.677	18.000	50.000	28
Control Group II	31.833	9.700	20.000	48.000	36
Experimental Group	32.531	14.009	13.000	65.000	32

Verbal IQ

Group	Mean	S.D.	Min.	Max.	N
Control Group I	93.179	6.572	77.000	101.000	28
Control Group II	94.389	5.347	81.000	101.000	36
Experimental Group	92.094	15.828	64.000	134.000	32

APPARATUS

(A) Emotional Perception Test (EPT)

A mono cassette tape-recording of a total of forty-five sentences, consisting of three speech samples each spoken in five different emotional tones (happy, neutral, sad, angry, and frightened) was used. The test further divided into three equivalent sets of fifteen sentences. One set was used for the left ear condition, one set for the right ear condition, and one set for the binaural listening condition. In each of these sets, the three speech samples were each spoken five times, once in each of the five emotional tones. Pages 2-5 of the Experimental Assessment Booklet (described below) provided the examiner scoring instructions and scoring forms for the Emotional Perception Test. The EPT was developed as a research instrument by the author in conjunction with Dr. P. Green. To check the internal consistency of the EPT, the Spearman-Brown split-half reliability formula (Anastasi, 1976, p. 116) was applied. Since the test was divided into one-third components (corresponding to the three ear conditions), it appeared appropriate to compare each ear condition to one another. The correlations between scores in each ear condition were as follows: L vs R =.92; L vs B =.89; R vs B =.90.

(B) The Experimental Assessment Booklet consisted of the Emotional Perception Test (EPT), WAIS-R Vocabulary

subtest, Benton Visual Retention Test (BVRT), WAIS-R Block Design subtest, and the Auditory Comprehension Test (ACT). Non-copyright material appears in Appendix II.

Page 1 provided space for recording the name, age, sex, date of birth, date of EPT test, hospital ward of the subject, EPT scores, and ACT scores. Additional space was provided to record the Vocabulary scaled score, Block Design scaled score, estimated Verbal IQ, BVRT (error) score, and notes on test behavior.

Pages 2 and 3 provided instructions for the examiner as to the scoring format of the Emotional Perception Test. Keys to the abbreviations contained on the test as well as an example of the scoring format are included.

Pages 4 and 5 were the Emotional Perception Test scoring forms. Each information item on these pages consisted of the five emotional tones, one of which was circled, to indicate the response made by the subject. The type of speech sample the sentence represented (factual, request, interrogation) along with the emotional tone of voice in which it was spoken, was printed with an empty square, for evaluating the response made by the subject. The square was left empty if the response made by the subject was correct, and was marked with an X if it was incorrect. The sentences were broken into three columns, representing the three listening conditions (left ear, right ear, and the binaural conditions).

Page 6 was a copy of the WAIS-R Vocabulary subtest, with space to estimate Verbal IQ.

Page 7 was a copy of the scoring format for the Benton Visual Retention Test (BVRT).

Page 8 was a copy of the WAIS-R Block Design subtest.

Page 9 was a copy of the Auditory Comprehension Test (ACT), Form I.

Tables of split-half, test-retest, and alternate forms reliability for the ACT using normal adults and children, learning-disabled children, and adolescents with psychiatric problems, are displayed in Appendix 9 (Green, 1987c).

In terms of validity, the ACT certainly has face validity since the story items resemble news stories. In terms of concurrent validity, the ACT is unique in the measurement of speech comprehension since comprehension is measured monaurally and binaurally. As such, the essential feature of the test (monaural and binaural speech comprehension) has not been validated against existing measures of speech comprehension. The ACT has clinical validity since individuals with an abnormal binaural deficit have demonstrated an increase in speech comprehension with utilization of an earplug (Green, 1984, 1987a). In a report by Green (1987b) to the St. Albert Board of Trustees, Green describes reports from teachers as to noticeable behavior changes in 13 of a recommended

16 children who wore an earplug for an average of seven months.

(C) i. Cassette recorder

ii. Switch box for delivering the speech stimuli to either one ear alone or to both ears simultaneously.

iii. Two pairs of headphones - one open set for the examiner, and one closed set for the subject.

iv. A EPT stimulus card with the words, happy, neutral, sad, angry, and frightened printed on it (see Appendix 3).

PROCEDURE

(A) EMOTIONAL PERCEPTION TEST

Test Under Headset

The subject was required to judge the emotional tone of voice in each of the forty-five spoken sentences. Presentation of the sentences alternated between left ear, right ear, and binaural conditions.

Standard Instructions

"This is a test to see how well a person can pick out the emotion expressed in a sentence. On this tape there is a woman reading some forty-five short sentences. In front of you, you notice there is a card with five

emotions printed on it - happy, neutral, sad, angry, and frightened. I want you to point to and state which emotion on the card the speaker is feeling. Pay attention to how she says the sentence, not what she says. You must only choose one of the emotions listed on the card in front of you. Sometimes you will hear the sentence in your left ear, sometimes in your right ear, and sometimes in both ears together."

"Let's try an example. Suppose the sentence spoken is "Close the door"". Examiner speaks the sentence in an angry voice. "Which one of the five emotions printed on the card am I feeling? Please point to and state the emotion". The subject responds by choosing one of the five alternative emotions. The examiner replies, "Good, that's what I want you to do." The examiner does not tell the subject if he is correct or incorrect. "Now let's begin. First, I'll let you listen to a few examples without having you judge them." These are played binaurally.

"Please put your headphones on so that they are comfortable." Play five samples with volume set at a level which is comfortable for people with normal hearing. Examiner checks with the subject as to whether the volume is adequate and makes the proper adjustment during these five samples.

"Now listen to the sentence and indicate which one

of the five emotions on the card the speaker is feeling by pointing to and stating the emotion."

The tape is then started in the left, right, or binaural condition. The examiner wears the "open" headphones in order to monitor the tape, so as to know when to stop the tape after the end of each sentence.

After the first sentence is played, say to the subject: "Point to and tell me the emotion the speaker is feeling". The examiner then circles on the record form the answer of the subject and either leaves the square blank (correct response) or puts an X (incorrect response) in the square provided, giving no feedback on response accuracy.

At the bottom of the last page of the record form is space to record three sets of information. This information includes the sum of incorrect responses in each of the three listening conditions, the sum of incorrect responses for each of the three speech samples, and the sum of incorrect responses for each of the five emotions.

(B) WAIS-R VOCABULARY SUBTEST

This subte s administered and a scaled score found as per the instructions in the WAIS-R manual (Wechsler, 1981). The scaled score is then multiplied by six to become an estimate of the "sum of the verbal subtests". Calculations of the estimated Verbal IQ is

then completed as per instructions in the WAIS-R manual.

With the experimental group, however, the best estimate of Verbal IQ was derived, whether from one verbal subtest, more than one, or all of the verbal subtests. This was dependent upon how much of the WAIS-R the patient actually was able to complete.

One of the experimental subjects was given the Wechsler Intelligence Scale for Children (WISC-R) instead of the WAIS-R, due to her young age.

(C) THE BENTON VISUAL RETENTION TEST (BVRT)

This test is administered and scored as per the instructions in the BVRT manual (Benton, 1974). Form C, Administration A was utilized in the majority of cases, with occasional use of alternate, equivalent forms of the test.

(D) WAIS-R BLOCK DESIGN SUBTEST

This subtest is administered and a scaled score found as per the instructions in the WAIS-R manual (Wechsler, 1981). One of the experimental subjects was given the WISC-R Block Design subtest due to her young age.

(E) AUDITORY COMPREHENSION TEST (ACT)

Form I of the ACT was administered according to standard instructions (Green, 1983b).

DATA ANALYSIS

Test results were entered on the MTS computer system as well as on an apple compatible microcomputer. Computer calculations consisted mainly of t-tests and correlational analysis. Criterion significance was set at .05.

CHAPTER FOUR

RESULTS

INTRODUCTION

Several hypotheses have been put forth in the present study. To begin, it was hypothesized that the psychiatric patients would be significantly less accurate in both speech comprehension and emotional perception than a normal control group. In terms of speech comprehension, significantly greater binaural deficits and larger left-right ear differences were expected in the psychiatric patient group. It was further believed than individuals with a binaural deficit with speech comprehension would also have a binaural deficit with emotional perception. A left-ear superiority for the identification of emotion in tone of voice was also expected. As well, it was hypothesized that the results of the Emotional Perception Test would correlate significantly with the results of right hemisphere oriented tests. It was further postulated that the correlations between the results of the Emotional Perception Test and the right hemisphere oriented tests would be significantly higher than the correlations between the results of the Auditory Comprehension Test and the same right hemisphere oriented tests. Likewise, it was thought that the correlation between the results of the Auditory Comprehension Test and

the results of a left-hemisphere test would be significantly higher than the correlation between the results of the Emotional Perception Test and the same left hemisphere test. All of these hypotheses are discussed in turn, along with the relevant analysis to test each hypothesis. Thereafter, the findings are offered with a statement of the conclusions one can make on the basis of the findings.

HYPOTHESIS I

It was hypothesized that psychiatric patients would be significantly less accurate in speech comprehension than a sample of hospital-staff (normal controls). A t-test for individual groups was performed, comparing the mean Auditory Comprehension scores (Left + Right + Binaural)/3 of the two groups.

Means, standard deviations, and range of scores for the mean ACT scores are shown in Table 2.

TABLE 2

Means, Standard Deviations, and Range of Scores for the Mean ACT Scores (L+R+B)/3

Group	Mean	S.D.	Min.	Max.	N
Control Group II	96.185	11.110	75.333	124.667	36
Experimental Group	73.469	28.722	30.333	134.333	32

A t-test for independent samples shows that the mean

ACT recall score of the psychiatric patients was significantly lower than that of the hospital-staff ($t=4.39$, $df=66$, $p < 0.001$).

CONCLUSION

As was hypothesized, the difference between the two group means was significant, with the psychiatric patients producing significantly lower speech comprehension scores than the hospital-staff.

Green (1987a) suggested a cut-off score of 80 or less as being a strong indicator of impairment in speech comprehension. This criterion represented 1.5 standard deviations from the normal mean. Therefore, the mean recall score of the experimental group can be described as reflecting impaired speech comprehension while the mean recall score of the control group can be described as representing normal speech comprehension.

It should be noted that while 63% of the psychiatric patients produced impaired scores, only 8% of the control group produced similar scores.

HYPOTHESIS II

In terms of speech comprehension, it was hypothesized that the psychiatric patients would have a larger left-right ear difference than the group of normal controls. A t-test for individual groups was performed, comparing the

absolute ear difference scores /R-L/ of the two groups.

Means, standard deviations, and range of scores for the absolute ear difference scores are shown in Table 3.

TABLE 3

Means, Standard Deviations, and Range of Scores for the Absolute Ear Difference Scores

Group	Mean	S.D.	Min.	Max.	N
Control Group II	6.444	4.150	1.000	19.000	36
Experimental Group	10.750	8.474	.000	38.000	32

A t-test for independent samples shows that the mean absolute ear difference score for the psychiatric patients was significantly larger than that of the hospital-staff ($t=-2.71$, $df=66$, $p=.009$).

An abnormally large ear difference on the ACT was said to be present if /R-L/ was greater than or equal to 16 points (Green, 1987a). This criterion represented 1.5 standard deviations from the normal mean. Although the mean absolute ear difference score for the patient group did not meet this criterion, it should be noted that 25% of the patient group had an abnormally large ear difference compared to only 3% of he normal control group.

CONCLUSION

As was hypothesized, the psychiatric patients showed a larger left-right ear difference in terms of speech

comprehension than did the hospital-staff.

HYPOTHESIS III

It was hypothesized that significantly greater binaural deficits, in terms of speech comprehension, would be found in the psychiatric group than in the normal control group. A t-test for individual groups was performed, comparing the mean binaural deficit scores [(Binaural-Highest Monaural)/Binaural * 100%] of the two groups.

Means, standard deviations, and range of scores for the binaural deficits are shown in Table 4.

TABLE 4

Means, Standard Deviations and Range of Scores for the Binaural Deficit Scores

Group	Mean	S.D.	Min.	Max.	N
Control Group II	-2.807	10.036	-25.610	15.741	36
Experimental Group	-11.602	19.325	-71.795	12.500	32

A t-test for independent samples shows that the mean binaural deficit score for the patients was significantly greater than that of the normal controls ($t=2.39$, $df=66$, $p=.020$).

CONCLUSION

As was hypothesized, significantly greater binaural deficits in terms of speech comprehension were found in the group of psychiatric patients than in the group of normal controls.

In terms of abnormal binaural deficit scores, Green (1983a) suggested a cut-off score of -20% or less as being an abnormally large binaural deficit. This criterion represented 1.5 standard deviations from the normal mean. Although the mean binaural deficit did not reach this criterion, it should be noted that 38% of the patients had an abnormal binaural deficit, compared to only 8% of the normal control group. Additionally, it is interesting to note that 75% of the patients with an abnormal binaural deficit showed the right ear score to be greater than the left ear score, indicating a left hemisphere superiority in the comprehension of speech.

HYPOTHESIS IV

It was hypothesized that psychiatric patients would be significantly less accurate in emotional perception than the hospital-staff, barring differences in verbal intelligence and age. Three t-tests for individual groups was performed, comparing the mean age, mean Verbal IQ, and mean EPT scores of the two groups.

Means, standard deviations, and range of scores for

the age of the two groups are shown in Table 5.

TABLE 5

Means, Standard Deviations and Range of Scores for the Age of Subjects

Group	Mean	S.D.	Min.	Max.	N
Control Group I	31.786	8.677	18.00	50.00	28
Experimental Group	32.531	14.009	13.00	65.00	32

A t-test for independent samples reveals that the mean age of the patients is not significantly different from the mean age of the normal controls (t=-.24, df=58, p=.808).

Means, standard deviations, and range of scores for the Verbal IQ of the two groups are shown in Table 6.

TABLE 6

Means, Standard Deviations, and Range of Scores for the Verbal IQ

Group	Mean	S.D.	Min.	Max.	N
Control Group I	93.179	6.572	77.00	101.00	28
Experimental Group	92.094	15.828	64.00	134.00	32

A t-test for independent samples shows that the mean Verbal IQ for the patients is not significantly different form the mean Verbal IQ of the normal controls (t=.34, df=58, p=.737).

Means, standard deviations, and range of scores for the Mean EPT scores (L+R+B)/3 are shown in Table 7. The mean scores represent the average number of correct responses over all three listening conditions, given a maximum of fifteen per condition.

TABLE 7

Means, Standard Deviations, and Range of Scores for the Mean EPT Scores (L+R+B)/3

Group	Mean	S.D.	Min.	Max.	N
Control Group I	10.929	1.562	7.333	13.333	28
Experimental Group	8.677	2.784	3.000	13.333	32

A t-test for independent samples demonstrates that the normal controls performed at a higher level than the patients ($t=3.79$, $df=58$, $p=.000$)

CONCLUSION

As was hypothesized, the difference between the mean EPT scores was significant, with the control group producing significantly higher emotional perception scores than the psychiatric patient group, barring differences in age and Verbal IQ.

A cut-off score of less than 9 was chosen as being a strong indicator of impaired emotional perception. This criterion was chosen because it represented a 1.5 standard

deviation difference from the Control Group I mean (normal mean). Thus, from a mean score of 8.7, the psychiatric patient group can be described as experiencing impaired emotional perception while it is assumed that the normal control group had unimpaired emotional perception.

It should be noted, that 53% of the psychiatric patients produced mean EPT scores within the impaired range, while only 4% of the control group produced similar scores.

HYPOTHESIS V

It was hypothesized that individuals with a binaural deficit in speech comprehension would also have a similar binaural deficit in emotional perception. Two types of analysis were performed to test this hypothesis.

First, Pearson Product Moment Correlations were computed. The responses of all 32 Experimental subjects were utilized in these analyses. The results of these analyses indicated that there was no significant relationship between a binaural deficit in speech comprehension and a binaural deficit in emotional perception. A correlation coefficient of -.1386 (p=.225) was computed.

Means, standard deviations, and range of scores for the binaural deficits for both the ACT and EPT are shown in Table 8.

TABLE 8

Means, Standard Deviations, and Range of Scores for the Binaural Deficit Scores for the ACT and EPT

Variable	Mean	S.D.	Min.	Max.	N
ACT Bin. Def.	-11.602	19.325	-71.795	12.500	32
EPT Bin. Def.	-2.154	20.452	-50.000	33.333	32

Secondly, percentage calculation of abnormal binaural deficits on the ACT and EPT was performed. A binaural deficit on the ACT was considered abnormal if it was less than or equal to -20% (this criteria represented 1.5 standard deviations from the normal mean (Green, 1983a)). On the EPT a binaural deficit was considered to be abnormal if it was less than -26%. This criterion was chosen since it also represented 1.5 standard deviations from the normal mean (Control Group I). Calculations resulted in 38% of the Experimental Group with an abnormal binaural deficit on the ACT but only 6% with an abnormal binaural deficit on the EPT. If these two variables were significantly correlated, one would expect similar percentages of abnormal binaural deficits on both tests.

CONCLUSION

The above findings present evidence that there is no significant relationship between the binaural deficit on the ACT and the binaural deficit on the EPT.

HYPOTHESIS VI

It was hypothesized that psychiatric patients would have a left-ear superiority in the identification of emotional tone in speech.

A t-test for correlated samples was performed to test whether the mean left EPT score was superior to the mean right EPT score (Ferguson, 1976, pp. 166-168).

Means, standard deviations, and range of scores for the left and right EPT scores are shown in Table 9. The mean score represents the average number correct out of 15 in the respective ear condition on the Emotional Perception Test.

TABLE 9

Means, Standard Deviations, and Range of Scores for the Left and Right Ear Conditions on the EPT

Variable	Mean	S.D.	Min.	Max.	N
Left EPT	8.625	2.780	3.000	14.000	32
Right EPT	8.281	3.134	3.000	15.000	32

A t-value of 1.16 was calculated. For df=31, a t-value of about 2.042 was required for significance at the 5 percent level. Thus, there was no significant difference between the right and left EPT scores.

CONCLUSION

Unlike dichotic listening tests, a left-ear superior-

ity was not found in the identification of emotional tone in speech under monaural listening conditions.

HYPOTHESIS VII

It was hypothesized that results on the measure of emotional perception would significantly correlate with results on tests considered to be associated with right hemisphere function, the Benton Visual Retention Test (BVRT) and the WAIS-R Block Design subtest (BD).

Pearson Product Moment coefficients were computed with the BVRT (errors) and the BD subtest respectively. For the BVRT, all 25 experimental subjects who completed this test were utilized in the analysis. The results of the analysis indicated that there was a significant relationship between the mean EPT score and the error score on the BVRT. A correlation coefficient of -.3942 (p=.026) was computed. With the BD subtest, all 30 Experimental subjects who completed this subtest was included in the analysis. The results of this analysis indicated that there was a significant relationship between the mean EPT score and the Block Design score. A correlation coefficient of .3109 (p=.047) was computed.

Means, standard deviations, and range of scores for the BVRT (errors), BD subtest, and Mean EPT score are summarized in Table 10.

TABLE 10

Means, Standard Deviations, and Range of Scores for the Mean EPT (correct), BVRT (errors), and BD Subtest

Variable	Mean	S.D.	Min.	Max.	N
Mean EPT	8.677	2.784	3.000	13.333	32
BVRT	7.360	5.722	.000	23.000	25
BD Subtest	8.533	3.256	3.000	16.000	30

CONCLUSION

As was hypothesized, the Emotional Perception Test correlated significantly with tests considered to be associated with right hemisphere function.

HYPOTHESIS VIII

It was hypothesized that correlations between the results on a measure of emotional perception and results on other right hemisphere tasks would be significantly higher than correlations between the results of a measure of speech comprehension and the results of the same right hemisphere tasks.

Pearson Product Moment correlation coefficients were computed between the BVRT (errors) and the mean EPT score, as well as between the BVRT (errors) and the mean ACT score. The responses of all 25 experimental subjects who completed the respective tests were utilized in the analysis. Both correlations were significant. The

correlation between the BVRT and the mean EPT score was -.3942 (p=.026) while the correlation between the BVRT and the mean ACT score was -.4690 (p=.009).

A t-test for dependent samples was computed to test the significance of the difference between the two correlations (Ferguson, 1976, pp. 184-185). A t-value of -.365 was computed. For df=22, a t-value of 2.074 was required for significance at the 5 percent level. Therefore, the difference between the two correlations cannot be said to be significant.

Further Pearson Product Moment Coefficients were computed, these being with the Block Design Subtest, the mean EPT score, and the mean ACT score, respectively. The responses of all 30 experimental subjects who completed the respective tests were utilized in this analysis. Both correlations were significant. A correlation coefficient of .3109 (p=.047) was computed between the mean EPT and the Block Design Subtest while a correlation coefficient of .5229 (p=.002) was computed between the mean ACT score and the Block Design Subtest.

Since both correlations were significant, a t-test was again computed to test the significance of the difference between the two correlations (Ferguson, 1976, pp. 184-185). A t-value of 1.155 was computed. For df=27, a t-value of 2.052 was required for significance at the 5 percent level. Subsequently, the difference between

the two correlation coefficients cannot be said to be significant.

Means, standard deviations, and range of scores for the Mean EPT, Mean ACT, BVRT, and Block Design subtest are shown in Table 11.

TABLE 11

Means, Standard Deviations, and Range of Scores for the Mean EPT, Mean ACT, BVRT, and Block Design Subtest

Variable	Mean	S.D.	Min.	Max.	N
Mean EPT	8.677	2.784	3.000	13.333	32
Mean ACT	73.469	28.722	30.333	134.333	32
BVRT (errors)	7.360	5.722	.000	23.000	25
Block Design	8.533	3.256	3.000	16.000	30

CONCLUSION

Hypothesis VII was disconfirmed. The BVRT and the Block Design subtest did not correlate significantly higher with the mean EPT than they did with the mean ACT.

HYPOTHESIS IX

It was hypothesized that the correlation between the results on the measure of speech comprehension and a left hemisphere task would be significantly higher than the correlation between the results on a measure of emotional perception and the results of the same left hemisphere task. Two types of analysis were performed to test this

hypothesis.

First, Pearson Product Moment coefficients were computed. The responses of all 31 experimental subjects who completed the subtest, were utilized in this analysis. The results of this analysis indicated that there was a significant relationship between the Vocabulary subtest and both the mean EPT score and the mean ACT score. Correlation coefficients of .3945 (p=.014) and .7884 (p=.000) were computed, respectively.

Means, standard deviations, and range of scores for the mean EPT, mean ACT, and Vocabulary subtest are summarized in Table 12.

TABLE 12

Means, Standard Deviations, and Range of Scores for the Mean EPT, Mean ACT, and Vocabulary Subtest

Variable	Mean	S.D.	Min.	Max.	N
Mean EPT	8.677	2.784	3.000	13.333	32
Mean ACT	73.469	28.722	30.333	134.333	32
Vocabulary	8.548	2.942	3.000	15.000	31

Secondly, a t-test was computed to test the significance of the difference between the two correlations (Ferguson, 1976, pp. 184-185). A t-value of 3.048 was computed. For df=28, a t-value of 2.048 was required for significance at the 5 percent level. Thus, the difference between the two correlation coefficients can indeed be

said to be significant.

CONCLUSION

As was hypothesized, the Vocabulary subtest correlated significantly more highly with the mean ACT than with the mean EPT. This lends support to the contention than the EPT is more right-hemisphere oriented, while the ACT is more left hemisphere oriented.

SUMMARY OF CONCLUSIONS

Several major conclusions can be formulated from the above research findings. Firstly, the psychiatric patients performed significantly more poorly than the normal control groups in terms of both speech comprehension and emotional perception. Secondly, there was an absence of a relationship between a binaural deficit on the Auditory Comprehension Test and a binaural deficit on the Emotional Perception Test. Thirdly, the psychiatric patient group produced greater binaural deficits and larger L-R ear differences in speech comprehension than did the group of normal controls. Fourthly, a left-ear superiority was not found with the identification of emotional tone in speech. Fifthly, the results of the Emotional Perception Test do not significantly correlate with the results of right hemisphere oriented tests. However,

the correlation between the results of the Emotional Perception Test and the results of these right hemisphere tests was not significantly different from the correlation between the results of the Auditory Comprehension Test and the results of these same right hemisphere tests. A final conclusion was that the correlation between the results of the Auditory Comprehension Test and the results of a left hemisphere oriented test was significantly higher than the correlation between the results of the Emotional Perception Test and the results of the same left hemisphere test.

CHAPTER FIVE

DISCUSSION AND IMPLICATIONS

DISCUSSION

Given the results of the present study, why did some of the results support previous research and the research hypotheses and why did some of the results reveal no support for the hypotheses? What are the implications for clinical practice? Should some follow-up research be considered? These questions form the outline for Chapter Five.

In terms of verbal content, it was found that the experimental group (a) was significantly impaired in their comprehension of speech (b) produced significantly larger left-right ear differences and (c) showed a greater mean deficit in binaural relative to monaural comprehension than did the normal control group. Specifically, 63% of the experimental group produced impaired scores in the amount recalled, while only 8% of the normal controls produced impaired scores. Using a criterion of at least 16 points to define an abnormally enlarged left-right ear difference score, 25% of the patients compared with only 3% of the normal controls displayed this abnormally enlarged ear-difference. Furthermore, 38% of the experimental group, as opposed to only 8% of the normal control group showed an abnormal binaural deficit. In

other words, 38% of the psychiatric patients were at least 20% better able to comprehend speech when listening with one ear occluded than when listening in the more natural (binaural) condition. Clinical observation suggests that these patients are apt to misunderstand what others say to them, making communication difficult. Occluding the inferior ear by means of an earplug may prove useful in some of these cases but demonstration of such an effect was not attempted in the present study.

With perception of emotional tone of voice, the results indicated that the experimental group was significantly less accurate in their ability to judge emotion than a control group, controlling for differences in both age and verbal intelligence. While 53% of the experimental group produced impaired scores, only 4% of the control group produced similar scores. However, no significant differences existed between groups in terms of ear difference scores or binaural deficits in the perception of emotional tone of voice. These results suggest that 53% of the psychiatric patients may misperceive the tone of voice of someone speaking to them, contributing further to their misunderstanding of the intent of the speaker.

The above results have confirmed the first four hypotheses. That is, psychiatric patients compared to normal controls, have impaired speech comprehension, with

significant binaural relative to monaural deficits and larger left-right ear differences. Even when controlling for both verbal intelligence and age, psychiatric patients are also less accurate than normal controls in the identification of emotional tone in speech.

The fifth hypothesis was disconfirmed, however. There was no correlation between having a binaural deficit in speech comprehension and having a binaural deficit in terms of emotional perception. Further, significant differences did not exist between the psychiatric and control groups in terms of ear differences or binaural deficits in terms of emotional perception.

Two alternative explanations may be offered for the disconfirmation of the latter hypothesis. First, perhaps the speech stimuli on the EPT and ACT were not properly matched. That is, while the ACT speech stimuli consisted of a minimum of two sentences per paragraph, the speech stimuli on the EPT were single, short sentences. If the speech samples on the EPT were more complex, perhaps then, correlations between the binaural deficits on these two tests would have been significant. In other words, when interhemispheric interference or a binaural deficit occurred on the ACT, a similar one would also have occurred on the EPT. In support of this idea, it has already been shown that patients with unilateral temporal lobe lesions do not display monaural ear-differences in

the repetition of single words but do display such ear-differences on more complex tasks, such as the perception of accelerated speech (Korsan - Bengtsen, 1973).

A second explanation involves the lateralization of cerebral functions. Perhaps verbal content is actually processed by both cerebral hemispheres, with final analysis performed by the left hemisphere, while emotional processing is only performed by the right hemisphere. In this way, messages arriving at both ears would travel to opposite brain hemispheres for process[illegible] f verbal content. If processing at one hemisphe[illegible] was not congruent with processing at the other, then "inter-hemispheric interference" would occur, producing the message in a distorted fashion. Thus, a binaural deficit would be evident. However, with emotion, only one hemisphere would operate, and thus interhemispheric interference would not occur, and neither would a binaural deficit.

The sixth hypothesis was not borne out by the data. Unlike dichotic listening studies (Haggard & Parkinson, 1971; Ley & Bryden, 1982), no left-ear superiority in the identification of emotion in tone of voice was found. The author would like to offer a possible explanation for this difference. Perhaps under dichotic stimulation, emotional stimuli arriving at the right ear first travels contralaterally, and then over to the right hemisphere for

processing. In contrast, under monaural stimulation, emotional stimuli arriving at the right ear travels ipsilaterally to the right hemisphere, since there is no competing message from the left ear.

The seventh hypothesis was supported by the research findings. The Emotional Perception Test did correlate significantly with right hemisphere oriented tests, lending support to the contention that the EPT is a measure of right hemisphere functioning.

The eighth hypothesis was not borne out by the data. The EPT did not correlate significantly more highly with right hemisphere oriented tests than did the Auditory Comprehension Test. A possible explanation is that the ACT is also involved with right hemisphere processing since information arriving at the left ear is registered contralaterally.

Hypothesis nine was confirmed by the data. The results of the Vocabulary subtest did correlate significantly more highly with the results of the ACT than it did with the results of the EPT. This result supports the contention that the ACT is more left hemisphere oriented while the EPT is more sensitive to right hemisphere functioning.

CONCLUSION

In summary, the majority of the psychiatric patients

assessed were found to be impaired in their ability to comprehend the two most important aspects of speech, verbal content and emotional tone of voice. In addition, larger left-right ear differences and a greater mean deficit in binaural relative to monaural comprehension in terms of verbal content were found. No correlation was found between having a binaural deficit on the ACT and having a binaural deficit on the EPT. Similarly, unlike dichotic listening studies, no left-ear superiority for the identification of emotional tone in speech was found. The EPT did significantly correlate with other right hemisphere oriented tasks. As well, it correlated significantly lower with a left hemisphere task than did the ACT, supplying more support for the belief that the EPT is predominantly associated with the right hemisphere.

IMPLICATIONS

Clinical Practice

The results of the present study indicated that the majority of the psychiatric patients assessed were impaired in their ability to accurately comprehend what others say to them. Obviously, these impairments would contribute negatively to their social adjustment. As a result, these findings pose implications for clinical assessment and treatment.

The Emotional Perception Test appears to be a useful

instrument for assessing the ability of a patient in terms of understanding the tone of voice used in speech. Paired with the Auditory Comprehension Test, the clinician has empirical evidence as to the ability of a patient to correctly interpret the speech of another person. This information might be useful in assessing the problems of the patient and in structuring a treatment plan for the patient.

First, the patient might be informed of his impairment and provided with suggestions about how to get along socially. During a conversation with someone, it may be suggested that the patient check periodically with the other person, as to the accuracy of his/her understanding of their conversation together. For example, the patient could say "You mean.....", or "Let me see if I understand you correctly....". One could suggest that the patient have others write down important dates, times, and other information for his/her use, in case the patient does not comprehend the information correctly.

During a therapy session with the patient, the clinician should frequently ask for feedback to ensure that the patient is understanding the conversation. The patient might also be encouraged to keep a diary of his/her thoughts and feelings for later discussion with the therapist. It is the opinion of the writer that individual therapy would be most beneficial to the

patient. Group therapy would seem inappropriate since ensuring that each individual is comprehending correctly would be an impractical task.

In some cases, in whom there is a pronounced advantage of story recall under monaural compared to binaural conditions, the use of an earplug may be considered. While use of an earplug is a relatively new development, the rationale is based on empirical findings. The present study offers some supportive evidence for the advantage of one ear versus binaural comprehension in some patients.

Future Research

Firstly, further analysis is possible with the present data. One could rank order the emotions as to their ease in identification, as well as analyze which emotions are better understood under the three sentence structures: a statement, a request, and an interrogation. This could provide evidence as to the ease or difficulty patients experience when presented with mixed messages (when the verbal content and the emotional tone of voice in which it is spoken are not congruent).

Secondly, the Emotional Perception Test speech stimuli could be lengthened to match the difficulty of the speech stimuli on the Auditory Comprehension Test. Perhaps then, a binaural deficit on the ACT would result

in a similar binaural deficit on the EPT.

COMMENT

The present thesis has demonstrated that compared to samples of normal controls, psychiatric patients indeed experience difficulty in comprehending the two major components of speech. It is not surprising, then, that psychiatric patients have considerable difficulty communicating with others or for others to communicate with them. Since understanding the speech of another is so important for social adjustment, it is the hope of the writer that more clinicians will take advantage of assessment techniques which aid in determining the comprehension ability of their clients.

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APPENDICES

APPENDIX 1

RESEARCH QUESTIONNAIRE

Number____ Sex____ Age____ Date of Birth____/____/____

Please complete the following questionnaire. Your responses will be kept strictly confidential.

1. Have you ever had a head injury which led to unconsciousness for any period of time?

   YES_____ NO_____

2. Have you ever had any neurological condition?

   YES_____ NO_____

3. Have you ever sought treatment for any psychiatric or emotional problem?

   YES_____ NO_____

4. Do you have any hearing loss?

   YES_____ NO_____

5. Are you presently taking any psychotropic medication?

   YES_____ NO_____

Thank you for your cooperation.

APPENDIX 2

EXPERIMENTAL ASSESSMENT BOOKLET PAGE 1

Tester: _____

Name: _____ Age: _____ Sex: _____

Date of Birth: ___/___/___ Date of EPT Test ___/___/___

Hospital Ward: _____

EPT Results	ACT Results
Listening Conditions	Recall
L =	L =
R =	R =
B =	B =

Emotional Tones:	Other Tests:
H =	Vocabulary Subtest Scaled Score: _____
N =	Estimated Verbal IQ: _____
S =	Block Design Subtest Scaled Score: ___
A =	BVRT Error Score: _____
F =	

Speech Samples:	Notes on Test Behavior:
1 =	
2 =	
3 =	

INSTRUCTIONS FOR EXAMINER

The following pages are for recording and scoring the subject's responses. Scoring proceeds from left to right on the record form. Below are keys to the abbreviations contained on these pages.

LISTENING CONDITIONS

L = Left Ear Listening Condition

R = Right Ear Listening Condition

B = Binaural Listening Condition

EMOTIONAL TONES

H = Happy

N = Neutral

S = Sad

A = Angry

F = Frightened

SPEECH SAMPLES

1 = Statement "The store is crowded with people."

2 = Request "Would you take the door on the left, please."

3 = Interrogati "Why didn't you call me at work this afternoon?"

Below is an example of the scoring format.

(L) R B

H (N) S A F

1 F [X]

1. Circle the appropriate listening condition.

2. Circle the subject's response for the emotional tone of voice.

3. By comparing the subject's response

with the answer given immediately to the left of the square, the subject's response can be determined to be correct or incorrect. If correct, leave the square blank. If the response is incorrect, put an X in the square.

In the above example, the statement "The store is crowded with people" is spoken in a frightened voice (1F). The subject responded "neutral" which is incorrect, so an X is placed in the square.

The bottom of the last page provides space for recording the total number of errors in each of the three listening conditions, the total number of errors for each of the three sentence structures, and the total number of errors for each of the five emotional tones of voice.

EMOTIONAL PERCEPTION TEST

Circle L, R, or B
to indicate condition.

L R B	L R B	L R B
H N S A F 1 H ☐	H N S A F 2 A ☐	H N S A F 3 F ☐
H N S A F 2 N ☐	H N S A F 3 H ☐	H N S A F 1 A ☐
H N S A F 2 H ☐	H N S A F 1 F ☐	H N S A F 3 A ☐
H N S A F 3 F ☐	H N S A F 1 H ☐	H N S A F 2 N ☐
H N S A F 3 S ☐	H N S A F 2 F ☐	H N S A F 1 N ☐
H N S A F 3 A ☐	H N S A F 2 H ☐	H N S A F 1 F ☐
H N S A F 1 S ☐	H N S A F 3 S ☐	H N S A F 2 S ☐
H N S A F 2 F ☐	H N S A F 1 A ☐	H N S A F 3 N ☐
H N S A F 1 F ☐	H N S A F 2 S ☐	H N S A F 3 H ☐
H N S A F 1 N ☐	H N S A F 2 N ☐	H N S A F 3 S ☐

Circle L, R, or B
to indicate condition.

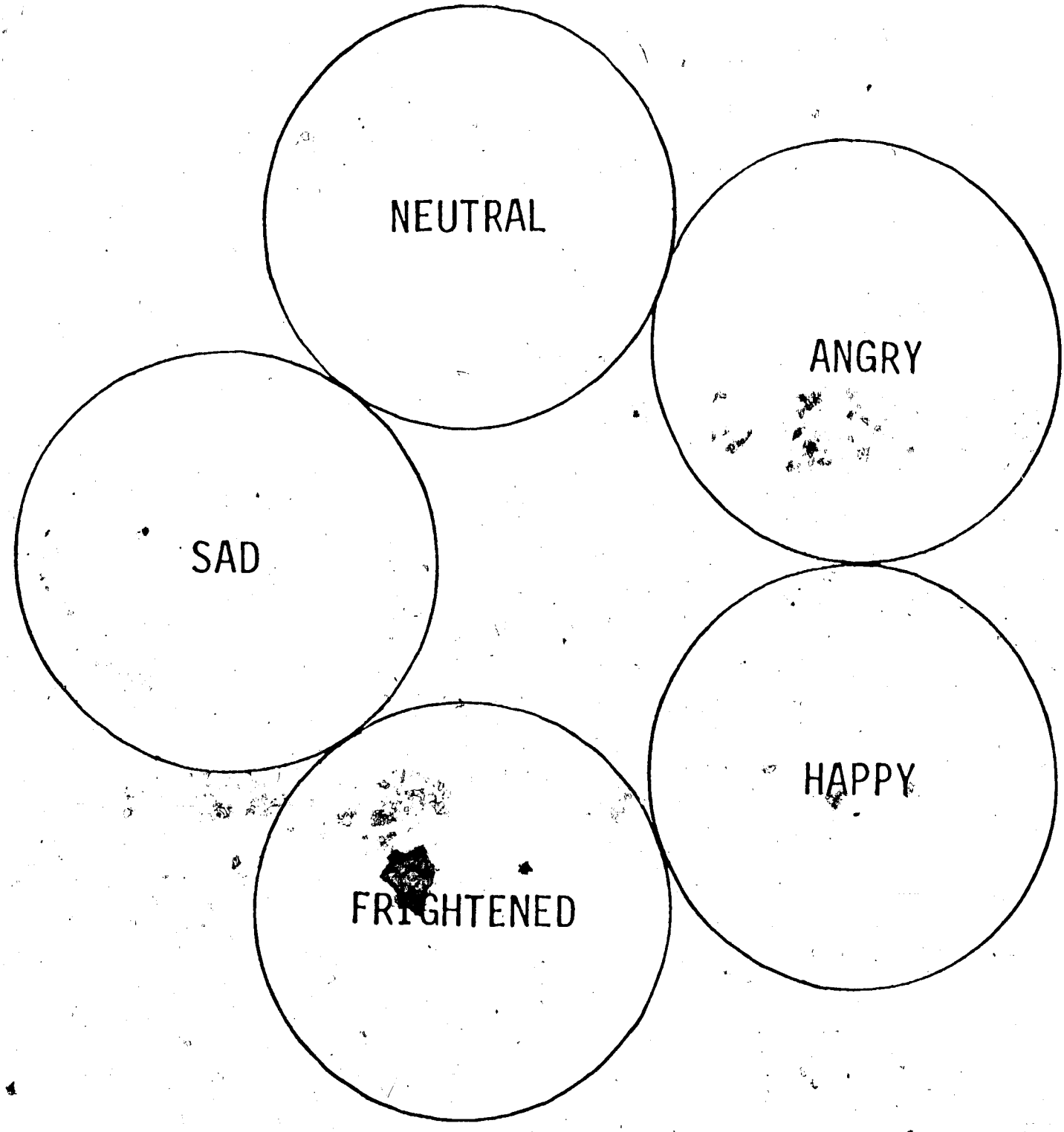
L R B	L R B	L R B
H N S A F 2 A ☐	H N S A F 3 N ☐	H N S A F 1 H ☐
H N S A F 3 H ☐	H N S A F 1 N ☐	H N S A F 2 F ☐
H N S A F 3 N ☐	H N S A F 1 S ☐	H N S A F 2 H ☐
H N S A F 2 S ☐	H N S A F 3 F ☐	H N S A F 1 S ☐
H N S A F 1 A ☐	H N S A F 3 A ☐	H N S A F 2 A ☐

SUMMARY OF SCORES

L	R	B

	1	2	3	H	N	S	A	F
L								
R								
B								
TOTALS								

APPENDIX 3



APPENDIX 4

CONTROL GROUP I

			BPT Listening Conditions (# Incorrect)				BPT Sentences (# Incorrect)			BPT Emotional Tones of Voice (# Incorrect)					
Sub. No.	Age	Sex	L	R	B	Avg.	1	2	3	HAP	NEW	SAD	ANG	PRT	VIQ
150	31	F	7	6	5	6.0	1	8	9	6	0	1	7	4	97
149	22	F	6	8	4	6.0	3	7	8	5	1	0	5	1	82
148	45	F	2	3	3	2.7	0	4	4	3	1	0	4	0	101
146	33	M	2	3	5	3.3	1	6	3	2	0	2	5	1	91
144	32	M	5	5	8	6.0	5	6	7	9	2	0	6	1	91
143	23	F	3	4	3	3.3	2	4	4	6	0	0	3	1	101
140	31	F	4	4	4	4.0	2	4	6	5	2	1	1	3	91
138	33	F	5	6	4	5.0	3	8	4	3	2	1	6	3	97
136	44	M	7	4	4	5.0	3	7	5	6	1	0	6	2	82
134	50	F	4	3	4	3.7	2	4	5	3	1	0	4	3	91
133	25	F	5	5	3	4.3	3	5	5	4	3	0	4	2	77
132	25	F	0	3	2	1.7	3	0	2	0	2	0	2	1	97
130	24	F	2	3	0	1.7	2	2	1	2	0	0	1	2	94
129	29	F	6	4	5	5.0	3	5	7	7	0	0	5	3	97
128	44	F	6	6	2	4.7	2	7	5	4	3	3	2	2	95
124	26	F	4	1	3	2.7	0	6	2	2	1	0	2	3	91
123	28	F	7	7	3	5.7	4	7	6	7	0	2	4	4	87
122	27	F	4	4	4	4.0	2	4	6	8	1	0	1	2	97
121	18	F	2	2	1	1.7	1	1	3	3	0	0	0	2	100
120	43	F	2	3	3	2.7	2	4	2	2	1	3	1	1	99
119	22	F	4	1	2	2.3	1	3	3	1	4	0	4	1	101
116	40	F	6	6	6	6.0	4	8	6	5	0	4	5	4	84
112	37	F	2	4	3	3.0	2	2	5	4	1	0	3	1	95
107	39	F	8	8	7	7.7	6	10	7	3	4	7	6	3	95
106	42	F	3	5	5	4.3	0	8	5	5	3	0	3	2	84
103	31	M	3	3	2	2.7	2	2	4	2	1	0	4	1	97
102	22	F	5	5	6	5.3	5	7	4	6	1	0	7	2	94
101	24	F	3	5	3	3.7	3	6	2	5	1	0	4	1	101

APPENDIX 5

CONTROL GROUP II

				Auditory Comprehension Test		
Subject No.	Sex	Age	Verbal IQ	L. Score	R. Score	B. Score
3	F	22	101	96	103	82
4	F	42	99	81	86	94
5	F	48	96	88	97	89
6	F	37	99	74	93	98
10	F	21	101	115	103	116
12	F	28	87	84	86	93
13	F	41	99	106	111	98
14	F	23	101	95	87	104
15	F	33	97	131	124	119
17	F	45	96	109	114	106
18	F	29	91	92	84	107
19	F	39	99	86	83	94
20	F	43	95	87	97	90
21	F	43	95	91	97	96
22	F	35	99	83	96	97
24	F	44	95	110	106	91
25	F	35	95	80	81	77
26	F	20	82	85	84	94
27	F	21	94	103	105	104
29	F	43	95	112	109	113
31	F	34	97	92	96	95
33	F	25	91	110	104	104
35	F	23	88	118	117	111
36	F	20	101	101	95	90
37	M	27	91	101	93	96
40	F	47	91	75	68	83
41	F	29	87	115	108	110
43	F	42	95	91	89	108
44	F	29	81	81	85	89
45	F	47	101	75	86	87
46	F	23	88	90	101	83
47	F	21	101	98	106	98
48	F	21	94	98	89	89
49	F	22	94	108	110	96
50	F	23	94	98	100	105
51	M	21	88	70	84	76

APPENDIX 6

EXPERIMENTAL GROUP

			EPT Listening Conditions (# Incorrect)			EPT Sentences (# Incorrect)			EPT Emotional Tones of Voice (# Incorrect)				
Sub. No.	Age	Sex	L	R	B	1	2	3	H	N	S	A	F
201	37	F	6	6	5	2	9	[illegible]	4	3	4	2	4
202	26	F	6	4	2	1	5	6	2	3	0	3	4
203	24	F	5	3	5	1	5	7	3	2	2	4	2
[illegible]	28	F	4	4	4	2	8	2	1	2	0	5	4
[illegible]5	25	F	12	12	11	12	12	11	8	6	8	5	8
206	51	M	8	10	7	7	8	10	3	7	2	7	6
207	13	F	8	6	5	2	9	8	1	5	4	7	2
208	28	M	5	4	3	3	4	5	7	0	0	2	3
209	19	F	8	10	6	6	9	9	5	2	8	1	8
210	24	F	8	8	5	5	10	6	2	3	3	5	8
212	43	M	7	5	8	5	8	7	9	0	5	4	2
213	34	F	5	3	2	2	6	2	4	0	0	4	2
214	57	F	8	9	7	8	9	7	9	4	3	5	3
215	23	M	6	6	7	4	8	7	6	4	2	4	4
216	65	F	8	9	8	6	[illegible]	10	5	5	1	6	8
217	50	F	5	9	7	4	10	7	7	1	2	7	5
218	[illegible]	F	4	5	6	0	8	7	5	1	1	2	6
219	29	F	3	3	4	1	6	3	1	0	1	4	4
220	17	M	5	6	4	1	10	4	4	3	1	4	3
221	17	M	4	7	5	1	8	7	5	3	1	1	6
223	50	F	10	9	6	7	9	9	7	4	4	2	8
224	43	F	6	7	6	4	9	6	3	4	3	6	3
225	60	M	10	12	11	10	11	12	7	4	8	9	5
226	19	F	6	8	9	7	7	9	8	6	6	1	2
227	26	M	4	6	2	3	3	6	3	5	1	0	3
228	44	M	12	12	12	12	12	12	9	0	9	9	9
230	23	M	9	11	10	9	10	11	7	8	9	2	4
231	24	M	1	4	1	1	4	1	0	2	0	3	1
232	22	F	5	4	2	1	4	6	5	3	0	1	2
233	28	F	2	0	3	2	3	0	0	0	2	2	1
234	46	M	11	10	11	11	11	10	4	9	6	6	7
235	27	F	3	3	4	1	4	5	2	3	0	4	1

EXPERIMENTAL GROUP (continued)

Sub. No.	Auditory Comprehension Test L	R	B	BVRT BBR	VOC SUB	BD SUB	VIQ
201	112	112	108	999	15	999	134
202	36	53	43	6	5	5	73
203	108	124	113	1	8	8	87
204	12[illegible]	122	116	999	13	9	100
205	[illegible]	45	36	999	[illegible]	[illegible]	64
206	71	93	73	6	[illegible]	9	92
207	67	29	39	4	[illegible]	8	70
208	97	86	107	999	[illegible]	9	97
209	67	75	83	999	[illegible]	8	86
210	85	100	103	13	[illegible]	8	98
212	116	108	89	4	13	8	106
213	34	48	35	17	6	5	89
214	33	26	32	999	7	8	82
215	58	59	64	1	5	14	79
216	68	85	68	15	9	5	97
217	59	47	60	8	8	5	91
218	60	58	65	999	5	8	7[illegible]
219	74	58	78	4	11	8	103
220	70	74	71	5	9	12	111
221	125	112	99	1	10	16	108
223	31	35	27	23	6	3	78
224	61	65	70	15	8	6	86
225	64	61	68	10	7	7	93
226	35	42	41	8	6	6	80
227	[illegible]	107	87	3	12	13	111
228	50	55	47	8	8	10	90
230	98	85	112	4	10	13	97
231	53	54	54	0	10	11	97
232	140	124	139	5	14	11	125
233	86	73	85	3	8	14	84
234	30	60	41	14	3	4	64
235	94	98	80	8	10	8	97

999 = Missing Data

APPENDIX 7

EXPERIMENTAL GROUP

PSYCHIATRIC DIAGNOSIS

Sub. No.	Diagnosis
201	Dependent Personality, Dysthymic Disorder (Neurotic Depression)
202	Bipolar Affective Psychosis-Manic, Marital Problems
203	Major (Recurrent) Depression, Dependent Personality
204	Dysthymic Disorder
205	Mild Mental Retardation
206	Schizo-affective Psychosis
207	Organic Delusional Syndrome, Secondary to Substance Abuse and Head Injury; Mental Retardation, Borderline
208	Organic Affective Syndrome, Cannabis Abuse
209	Avoidant Personality Disorder
210	Schizo-affective Psychosis
212	Schizophrenia, Paranoid, Chronic with Acute Exacerbation
213	Dissociative Disorder
214	Major Affective Disorder, Depression, Psychotic Features
215	Adjustment Disorder with Mixed Emotional Features, Alcohol Abuse
216	Major Depression, Recurrent; Hypothyroidism
217	Schizo-affective Psychosis
218	Dysthymic Disorder, Simple Phobia, Dependent Personality Disorder
219	Bipolar Disorder, Depressed; Inhibited Sexual Desire
220	Organic Affective Syndrome/Cannabis Abuse
221	Family Conflict, Schizoid Personality
223	Chronic Schizo-Affective Psychosis
224	Alcohol Abuse, Phase of Life Problem
225	Dysthymic Disorder, Immature Personality
226	Schizophrenic Disorder, Borderline Intellectual Functioning
227	No Diagnosis (Staff)
228	Chronic Paranoid Schizophrenia
230	Depression with Catatonic Features, Personality Disorder
231	Delusional Disorder, Cannabis Abuse
232	Dysthymic Disorder, Histrionic Personality Disorder, Parent-Child Problem (incest)
233	Substance Abuse, Drug Induced Psychosis, Psychopathic Personality Traits, Borderline Personality
234	Substance Abuse (Valium) and Withdrawal
235	Major Depression, Recurrent; Borderline Personality

APPENDIX 8

EXPERIMENTAL GROUP

PATIENT MEDICATIONS AT TIME OF EMOTIONAL PERCEPTION TEST

Sub. No.	Medications
201	Ditropan, Rivotril, Parnate, Ortho-Novum 1:80
202	Lithium Carbonate, Trimipramine
203	Elavil, Chloral Hydrate, Tegretol, Surfak
204	Tofranil, Propranalol
205	Tetracycline, Chloral Hydrate
206	Cogentin, Haloperidol, Lithium Carbonate
207	No Medication
208	Lithium Carbonate, Tegretol
209	Nardil
210	Lithium Carbonate, Halcion, Stelazine
212	Methotrimeprazine
213	Elavil, Stelazine, Cogentin
214	Clomipramine, Pimozide, Surfak
215	Tylenol
216	Valium, Halcion
217	Surfak, Lithium Carbonate, Clomipramine, Ampicillin
218	Tegretol, Cimetidine, Benadryl, Ortho 7:7:7
219	Lithium Carbonate, Anafuanil, Ativan, Cloxacillin, Mellauil, Disipal
220	Stelazine, Cogentin, Lithium Carbonate
221	Penicillin
223	Chloropromazine, Stelazine, Elavil, Synthroid, Cogentin, Diabeta
224	Dalmane
225	Chloral Hydrate, Surmontie
226	Cogentin
227	Staff Member - Medication (if any) unknown
228	Cogentin
230	Elavil
231	Lithium Carbonate
232	No Medication
233	Ferrous Gluconate, Cogentin
234	Chloral Hydrate
235	Nardil, Chloral Hydrate, Surfak, Ortho 10:11

Note: Medication list may be incomplete due to possible PRN (administer when necessary) medications.

APPENDIX 9

TABLES OF SPLIT-HALF, TEST-RETEST, AND ALTERNATE FORMS RELIABILITIES FOR NORMAL ADULTS AND CHILDREN, LEARNING-DISABLED CHILDREN, AND ADOLESCENTS WITH PSYCHIATRIC PROBLEMS.

1 SPLIT-HALF RELIABILITIES FOR NORMAL CHILDREN AND ADULTS ON THE ACT, FORMS I AND II. MEAN ACT SCORES AND AGES HAVE STANDARD DEVIATIONS (S.D.) IN BRACKETS BELOW THEM.

GROUP	ACT FORM (I or II)	MEAN PLUG FORM A SCORE (S.D.)	MEAN PLUG FORM B SCORE (S.D.)	CORRELATION BETWEEN PLUG FORMS A & B	p =	SPLIT-HALF RELIABILITY COEFFICIENT
52 NORMAL ADULTS	FORM I	152.73	152.40	r = 0.9045	0.0000	0.95
132 NORMAL CHILDREN	FORM I	135.97 (33.1)	129.30 (32.1)	r = 0.9401	0.0000	0.97
10 NORMAL ADULTS	FORM II	157.20 (21.1)	147.00 (16.9)	r = 0.8432	0.0025	0.91
40 NORMAL CHILDREN	FORM II	131.05	125.13	r = 0.9328	0.0000	0.96

2 TEST-RETEST AND ALTERNATE FORMS RELIABILITY COEFFICIENTS FOR NORMAL ADULTS AND CHILDREN, LEARNING-DISABLED CHILDREN, AND ADOLESCENTS WITH PSYCHIATRIC PROBLEMS. MEAN ACT SCORES AND AGES HAVE STANDARD DEVIATIONS (S.D.) BELOW THEM IN BRACKETS.

GROUP	WHICH FORM(S)	MEAN ACT SCORE 1st TEST GIVEN (S.D.)	MEAN ACT SCORE 2nd TEST GIVEN (S.D.)	CORRELATION BETWEEN TEST AND RETEST	MEAN TIME BETWEEN TESTS	TYPE OF RELIABILITY
20 NORMAL ADULTS	FORM I	98.80 (10.5)	109.28 (12.6)	r = 0.8848 (p = 0.0003	22 days	TEST-RETEST RELIABILITY
10 NORMAL ADULTS	FORM I and FORM II	104.37 (12.2)	101.40 (12.2)	r = 0.8895 (p = 0.0008)	4 YEARS	ALTERNATE FORMS RELIABILITY
40 NORMAL CHILDREN	FORM I and FORM II	92.47 (20.4)	84.79 (23.9)	r = 0.9135 (p = 0.0000	1 DAY	ALTERNATE FORMSX RELIABILITY
50 LEARNING DISABLED CHILDREN	FORM I	76.13 (19.9)	90.27 (19.8)	r = 0.8539 (p = 0.0000	1 YEAR	TEST-RETEST RELIABILITY
19 PSYCHIATRIC ADOLESCENTS	FORM I	67.68 (26.2)	62.07 (25.1)	r = 0.9694 (p = 0.0000	NOT KNOWN	TEST-RETEST RELIABILITY

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