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Identification of affectively intoned speech in a group of right hemisphere brain-damaged patients using audio vs. audio-visual stimuli.

Paula Avallone

The University of Montana

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IDENTIFICATION OF AFFECTIVELY INTONED SPEECH
IN A GROUP OF RIGHT HEMISPHERE BRAIN-DAMAGED PATIENTS
USING AUDIO VS. AUDIO-VISUAL STIMULI

by

Paula Avallone
B.S., Boston University, 1975

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ABSTRACT

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Identification of affectively intoned speech in a group of right hemisphere brain-damaged patients using audio vs. audio-visual stimuli

Director: Frances Tucker, M.A.

Recent research has documented cases of right-hemisphere brain-damaged patients who have lost their ability to comprehend affectual/emotionally intoned speech. However, the possible effects of presentation mode have not been investigated. This pilot study presented a series of 30 simple, active, affirmative, declarative, emotionally intoned sentences to a group of six right-hemisphere brain-damaged adults. Sentences, validated by normal adults, were randomly presented either auditorily or audio-visually to determine whether or not method of presentation would aid in better identification of the emotions conveyed. The results indicated that, for this group of brain-damaged patients, presentation method made no difference in performance. In addition, overall test performance (audio and audio-visual) was poor for all of the subjects: only two subjects scored better than 50%. Theoretical and practical implications of these preliminary results are discussed.
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The speech pathology literature is abundant with information about characteristics, assessment, and management of individuals who have been the victims of strokes, traumatic head injuries, or diseases involving the left hemisphere of the brain. A paucity of research in our field has been devoted to the effects of right-hemisphere brain-damage on communication. The little that has been done is found primarily in neurology journals, despite the fact that a significant number of these patients display varying degrees of communication disorders. Their speech has been characterized as copious and inappropriate, confabulatory, and occasionally bizarre (Brookshire, 1978; Gardner, Ling, Flamm, and Silverman, 1975). Myers and West (1978) in a round-table discussion presented the following as the most notable communication deficits among right-brain-damaged patients: 1) lack of sensitivity, 2) inappropriate behavior, 3) denial of cognitive deficits, 4) irrelevant conversation, 5) a dissociation between what is said and what is being experienced, 6) lack of affect, and 7) extreme lability, described as inappropriate laughing or crying.

The significance of these deficits is important for several
reasons. First, these individuals report that during emotional outbursts they are not necessarily experiencing the inner emotion which is conveyed overtly to the listener. Thus, the behavior of these individuals is often labelled "inappropriate and insensitive". Second, these individuals are sometimes unable to convey, either through facial gestures or emotional intonations, feelings that they are experiencing internally. As a result they are often misdiagnosed as depressed or indifferent (Ross and Mesulam, 1979; Tucker, Watson, and Heilman, 1977). Third, some of these individuals have been reported to be incapable of comprehending the affectual/emotional components of language: the pitch, tempo, and tonal contours. Heilman, Scholes, and Watson (1975) describe the problem as an inability in processing "how" something is said, yet propositional language remains intact. Stated differently, they process "what" is said but not "how" it is intended.

While the left hemisphere for most individuals has been documented as the major hemisphere involved in language comprehension, formulation, and expression, the role of the right or "silent hemisphere" was thought to contribute little to language per se, and more to other cortical functions. Control of visual-spatial perception and memory, and musical or tonal abilities are a few of the more important functions of the right hemisphere as documented by the works of Kimura (1969), and reported by other researchers in Springer and Deutsch's (1981) text. Bogan (1969) describes the right hemisphere as having "a highly developed 'apositional' capacity, implying a capacity for apposing or comparing of
When the components of language are discussed and analyzed, the most frequently mentioned characteristics are: pragmatics, semantics, syntax, and articulation. Frequently neglected are the supra-segmental aspects of language, specifically, prosody (pitch, length, intensity, stress, and tempo) and facial gesturing. Ross et al. (1979) demonstrated that these two supra-segmental aspects of language are crucial in conveying the emotional, and thus affective, tones conveyed in speech. They reported on two case studies of patients who suffered prosodic losses following infarcts to the right hemisphere. Both patients were unable to modulate the tone of their voices and spoke in essentially a monotone quality. In addition, they were unable to make facial gestures spontaneously or through imitation, yet both were able to accurately perceive and interpret the emotions of others. Computerized tomographic (CT) scans showed that the lesions were around the right middle-cerebral artery, above the Sylvian region, sparing the temporal lobes. Tucker et al. (1977) report similar findings in patients with right parietal lobe disease who are incapable of producing emotionally intoned speech. These authors found that best performance was observed when the true emotion being elicited was indifference.

Similar deficits have also been noted in the comprehension of affectively intoned speech with the same population (Heilman et al. 1975; Heilman and Valenstein, 1980; Schlanger, Schlanger, and Gerstman, 1976; Tucker et al. 1977). One of the earliest studies conducted examined comprehension of the affective aspects
of speech in a group of right-brain-damaged patients. Heilman et al. (1975) presented 32 tape-recorded sentences (16 conveying content, 16 conveying emotional affect) with corresponding line drawings, to 12 patients, six with right temporoparietal lesions and six with left temporoparietal lesions. Their results showed that both groups of subjects scored 100% on judging the content sentences, however, the right-hemisphere brain-damaged subjects did significantly poorer than the left hemisphere group on judging emotional affect. Facial agnosia and left neglect were ruled out as causal factors for poor performance since these variables were controlled. Similar results were found by Tucker et al. (1977) when they set out to determine if right brain-damaged subjects could 1) judge by naming the emotion conveyed, and 2) discriminate if same or different emotions were being presented. The right brain-damaged subjects in this study had significantly more difficulty than the left brain-damaged group in judging emotional states and in describing whether emotional tones were same or different. The majority of these right-brain-damaged subjects suffered lesions in the temporoparietal area, as did the subjects in the Heilman et al. (1975) study.

A similar study conducted by Schlanger et al. (1976) failed to support the findings of the previous investigators. These authors presented a series of 60 tape-recorded sentences conveying three emotions (happy-sad-angry) to 40 aphasics (20 highly verbal and 20 low verbal), and to 20 right-brain-damaged subjects. (Of the 20 with lesions in the area of the right middle cerebral artery,
only three were temporoparietal lobe lesions.) Their results indicated that no significant differences existed in performance between the right brain-damaged group and either of the two aphasic groups in identifying emotions. Several factors could have accounted for the differences between the Schlanger et al. (1976) results and those of Heilman et al. (1975) and Tucker et al. (1977). As was pointed out in the Schlanger et al. (1976) article, their task may not have been sufficiently discriminating, or neglect may have contributed to poorer performance in the other two studies. Another possibility offered by Tucker et al. (1977) is that the site of lesion was not controlled for in the Schlanger et al. (1976) study. Still another possibility for all studies discussed above is the extent or severity of the brain damage, which was not discussed.

Disorders of affect can interfere with communication directly or indirectly and may reflect an emotional, or an auditory comprehension deficit, specifically for tonal distinctions. Patients can be mislabeled and thus mismanaged without fully appreciating the extent of their problems. Their inability to use facial gesturing, in some cases, or modulate the tone of their voice when interacting with members of the family or friends, leads to misinterpretations of insensitive and uncaring individuals. Likewise, their inability to comprehend others' emotional moods may result in inappropriate responses to the message being conveyed. Since the right hemisphere has been documented by Ross (1981) as being more important in mediating the prosodic components of language, further empirical data are needed to determine the extent to which
the right hemisphere is involved and how lesions to this side of
the brain affect communication. This will enable the clinician to
have a better understanding of the problems these patients present
to the untrained observer, and will enable them to counsel the patient,
family, and significant other care providers. In addition, arriving
at appropriate management programs is of utmost importance.

Since the previous studies used auditory presentation only,
the question was raised about the affects of adding visual cues.
The purpose of this pilot study was to investigate whether having
visual cues affects the right-hemisphere brain-damaged patient's
ability in identifying various emotions conveyed during speech.
Specifically, the question asked was: Will differences in performance
exist in the ability to accurately identify emotions conveyed
through speech when two different modes—audio vs. audio-visual—are
used?
Subjects

Six non-aphasic, right brain-damaged adults, recovering from cerebral vascular accidents at the Veterans Administration Medical Center in Seattle, participated in this pilot study. Diagnosis of right brain damage was confirmed by CT Scans. Information regarding etiologies and site of lesion is summarized in Appendix A. Eligibility criteria for this study included general alertness, defined as orientation to time and place, absence of significant hearing or visual acuity impairments, an ability to follow spoken directions, and an absence of aphasia. Significant other medical complications, including coronary and pulmonary disease, and histories of prior alcohol abuse, could not be ruled out for all patients; however, no evidence of generalized cognitive impairments were noted for any of the 6 subjects, as seen on the learning modalities profiles in Appendix B.

Prior to inclusion in the study, subjects passed preliminary screenings for hearing sensitivity. These tests were performed by an audiologist and required a speech-reception threshold score within normal limits ($\leq$25 dB HL). Auditory comprehension was measured
using the Language Comprehension subtests of the Learning-Language Battery developed by and used at the Seattle Veterans Administration Medical Center. These subtests are contained in Appendix C and are a modification of the Schuell's Short Exam for Aphasia. Appendix D has the raw scores for each subject on the Language Comprehension Subtests. A score of 35 out of a possible 40 was required. Any subject showing evidence of debilitating visual acuity impairment such that they could not perform the required task was excluded from the study.

Five normal adult volunteers participated in this study for purposes of validating the emotions being tested. They received the same instructional set used with experimental subjects. Due to time limitations, normal subjects were not matched for sex, age, education level or socioeconomic status with the brain-damaged group.

Stimulus Sentences

Five simple, active, affirmative, declarative sentences (SAAD), void of emotional words, were arbitrarily chosen, then read and recorded by a speech pathologist other than this investigator. Each of the five different sentences were read conveying three different emotional tones: happy, sad, and angry. No attempt was made to control for rate of speech. A random recording was done so that half of the sentences were presented auditorily and half presented audio-visually; thus a battery of 30 sentences was comprised. These sentences are contained in Appendix E. A Sony AV-3650 Solid State Videocorder, with ½" reel-to-reel tape, was
used to record and reproduce the sentences for purposes of consistency throughout test administration. A 10-second inter-stimulus interval was used between sentence presentations.

**Procedures**

Five, 5"x8" index cards, with the printed words for the three emotions and two foils (indifference and sarcasm), were placed on a table in front of the subject. The arrangement of the response items is shown in Appendix F. (The cards were arranged slightly to their right side to control for neglect.) Subjects were required to read each word before the instructional set was given. All subjects received the same instructions, and were asked to repeat the task to confirm their understanding. If there was any doubt about comprehension of the task, instructions were re-worded. Prior to beginning the tape, subjects were asked if they were ready. When extraneous comments were made between sentences, the subject was reminded to watch and listen for the next sentence.

Each sentence was scored as a plus (+) or minus (−). An overall raw score (number correct out of 30) was obtained, in addition to total raw scores for each presentation category (number correct out of 15).
CHAPTER III
RESULTS

Performance for Normals

Table 1 depicts the group means and standard deviations of the correct responses for each presentation mode for the normal volunteers. Because of the small N for this group, statistical tests were not administered. Since all of the normal volunteers, with the exception of Subject 5, received scores of 100% on both audio and audio-visual presentation, the emotions were viewed to be validly portrayed.

<table>
<thead>
<tr>
<th>Presentation Mode</th>
<th>Audio</th>
<th>Audio-Visual</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAN # CORRECT</td>
<td>14.6</td>
<td>15</td>
</tr>
<tr>
<td>(out of 15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STANDARD DEVIATIONS</td>
<td>.89</td>
<td>0</td>
</tr>
</tbody>
</table>

TABLE 1. Group means and standard deviations of the correct responses for the 5 normal volunteers on the test battery.

Performance for the Brain-Damaged Subjects

Table 2 depicts the raw scores, group means, and standard deviations of the correct responses for each presentation mode for the brain-damaged subjects, on the sentence battery. These scores
Indicate relatively poor performance on the test battery. Only two of the six subjects achieved scores better than 50% correct (subject 1 = 53%, subject 2 = 57%); the remaining subjects achieved scores ranging from 13%-37% correct. Only two of the six subjects had higher scores with audio-only presentation, while the remaining four had higher scores with audio-visual presentation. However, a Wilcoxon Matched-Pair Signed Ranks non-parametric statistic failed to show any significant differences between the individuals' audio vs. audio-visual scores (T=7, N=6, p>.05).
categories. All tests failed to reach significance (\( \alpha = .05 \)), suggesting that responses to emotional tones were random.

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Happy</th>
<th>Sad</th>
<th>Angry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

**MEAN # CORRECT**

(out of 10) 3.83 4.33 3.17

**STANDARD DEVIATIONS**

1.72 2.42 2.93

TABLE 3. Raw scores, group means, and standard deviations of correct responses for the 6 brain-damaged subjects by emotional category.

In five of the six cases, subjects responded with literal interpretations, without regard to the prosodic intonation of the sentence. For instance, to the stimulus sentence, "The rabbit is running through the yard," such responses as, "Kill em," and "I wonder if they ever caught the rabbit running through her yard," were recorded. To the stimulus sentence, "The dog is eating the ice cream," responses such as, "She's mad cuz the dog is eating her ice cream", and "I bet the dog got sick from eating all that ice cream", were recorded.
Although the sad category had a slightly higher percentage of correct responses than either happy or angry (43%, 38%, and 32% respectively), these differences were not significant. Of the 34 total sads perceived incorrectly across all subjects, 41% (14) were perceived as indifference. This is not surprising since the prosodic intonation of sadness and indifference are perceptually very similar. That is, the prosodic intonation for sadness is a gradual downward inflection; for indifference, it is primarily flat with a possible slight downward inflection on the end of the statement.
CHAPTER IV
DISCUSSION

The present study was designed to investigate whether accurate identification of emotions conveyed during speech differed as a function of audio vs. audio-visual presentation for right brain-damaged individuals. The results indicated that for this group of right brain-damaged subjects, method of presentation made no difference in performance and the subjects scored poorly regardless of presentation mode. Thus, the right brain-damaged subjects appear to be severely impaired in their ability to accurately interpret emotions conveyed during speech. Assuming that the right hemisphere is dominant in the recognition of melodic or tonal patterns (Springer and Deutsch, 1981), and other factors prevalent in prosody (Heilman et al., 1980), it is not surprising that these patients did poorly on this task since the underlying non-verbal components conveying affect are the suprasegmental aspects of prosody: pitch, inflection, stress, and tempo, as stated by Paul (cited in Heilman et al., 1975).

This study lends support to previous research (Heilman et al., 1975; Tucker et al., 1977) that right brain-damaged subjects do significantly poorer than normals, and, in some cases, left brain-damaged subjects, in comprehending and discriminating affectively
intoned speech. In addition, analysis of the types of responses the subjects of the present study gave lends further support to previous research which found that right brain-damaged subjects interpret literally much of what is presented to them, thereby missing the subtleties of the language (Gardner et al., 1975; Myers and Linebaugh, 1981; Winner and Gardner, 1977). These authors found that groups of right brain-damaged subjects gave literal interpretations to material that was intended to be humorous and metaphorical. Gardner et al. (1975) nicely sum up these patients as resembling "sophisticated language machines, responding appropriately to linguistic messages, but relatively insensitively to the non-linguistic information" (p. 409). That is, the right brain-damaged patient responds appropriately to propositional but inappropriately to affectual speech. In the present study five of the six subjects did not respond to the intended affect or emotion being conveyed but instead responded literally to the proposition of what was being said. Their responses suggested that they were internalizing the events as they heard the sentences.

**Theoretical Implications**

According to these preliminary results, one concludes that presentation method (audio vs. audio-visual) makes no difference. Why did these right-hemisphere brain-damaged patients perform so poorly regardless of presentation mode? Is it the result of an inability to adequately integrate the sensory information they were receiving? Two different types of auditory input should have been
received: 1) the propositional, and 2) the affectual information. Through the visual channel, only the facial gestures should have been received. The results of this study seem to suggest that in five of six cases, subjects were responding to one piece of information only—the propositional information—while disregarding the other information. Had these subjects truly integrated all of the sensory information, the emotions under test should have been perceived accurately.

This raises another issue. Did these subjects comprehend the emotions in question? Following the test battery, five of the six subjects were interviewed to determine whether their poor performance was the result of an inability to comprehend the emotions, or a reflection of a prosodic recognition impairment. (The one remaining subject was discharged before he could be interviewed.) All of the subjects were able to appropriately define events or people which made them happy, sad, or angry. This information appears to support the notion that rather than a comprehension deficit, a perceptual or other integration deficit may be interfering with their ability to accurately identify the emotions of others. This view has been supported indirectly by the previous literature that discusses the role of the minor hemisphere in the perception of visual-spatial recognition, facial recognition, and musical or tonal recognition (Springer and Deutsch, 1981).

Regarding the issue of an integrative vs. a comprehension deficit, Ross, Harney, deLacoste-Utamsing, and Purdy (1981) reported
on a single case history of a stroke patient who suffered a fatal heart attack as a result of a massive pulmonary embolism. Post-mortem CT scan showed the lesion to be in the region of the right frontoparietal area and a second lesion in the region of the left mid-central internal capsule. Both lesions were located within the internal capsule below the corticocortical transcallosal connections. Clinically, this man presented with a severe motor hemiplegia on the left, and a flat prosodic affect lacking facial expression. His comprehension of affective tones and facial expressions in others remained intact. On the basis of this case study and his previous research, Ross et al. (1981) hypothesized that "higher order" integration of propositional and affective speech takes place in the corpus callosum between the sensory language areas in each hemisphere, and the actual motor integration of these components appears to take place subcortically, in the brain stem.

Given the information proposed by the Ross et al. (1981) research, it is possible that total perception of sensory information needed to accurately interpret affective information conveyed in speech requires total integration of a healthy brain, one which allows us to relate present and future experiences to past events. Failure to integrate could result in perceptual deficits, possibly due to sensory overloading. Myers (1978) reports on a highly verbal right brain-damaged patient who described his problems as "difficulty keeping the whole thing in mind" (p. 56). He displayed an "inability in taking in the 'gestalt' and had to rely instead on deliberately analyzing each separate element before reaching an
understanding of what was happening around him" (p. 56).

**Clinical Implications**

Important clinical implications to be drawn are that many right brain-damaged patients present serious communication problems by their inability to comprehend, express, or perceive affectively intoned speech. Because of these deficits they are often described as "inappropriate," "bizarre," or "insensitive" to others' reactions (Myers et al., 1978). Often times the label "depressed" is attached.

Ross (1981) pointed out that flat affect following right brain-damage should not be confused, or necessarily indicative of, depression or unconcern. He goes on to state that people who are depressed have a depressive affect, whereas people with flat affect following brain damage have little or no affect. Patients are described as completely denying their deficits when asked a general question about how the stroke has changed them, yet when asked specifically about their impaired arm or leg, display labile behavior. He labels this inability to produce the prosodic features necessary for conveying affective speech "aprosodia". With these types of patients attention should be paid to the patients' propositional language and not their flat affect.

Ross's (1981) views are supported by the work of Heilman et al. (1980). These researchers believe that management for patients whose speech lacks prosodic intonation, should be focused on getting the patient to verbalize what they are feeling and, in
some instances, use gestures or facial expressions (provided facial muscles are intact).

Myers and West (1978) further state that a patient's denial of his problems could be overcome by training him to cope through verbalizing input from his environment. These authors believe that patients could be trained to use their analytical powers, which are more left-hemisphere controlled, to aid in modifying inappropriate behavior. Our role, as speech pathologists, is to do just this.

In the five months of my traineeship, several concerns have developed regarding the role of the speech pathologist as a member of the rehabilitation team. On several occasions I observed individuals involved as primary care takers label the verbalizations that some right brain-damage patients engage in as "bizarre". Additionally, patients may sometimes be labelled and treated as "depressed" without considering the implications of the behavioral changes incurred following the brain damage.

As communicologists, we have a responsibility to the patient and family, as members of rehabilitation teams. Our role becomes critical in accurately assessing and developing appropriate management strategies for those directly involved in the rehabilitation process. The speech pathologist should be responsible for informing and educating primary care takers about the behavior changes noted in affect. Individuals should be alerted to the fact that lack of affect may, in some cases, be more related to the primary condition of the brain injury and not secondary to
depression; however, the reverse is true when cases of depression present themselves. In addition, the "bizarre" statements frequently uttered by these brain-damaged patients should not be encouraged since often times these statements are merely a reflection of their poor judgement and/or sometimes confused state.

Our role is equally important with family members and should be geared toward helping them recognize the patients' obvious deficits as well as helping them recognize and understand the subtle communication difficulties these patients present when engaged in conversation. Helping them to recognize that flat affects or "insensitive" statements may not always be representative of what the person is experiencing internally, can only help the family in more effectively managing the patient. Instructing the family to be very direct and to avoid sarcasm or other sophisticated language forms will serve to help communication between the family and patient.

Future Implications

Caution should be taken in generalizing the results of the present study for several reasons: 1) small sample size threatens internal and external validity; 2) site or size of lesion for the brain-damaged group was not controlled; 3) etiologies could not be adequately assessed in four of the six cases; 4) previous bilateral brain-damage could not be ruled out in two cases; 5) other complicating medical factors, such as alcoholism, may have affected the results in four of the six cases.
Perhaps administering this battery to larger samples would lend further support for these results—that most right brain-damage patients do poorly regardless of presentation method—or different trends would be found.

Another variable to address is the comparison of performance between right- and left-hemisphere brain-damaged subjects. The present study was unable to address this issue since few left brain-damaged subjects were available. However, this test could be modified in such a fashion as to ensure that the left brain-damaged group understood the directions and could reliably respond to the task. On the basis of findings from previous studies (DeKosky, Heilman, Bowers, and Valenstein, 1980), left brain-damaged subjects would probably perform better in accurately identifying emotions conveyed through speech than the right brain-damaged group, regardless of presentation mode.

Test-retest measures over time might also yield interesting results. Does performance improve over time? Would future performance on this battery be the result of training effects and/or spontaneous recovery? Or might this information tell us something about the reliability with which these subjects interpret affectively intoned speech.

At this time the benefits of training right brain-damaged patients to respond more appropriately to the affectual information conveyed in speech remains unexplored. These preliminary data suggests that additional cues may not in itself be sufficient in the training process. However, if training these patients proved
to be beneficial in certain situations, there is no conclusive evidence at this time that this new learning would generalize to other people, situations, or even other more subtle language forms, i.e.: humor, sarcasm. Generalization data is currently being gathered with respect to the brain-damaged population.

Another variable warranting further study is the development of a tool to test comprehension and/or discrimination of prosodic intonation patterns. A study designed to control for each prosodic component might enable us to get a little closer to answering the question of whether the deficits displayed by these individuals is one of comprehension (as some of the previous researchers would suggest) or recognition of prosodic patterns. The preliminary results of the present study would suggest that inaccurate interpretation of emotions was a prosodic recognition deficit and not one of comprehension.

**Summary**

The present study was designed to investigate if visual cues would aid the right brain-damaged patient in accurately identifying emotions conveyed through speech. These preliminary results found that presentation mode—audio vs. audio-visual—made no difference in performance. All subjects performed poorly regardless of presentation mode. Theoretical and clinical implications were discussed. This researcher hypothesized that the deficits displayed by these individuals is one of prosodic recognition rather than comprehension.
REFERENCES


TABLE A1. Descriptive data on the 6 experimental subjects obtained from hospital medical records. The symbol (-) indicates that the information was not in the patient's medical file.
APPENDIX B

LEARNING MODALITIES PROFILES FOR THE 6 SUBJECTS
FIGURE B1. Learning modalities profile for Subject 1 on the Learning-Language Battery.
FIGURE B2. Learning modalities profile for Subject 2 on the Learning-Language Battery.
FIGURE B3. Learning modalities profile for Subject 3 on the Learning-Language Battery.
FIGURE B4. Learning modalities profile for Subject 4 on the Learning-Language Battery.
FIGURE B5. Learning modalities profile for Subject 5 on the Learning-Language Battery.
APPENDIX C

LANGUAGE COMPREHENSION SUBTESTS OF THE

LEARNING–LANGUAGE BATTERY
Auditory Comprehension (Simple) 

Testing the recognition of objects when given the name auditorily. Place the objects in front of the patient in the following order, left to right: cup, spoon, fork, scissors, watch, lock, key, pencil.

Scored as Language Comprehension (8). Say: "POINT TO"

- Watch
- Lock
- Cup
- Fork
- Key
- Pencil
- Spoon
- Scissors

Auditory Comprehension (Complex) 

Keep objects in the same order as above and put them back into position when moved. Scored as Language Comprehension (9) and Auditory Memory (9).

Say: "LISTEN CAREFULLY AND DO WHAT I ASK YOU TO DO." 

Point To: cup, watch, lock, pencil, fork, scissors, key, spoon, watch, cup.

Say: Turn over the key, put the spoon in the cup, put the key under the scissors, put the pencil to the left of the fork, put the lock between the scissors and the watch.

Auditory-Visual Comprehension 

Using Card 1 with printed words, the patient must recognize the printed word when it is named auditorily. Scored as Language Comprehension (5). Say: "POINT TO THE WORD"

- cup
- spoon
- fork
- scissors
- watch
Visual Comprehension (Simple)  
Keep objects in same order as above. Present printed words (cards 2-9) in order below telling the patient to MATCH THE WORD TO THE OBJECT (if he doesn't understand, demonstrate). Scored as Language Comprehension (8).

- watch___________________________________
- lock_________________________________
- cup____________________________________
- fork____________________________________
- key_____________________________________
- pencil__________________________________
- spoon___________________________________
- scissors______________________________

Visual Comprehension (Complex)  
Keep objects in same order as above. Present cards 10-14 and say READ THIS AND DO WHAT IT SAYS TO DO. Scored as Language Comprehension (5).

- Turn over the cup_____________________
- Put the key in the lock________________
- Put the pencil above the lock__________
- Put the watch to the left of the fork____
- Put the scissors between the cup and the spoon______________________________

Interpreting (Verbal)  
Say: EXPLAIN IN YOUR OWN WORDS THE MEANING OF THE FOLLOWING PROVERBS. In order to receive credit, the patient must show abstraction. Scored as Expression (3), Language Comprehension (3), and Ideation (3).

- Don't judge a book by its cover. (External appearances may be deceiving.)_____________________________________________________________
- The mouse that has but one hole is easily taken. (Disaster is less likely where there are several alternatives.)________________________________________
Let sleeping dogs lie. (Don't seek trouble if you can avoid it.)

Logical Memory

Say, I AM GOING TO READ TO YOU A LITTLE SELECTION OF ABOUT 4 OR 5 LINES. LISTEN CAREFULLY BECAUSE WHEN I'M THROUGH, I WANT YOU TO TELL ME EVERYTHING I READ TO YOU. ARE YOU READY? Scored as Language Comprehension (2) and Auditory Memory (2). Patient must recall and relate at least 6 items of information from each selection in order to receive credit.

Anna Thompson/ of South/ Boston/ employed/ as a scrub woman/ in an office building/ reported/ at the City Hall/ Station/ that she had been held up/ on State Street/ the night before/ and robbed/ of fifteen dollars/. She had four/ little children/; the rent/ was due/; and they had not eaten/ for two days/. The officers/ touched by the woman's story/ made up a purse/ for her/.

The American/ Liner/ New York/ struck a mine/ near Liverpool/ Monday/ evening/. In spite of a blinding/ snowstorm/ and darkness/, the sixty/ passengers, including 18/ women/, were all rescued/, though the boats/ were tossed about/ like corks/ in the heavy sea/. They were brought into port/ the next day/ by a British/ steamer/.
### Subtest (possible number correct) | Number Correct by Subject
--- | ---
Auditory Comprehension Simple (8) | S1 S2 S3 S4 S5 S6
Auditory Comprehension Complex (9) | 9 9 9 9 8 9
Auditory-Visual Comprehension (5) | 5 5 5 5 5 5
Visual Comprehension Simple (8) | 8 8 8 8 8 8
Visual Comprehension Complex (5) | 5 5 5 5 3 4
Interpreting: Verbal (3) | 2 2 3 0 1 3
Logical Memory (2) | 1 0 2 0 0 2

TABLE D1. Raw scores (number correct) for each subject on the Language Comprehension subtests of the Learning-Language Battery.
APPENDIX E

STIMULUS SENTENCE BATTERY
**APPENDIX E**

Stimulus Sentence Battery

Instructions:

"You will be hearing a voice and sometimes seeing a face on the T.V. Your job is to watch and listen carefully to the tone of voice and tell me 'how' the person is feeling, by pointing to one of the word cards in front of you. Are you ready?"

<table>
<thead>
<tr>
<th></th>
<th>Correct</th>
<th>Incorrect</th>
<th>Manner</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (A) Mary is chasing the cat.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>2. (H) Mother is going to the store.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>3. (H) John is going to race his bike.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>4. (A) The dog is eating the ice-cream.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>5. (H) The rabbit is running through the yard.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>6. (S) The rabbit is running through the yard.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>7. (A) Mother is going to the store.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>8. (H) Mary is chasing the cat.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>9. (S) The rabbit is running through the yard.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>10. (S) Mary is chasing the cat.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>11. (H) The dog is eating the ice-cream.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>12. (A) The dog is eating the ice-cream.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>13. (S) Mother is going to the store.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>14. (S) John is going to race his bike.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>15. (S) The dog is eating the ice-cream.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>16. (A) John is going to race his bike.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td></td>
<td>Correct</td>
<td>Incorrect</td>
<td>Manner</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>17. (A) The rabbit is running through the yard.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>18. (S) Mother is going to the store.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>19. (H) The rabbit is running through the yard.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>20. (H) The dog is eating the ice-cream.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>21. (S) Mary is chasing the cat.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>22. (H) Mother is going to the store.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>23. (A) Mary is chasing the cat.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>24. (S) John is going to race his bike.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>25. (A) The rabbit is running through the yard.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>26. (A) Mother is going to the store.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>27. (H) Mary is chasing the cat.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>28. (S) The dog is eating the ice-cream.</td>
<td>+</td>
<td>-</td>
<td>AV</td>
</tr>
<tr>
<td>29. (A) John is going to race his bike.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>30. (H) John is going to race his bike.</td>
<td>+</td>
<td>-</td>
<td>A</td>
</tr>
</tbody>
</table>
APPENDIX F

ARRANGEMENT OF RESPONSE ITEMS

ANGRY

INDIFFERENT

SARCASTIC

HAPPY

SAD