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**COMMUNICATION ABILITIES AND WORK RE-ENTRY  
FOLLOWING TRAUMATIC BRAIN INJURY**

by

**Emi Isaki**

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**A Dissertation Submitted to the Faculty of the  
DEPARTMENT OF SPEECH AND HEARING SCIENCES  
In Partial Fulfillment of the Requirements  
For the Degree of  
DOCTOR OF PHILOSOPHY  
WITH A MAJOR IN SPEECH-LANGUAGE PATHOLOGY  
In the Graduate College  
THE UNIVERSITY OF ARIZONA**

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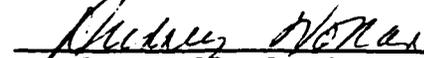
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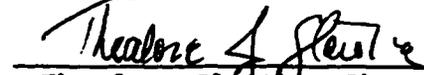
and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy

  
Lyn Turkstra, Ph.D.

Feb 18/1999  
Date

  
Audrey Holland, Ph.D.

Feb 18, 1999  
Date

  
Theodore Glattke, Ph.D.

Feb 18, 1999  
Date

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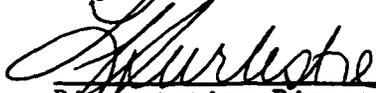
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## **ABSTRACT**

**The purpose of this exploratory study was to determine if a single communication measure or combination of measures could discriminate employed from unemployed individuals with traumatic brain injury (TBI). Twenty adult subjects (ten employed and ten unemployed), one to four years post injury, with comparable severity of injury and type of work participated in the study. Each subject was given ten communication tests measuring: auditory processing (Filtered Words, Auditory Figure Ground, Competing Words, and Competing Sentences subtests of the SCAN-A); the effects of speaking under time pressure (FAS and Rapid Automatized Naming); production of oral language (local coherence); language ability (Aphasia Quotient portion of the Western Aphasia Battery); and functional verbal reasoning ability (Scheduling and Planning an Event subtests of the Functional Assessment of Verbal Reasoning (FAVR)). Results revealed that when a combination of three communication tests, the Scheduling subtest of the FAVR, and the Filtered Words and Competing Sentences subtests of the SCAN-A, was used, the model correctly classified 85% of employed and unemployed individuals. The findings suggest that both impairment and disability-based tasks (i.e. those measuring activities that reflect daily communication) may be more revealing than the impairment-level tasks alone that frequently appear in the TBI and work re-entry literature. Impairment and disability level communication tasks may provide functional and practical information, which can be used to assist in work re-entry.**

## **CHAPTER I**

### **INTRODUCTION**

Kraus (1993) estimated that in 1990, there were 75,000 deaths, 366,000 hospitalizations, and 1,975,000 medically-attended cases of traumatic brain injury (TBI) in the United States. The annual rate of occurrence including all severities of TBI was estimated to be 145/100,000 persons (Kraus, 1993). The rate of TBI-related hospitalizations was estimated to be 102/100,000 by the Centers for Disease Control (CDC, 1997a) based on the 1993 National Hospital Discharge Survey data. The CDC (1997a) also estimated that 250,000 serious brain injuries occurred annually in the United States.

Motor vehicle accidents account for approximately 50% of all traumatic brain injuries, followed by falls which account for slightly more than 20% of the injuries (Kraus, 1993; CDC, 1997a). The risk for TBI is greatest among males and females between the ages of 15-24 years (Kraus, et al., 1990), with twice as many injuries occurring among males than females (Kraus, 1993).

TBI may result in long-term physical, cognitive, emotional, behavioral, and communicative deficits (Hartley, 1995; Ylvisaker, 1992). Bigler (1990) reported that the cost of rehabilitating individuals with TBI has been estimated at 5-10 billion dollars annually in the U.S. The loss of potential earned income among survivors who are unable to work may reach upwards of 25-30 billion dollars annually (National Institute of Neurological Disorders and Stroke, 1989).

Head injury can be described as either open or closed (Bigler, 1990). Open head injuries include those that penetrate the skull (e.g. gun shot wound), whereas closed head injuries do not involve penetration of the skull. The distribution of brain damage in closed TBI reflects both diffuse and focal effects of applied force. Diffuse axonal injury results

from a neuronal shear-strain effect as brain tissue is twisted during rotation and rapid acceleration/deceleration (Stratton & Gregory, 1994; Bigler, 1990; Adamovich, Henderson, & Auerbach, 1985). Focal changes occur when the brain contacts the skull or other rigid surfaces, and include orbitofrontal, anterior, and inferior temporal contusions, damage to the hippocampus and other medial temporal lobe limbic structures, and contre-coup injury to the occipital lobe (McAllister, 1992; Ylvisaker, 1992; Bigler, 1990). In addition to the injuries described, hematoma, edema, ischemia, infection, hydrocephalus, and hypoxia may occur secondary to the initial insult (Stratton & Gregory, 1994). The severity of the injury is typically categorized in the emergency room as mild, moderate, and severe. Recovery is often predicted from the findings of this initial assessment following injury.

Health care assistance following TBI can vary considerably according to the severity of the injury and other factors, such as insurance, provider awareness, and service availability. Patients with mild TBI may be released immediately after the initial evaluation by a physician in the emergency room setting, with minimal follow-up and education concerning TBI. Patients with more severe TBI may require hospitalization and intensive rehabilitation to improve cognitive, communicative, physical, and behavioral skills in order to return to everyday activities, work, or school.

Traumatic brain injury typically affects young adults and their ability to return to work. Individuals within this population group have the potential to establish financial independence and become integral participants in the job market. However, TBI may be associated with long-term physical, cognitive, and psychosocial consequences that can limit or even prohibit return to work (Conboy, Barth, & Boll, 1986). A study by Sander, Kreutzer, Rosenthal, Delmonico, & Young (1996) revealed that unemployment continued to be a problem 3 to 4 years following injury. The authors suggested that employment

tended to be dynamic rather than stable over time, and assumptions that employment rate increased with length of recovery were incorrect. Since vocational status is linked to financial independence, self-respect, coping abilities, sense of purpose, and self-esteem, work becomes an important outcome variable in TBI research (West, 1995; Stratton & Gregory, 1994). Changes in independence and self-esteem may produce social withdrawal, depression, or lack of motivation in TBI patients (Prigatano, 1987). Thus, long term follow-up is necessary to determine if patients successfully return to work and, if they do not return to work, it is important to investigate why they have not done so successfully.

Although the long term goal of many individuals with TBI is work re-entry, there are many reasons for not working. These include: decreased income (from their current job); a financial advantage from collecting long-term disability and worker's compensation rather than working; dissatisfaction with their current position/employment; financial settlements; or difficulties in their current position.

Among survivors who choose to return to work, many are unable to regain and maintain competitive employment (Sander, Kreutzer, Rosenthal, Delmonico, & Young, 1996). As many as one third of individuals who have had a mild TBI may display difficulty returning to work 6 months after injury (Levin, Eisenberg, & Benton, 1989; Levin, et al, 1987; Veltman, VanDongen, Jones, Buechler, & Blostein, 1993). Other studies investigating mild, moderate, and severe TBI reported 30-80% of individuals do not return to work and continue to exhibit residual deficits more than one year after injury (Gollaher, et al., 1998; Cifu, et al., 1997; Sander, Kreutzer, Rosenthal, Delmonico, & Young, 1996; Ip, Dornan, & Schentag, 1995; Schalen, Nordstom, & Nordstom, 1994). These studies demonstrate the large variability associated with quantifying the percentage of individuals who return to work.

Previous studies of work re-entry after TBI have focused on neuropsychological, physical, and behavioral aspects of TBI without discussing the related communication deficits. Researchers acknowledge that executive functions and other cognitive skills such as attention, memory, and problem solving are affected in individuals with TBI, but the effect of these functions on daily communication has received much less attention. The study of communication is extremely important in work re-entry, as verbal and nonverbal interaction occurs continuously within this environment. Misunderstanding between communicative partners could cause the individual with TBI to be an ineffective member of the employment community. Therefore, helping individuals with TBI to communicate effectively with employers, supervisors, and co-workers may provide them with a sense of self worth and success in the work place.

### **Definition of Terms**

The following definitions are presented to clarify terms used throughout this study.

#### **Glasgow Coma Scale Score**

Glasgow Coma Scale Score (GCS) is a measure of injury severity (Teasdale & Jennett, 1974). The scale evaluates a patient's eye opening, motor response, and verbal response. A patient is given a total score that is a combination of the individual scores for eyes, motor response, and verbal response. Severity of injury is categorized as mild (total score of 15-13), moderate (total score of 12-9), and severe (total score of 8-3). The GCS score frequently is used in TBI studies as a predictor of outcome.

#### **Posttraumatic Amnesia Score**

Individuals with TBI often have impairments in working memory, orientation, and new learning (Adamovich, Henderson, & Auerbach, 1985). These skills are initially

evaluated after injury, and a posttraumatic amnesia score is given. Posttraumatic amnesia (PTA) is defined as the period after a brain injury when the patient does not have continuous memory for ongoing events in daily life. PTA has been used as an indicator of injury severity and predictor of outcome in many TBI studies. The Galveston Orientation and Amnesia Test (GOAT) is used to evaluate length of PTA and includes measures of orientation, interval of posttraumatic amnesia, retrograde amnesia, and the ability to remember events that occurred prior to injury (Levin, O'Donnell, & Grossman, 1979). The GOAT has been used in many TBI studies as a predictor of outcome. Severity of PTA is categorized by its duration, therefore, less than 5 minutes constitutes very mild PTA, 5 minutes to 1 hour is mild PTA, 1 to 24 hours is moderate PTA, 1 to 7 days is severe PTA, and more than 1 week is very severe (Brooks, 1983).

### **Communication**

Boone (1987) defines communication as, "an interaction or exchange of one's feelings, ideas, thoughts, and wants among two or more people by such modes as speech, writing, expression, gesture, or touch". Communication involves a shared system of symbols that provide mutual knowledge of syntax, semantic information, phonology, morphology, and pragmatics. Communication can occur either verbally or nonverbally and is considered successful only when the intended message is conveyed to the other person.

### **Work Re-entry**

Work re-entry will be operationally defined in this study as the retention of a part- or full-time job for 6 consecutive months. Students attending school part- or full-time for 6 consecutive months also will be classified in the employed category. A work re-entry questionnaire will be given orally to each subject to determine whether the subject is either

employed or attending school part- or full-time and to document the skill level of the job or education. Information concerning the subject's current pay level and job or educational history since the injury will be collected (see Appendix A).

### **Impairment, Disability, and Handicap**

The World Health Organization (W.H.O.; 1980) has classified and defined the effects of a person's disease or injury according to three levels: impairment, disability, and handicap. An impairment is defined as, "a loss or abnormality of cognitive, emotional, physiological, or anatomical structure or function" (W.H.O., 1980). Hartley (1995) presents examples of impairments following TBI that include: decreased memory, reduced auditory comprehension, word finding deficits, and reduced speed of processing. A disability is defined as, "any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being" (W.H.O., 1980). Hartley (1995) describes disabilities as the effect of impairments on functional life activities. Some examples of disabilities include: mobility, psychosocial functioning, and communication (Hartley, 1995). Finally, handicap is defined as, "a disadvantage for a given individual that limits or prevent the fulfillment of a role that is normal (depending on gender, social, and cultural factors) for that age" (W.H.O., 1980). Hartley (1995) provides the examples of difficulty resuming a role as a parent, spouse, student or employee due to TBI.

Recent revisions have been made to this classification system by the World Health Organization (1997). These changes include combining the concepts of disability and handicap and forming a new category titled limitations of activities that result from impairment. This category is defined as, "the restriction of participating in society to the same degree as prior to the impairment" (W.H.O., 1997). However, due to wide spread

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**familiarity of the W.H.O. (1980) classifications, the terms impairment, disability, and handicap will be used in this study.**

## **CHAPTER II**

### **REVIEW OF THE LITERATURE**

TBI may be associated with profound deficits in cognitive, physical, behavioral, and communicative skills. These deficits may be either temporary or long lasting and life-affecting. The cognitive, physical, and psychosocial deficits associated with TBI are well known, but there is still uncertainty about factors that influence successful work re-entry. Furthermore, much of the work re-entry literature is devoted to neuropsychological assessment, and there is little discussion about how the neuropsychological results relate to the individual's functioning in the actual work environment. Factors related to the injury and demographic variables must also be considered when examining studies involving work status. Thus, the following review addresses injury, sociodemographic, and neuropsychological factors thought to influence return to work after TBI.

#### **Injury and Sociodemographic Factors Related to Work Re-entry**

Stratton & Gregory (1994) described many injury and sociodemographic factors thought to affect work re-entry. These factors included severity (defined in terms of GCS score and PTA) and type of injury, psychiatric disturbances, poor vocational decision making, and decreased social functioning. Cifu, et al. (1997), West (1995), McAllister (1992), and Conboy, Barth, & Boll (1986) stated that other factors such as age, race, marital status, educational level, alcohol and substance abuse, gender, physical impairments, pre-injury employment variables, and presence of multiple trauma also have been used as predictors of work re-entry. Many longitudinal studies have attempted to determine the predictive value of these various factors and their relation to work re-entry.

Cifu, et al. (1997) investigated the influence of acute injury characteristics on return to work in mild, moderate, and severe patients with TBI. Subjects were selected from a national database of 245 rehabilitation inpatients admitted to acute care within eight hours of experiencing TBI. One year after injury, 49 subjects with TBI were competitively employed and 83 were unemployed. The remainder of the subjects were lost to follow-up. Measures used in the study included physical functioning (Disability Rating Scale (DRS; Rappaport, Hall, & Hopkins, 1982)), performance in daily living (Functional Independence Measure (FIM; Keith, Granger, Hamilton, et al., 1987)), behavioral functioning (Rancho Los Amigos Scale (RLAS; Hagen, Malkmus, Durham, & Bowman, 1979); Neurobehavioral Rating Scale (NRS; Levin, High, Goethe, et al., 1987)), injury severity (GCS score, PTA) and neuropsychological test results. Subjects employed one year post injury obtained significantly better scores on all measures than their unemployed counterparts. The most significant predictors of employment were related to initial injury severity and level of daily functioning at one year.

Ponsford, Olver, Curran, & Ng (1995) attempted to determine what injury and demographic factors predicted employment in mild, moderate, and severe patients with TBI two years post injury. The study included 74 individuals who were working prior to TBI. Subjects were interviewed and reevaluated during a two year follow-up. Interviews revealed that thirty individuals (40%) were employed in either full- or part-time jobs at 2 years post injury. Results indicated that the Disability Rating Scale total score (DRS; Rappaport, Hall, & Hopkins, 1982), GCS score, and age were correlated highly with employment status. These factors correctly classified 74% of subjects as either employed or unemployed. Correlations for the discriminating variables used in the model were .86 for the DRS total score, -.46 for GCS score, and .31 for age. In a second analysis involving 50 subjects, the authors found that the original discriminant function correctly

classified 68% of the cross-validation sample. The authors suggested that the greater the severity of brain injury, degree of disability, and age, the poorer the outcome of work re-entry.

Gollaher, et al. (1998) investigated the relationship between age, education, pre-injury productivity (PIP) using the Patient Evaluation and Conference System (PECS; Rao, et al., 1990), GCS score, and rehabilitation admittance and discharge Disability Rating Scale scores (DRS; Rappaport, Hall, & Hopkins, 1982) in an attempt to find the best discriminant model for classifying employed and unemployed subjects one to three years post injury. Ninety-nine subjects with mild, moderate, or severe TBI were included in the study. Eighty-seven of the subjects were competitively employed or students at the time of injury, and twelve were classified as being unproductive in either category. At the time of the study, 31 of the previously employed subjects had returned to their job or school, and 56 were unemployed. The 12 subjects identified as unproductive at the time of injury continued to remain unemployed following injury. The most significant predictors in the discriminant model were the discharge DRS score, PIP score, and education which correctly classified 84% of the employed subjects and 66% of the unemployed subjects. As in the studies by Cifu, et al. (1997) and Ponsford, Olver, Curran, & Ng (1995), disability appeared to be as significant a predictor as demographic factors.

Greenspan, Wrigley, Kresnow, Branche-Dorsey, & Fine (1996) interviewed 343 individuals with mild, moderate, or severe TBI at one year post injury to study factors that influenced return to work. Of the 343 subjects interviewed, 54% were employed one year after discharge, and of those employed, 83% were employed full-time. Seventy-one percent of those not working indicated their unemployment was due to their injury, and 21% indicated that unemployment was not injury-related. Factors used to account for work re-entry included demographic characteristics (age, race, gender, marital status,

education), concurrent medical condition (e.g., hypertension, alcohol dependency, obesity) and results from the telephone version of the Functional Independence Measure (FIM; Keith, Granger, Hamilton, et al., 1987). The study revealed that unmarried patients with TBI who had motor limitations and had not completed high school were less likely to return to work one year after injury as compared to a group of married patients with TBI who displayed no motor deficits and had completed high school. The results also found that individuals who were not independent on FIM items (a disability measure) were less likely to return to work.

Fabiano, Crewe, & Goran (1995) also investigated work re-entry after severe TBI. Ninety-four individuals with TBI were selected for the study. The subjects were two to eight years post injury, and 54 subjects were either employed full- or part-time. All subjects had received post acute rehabilitation services over a three year period, and were interviewed for the study by telephone. Factors used to predict work re-entry included neuropsychological scores obtained prior to discharge, time post injury, and employer selection. Results revealed a significant relationship between severity of injury and period of unemployment post injury. Subjects who returned to work within two years of injury were more likely to be employed at the time of the study than those who took longer than three years to become employed. Subjects who were employed within two years tended to have less severe injuries (GCS score) and higher IQs as determined by neuropsychological testing. Also, subjects re-hired by the same employer showed a significant advantage in remaining successfully employed compared to those with new employers. Thus, severity of injury, as well as overall IQ, and work setting, appeared to be key items in determining work re-entry.

Ip, Dornan, and Schentag (1995) studied 70 subjects with mild, moderate, and severe TBI in an attempt to predict factors for work or school re-entry. Predictive factors

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included sociodemographic characteristics, chronicity, indices of severity, physical impairment, and cognitive functioning. The results indicated that GCS score, time post injury, and physical impairments were not significantly related to return to work, a contradiction to the other studies just described. This contradiction of findings may have occurred because of the numerous independent variables and the small sample size used in the study. Results also indicated that older, married subjects with a history of alcohol abuse were less likely to return to work.

Wehman, West, Kregel, Sherron, & Kreutzer (1995) attempted to determine if supported employment would improve work re-entry for individuals with severe TBI. Eighty-seven individuals with TBI participated in the study. Subject selection criteria for the study included age, GCS score, PTA, neuropsychological test scores, and need for vocational intervention. All 87 individuals were placed in supported employment, and 23 (26.4%) required a second job placement. The sample sizes tended to decrease over time, with 78.3% of the participants employed at three months, 59.3% at six months, 53.1% at nine months, and 51.3% at 12 months. The authors commented that the severity of injury appeared to have a powerful effect on work re-entry.

Studies specific to mild TBI and post-concussion syndrome (Veltman, VanDongen, Jones, Buechler, & Blostein, 1993; Levin, et al., 1987; Fenton, McClelland, Montgomery, MacFlynn, & Rutherford, 1993) have described continued residual deficits that potentially could affect work. According to GCS and PTA scores, post-concussion syndrome or mild TBI is at the lower end of the severity scale and the effects may be minimized in health care settings. Nonetheless, individuals in this group have been reported to display problems in cognition and behavior six months or more after injury (Veltman, VanDongen, Jones, Buechler, & Blostein, 1993; Levin, et al., 1987; Fenton, McClelland, Montgomery, MacFlynn, & Rutherford, 1993). The cognitive and behavioral

difficulties associated with mild TBI and their relation to work re-entry have not been studied.

In summary, a variety of injury and sociodemographic factors have been used to examine successful work re-entry in the TBI population. In general, all studies use severity indices such as the GCS score or PTA to identify the subjects, and these factors have a significant relation to outcome in most studies. However, severity alone does not account for all of the variability. In fact, injury and demographic variables generally account for less than 30% of the variance in work outcome (Girard, et al., 1996). The addition of measures of daily functioning substantially improves this prediction. The differences across studies suggest that a variety of factors interact with the injury (e.g., premorbid employment, family support, type of job). Among these, the effects of TBI on cognitive function appear to play an important role, as discussed in the next section.

### **Neuropsychological Factors Related to Work Re-entry**

Neuropsychological studies have documented many cognitive impairments in individuals with TBI. Those frequently reported in the literature include impairments in: memory, orientation, attention, concentration, perception, mental flexibility, speed of processing, problem solving, judgment, language, comprehension, self-awareness, personality, and mental endurance (Cicerone, 1996; Girard, et al, 1996; Ip, Dorman, & Schentag, 1995; McAllister, 1992; Stratton & Gregory, 1994; Ylvisaker, 1992; Conboy, Barth, & Boll, 1986). Neuropsychological tests are often used to determine success in work re-entry, and as noted by Crisp (1992) in his review of these tests, the inconsistent findings across studies in part reflect the different tests used to measure cognitive functioning. Scoring procedures and identification of impairment type and severity may differ between tests making it difficult to find similarities in the results. For example,

Cifu, et al. (1997) attempted to identify neuropsychological predictors of successful return to work one year after mild, moderate, and severe TBI. The tests used included the Logical Memory subtest of the Wechsler Memory Scale-Revised (WMS-R Immediate and Delayed; Wechsler, 1987), the Grooved Pegboard Test (Matthews & Klove, 1964), and the Halstead-Reitan Trailmaking Test Forms A and B (Reitan & Wolfson, 1993). The results revealed that the Logical Memory Delayed subtest scores were significantly higher in those who were employed compared to those who were unemployed. The other neuropsychological tests revealed no significant differences. As previously reported, Cifu, et al. (1997) concluded that injury severity and daily functioning were significantly different between groups. A general finding from studies using injury severity and sociodemographic variables is that the use of functional outcome measures can provide important information about impairment and disability within the workplace.

Girard, et al (1996) also investigated the relationship of neuropsychological status and productive outcome following TBI. One hundred fifty-two outpatients with open and closed TBI participated in the study. Information concerning the subject's severity of injury was not given. Demographic measures included age, gender, ethnicity, premorbid marital status, premorbid occupational status, premorbid psychiatric history, premorbid learning difficulty, premorbid substance abuse, premorbid educational attainment, mechanism of injury, and insurance coverage. All subjects were administered several neuropsychological tests at six and 12 months after injury, including the Symbol Digit Modalities Test (written and oral; Smith, 1982), the Halstead-Reitan Trailmaking Test Forms A and B (Reitan & Wolfson, 1993), the Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1981), the Wechsler Memory Scale-Revised (WMS-R; Wechsler, 1987), the Wisconsin Card Sort Test (Berg, 1948), the Booklet Category Test (Categories; Reitan & Wolfson, 1993), and the Wide Range Achievement Test-Revised

(WRAT-R; Jastak & Wilkinson, 1984). Sixty-one percent of the subjects were unproductive at premorbid work settings or could not return to work one year after injury. Neuropsychological reevaluation at 12 months revealed that scores from eight tests or subtests were related significantly to outcome: WAIS-R Verbal, Performance, and Full Scale IQ, WAIS-R Arithmetic, Block Design, and Digit Symbol subtest scores; the WMS-R Verbal Memory Index; and scores from the Categories Test from the Halstead-Reitan Battery. These tests revealed difficulties in verbal and nonverbal intelligence, mental arithmetic/concentration, visual-spatial abilities, speed of information processing, immediate verbal memory, nonverbal problem solving, dual processing, and executive functioning. These results contrasted with those of Cifu et al (1997), who found delayed memory, but not immediate memory or IQ to differ in employed versus unemployed subjects. Girard, et al. (1996) concluded their study by stating that cognitive and demographic variables accounted for less than 30% of the total variance of work re-entry. The authors suggested that a multifaceted approach, using multiple variables for impairment, injury severity, sociodemographic factors, and functional outcome measures, should be taken when assisting individuals with TBI returning to work. This observation is noteworthy given the limitations of cognitive tests in identifying skills necessary for work re-entry.

Godfrey, Bishara, Partridge, & Knight (1993) administered the Raven's Progressive Matrices (Raven, Court, & Raven, 1976), the Paced Auditory Serial Addition Task (PASAT; Gronwall, 1977), the Rey Auditory Verbal Learning Test (Rey, 1964), the Neuropsychological Impairment Scale (NIS; O'Donnell, DeSoto, & Reynold, 1984), and the Inpatient Memory Impairment Scale (IMIS; Godfrey & Knight, 1989) to 66 patients with severe TBI. Subjects for this study were up to three years post injury. Results indicated that 17% of the subjects required special conditions to work and 25% were

unemployed. As in the study by Girard et al. (1996), patients who returned to work had significantly higher intelligence as assessed by the Raven's Progressive Matrices test. However, memory was not a significant predictor of return to work, and attention failed to reach significance as a work re-entry predictor in this study. The authors stated that each subject's level of cognitive impairment did not change from six months to one year, and from two to three years after injury.

As described earlier, Fabiano, Crewe, & Goran (1995), also found IQ to be related to return to work. Subjects with TBI who returned to work sooner (within two years post-injury) had better WAIS-R IQ (Wechsler, 1981) scores, in addition to less severe injuries.

In summary, neuropsychological test scores for IQ, memory, and attention may be lower for unemployed individuals with TBI than for those who are employed, although the literature suggests that injury severity is a more powerful factor. However, there are contradictions to this finding within the neuropsychological literature possibly due to the different tests used in the various studies. There are numerous demands in an employment setting, and the current literature that focuses on injury severity and neuropsychological testing may not reflect what is actually required in the work place. The ability to communicate is necessary for any type of employment, yet it is seldom considered in the work re-entry literature. Studies of communication may reveal why individuals with TBI are having difficulty returning to the employment setting.

### **Role of Communication**

The American Speech-Language-and Hearing Association (ASHA; 1988) has identified common communication difficulties associated with TBI. These include difficulties with discourse (e.g., tangential and disorganized output), word retrieval, social language, comprehension, rapidly spoken language, communication in challenging

environments, abstract language, and verbal learning and reasoning, as well as imprecise language and disinhibition. Hartley (1995) and Ylvisaker (1992) presented comprehensive reviews of communication deficits associated with cognitive problems after TBI. For example, Ylvisaker (1992) suggested that problems with attention can result in disorganized discourse and weak comprehension of language in the presence of competing stimuli. A problem with memory may produce difficulties in requesting assistance and direction, following instructions, providing information to co-workers, expressing feelings, and responding to nonverbal and social cues in the work setting. While it is assumed that these communication disorders would affect work, few empirical studies have actually addressed communication and work after TBI. Curl, Fraser, Cook, & Clemmons (1996) studied nine adults with severe TBI who had been injured six months previously. All subjects were unemployed. Subjects were studied to determine if a co-worker training project would promote employment. Co-workers were taught how to communicate with individuals with TBI. For instance, a work related task first was verbally explained by the co-worker. Next, the task was modeled and then broken down into steps. Finally, the instructions for the task were repeated as needed. If the individual with TBI misunderstood the information, the idea was clarified by verbal prompting, shaping, and/or repeating. Seven of the nine subjects were able to return to some type of employment with this assistance. These preliminary data suggest that communication may be an important component in work re-entry.

The importance of communication was revealed in a study by Wehman, Kregel, Sherron, Nguyen, & Kreutzer (1993). These investigators attempted to determine what factors hindered or enhanced employment in 67 adults with severe TBI. Subjects were required to have been employed for 3 months and to have completed a supported employment program. Subjects were then divided by employment specialists into two

groups: 1) least difficult to employ and maintain in a job, and 2) most difficult to employ and maintain in a job. Those who were most difficult to employ and maintain in a job were those likely to be working in a position that required frequent work-related interactions with co-workers or the general public. Communication problems were evident in this group, based on a vocational client information and referral form. Subjects who were identified as difficult to employ repeatedly asked for assistance and directions, occasionally acted or spoke aggressively, and responded inappropriately to nonverbal social cues.

Finally, in a review of 41 vocational outcome studies, Fraser & Wehman (1995) concluded that language and visual-spatial abilities appeared to have moderate correlations with employment outcome. The authors did not expand on this observation within the review.

In summary, the literature suggests that communication is an important component of work re-entry. However, language and communication deficits related to work re-entry are only mentioned briefly in the literature and more research is needed in this area. The information gathered from communication-oriented studies could assist patients with TBI and their co-workers to be more effective communicators and perhaps better prepared for work re-entry.

### **Purposes of the Study**

The study is designed to address the need for research regarding the role of communication ability in work re-entry. The first purpose of this study is to determine which communication variables differentiate employed from unemployed adults with comparable injury severity and type of work. The second purpose of this study is to determine which communication test or tests best discriminates employed from unemployed adults with TBI. The dependent variable in this study is work re-entry,

operationalized as the retention of a part- or full-time job for 6 consecutive months. The communication variables examined in this study will be comprehension, fluency, speed of processing, and verbal reasoning, as measured by five speech-language tests and two discourse tasks. These variables were selected to represent multiple skill areas reflecting workplace demands and to be acceptable and practical for clinicians to use.

### **Hypotheses**

First, it is hypothesized that employed individuals with TBI will perform better on communication measures than unemployed individuals with TBI. Specifically, it is predicted that the selected communication tests will differentiate employed from unemployed adults with comparable severity of injury and type of work as identified by the modified Blishen Index (Blishen & McRoberts, 1976). Second, it is hypothesized that there will be a communication test or combination of tests which best discriminates employed from unemployed adults with TBI.

## **CHAPTER III**

### **METHOD**

#### **Subject Selection**

Individuals were considered for this study based on the following criteria: a) age 18-55 years; b) GCS score of 8-13; c) positive loss of consciousness (LOC), with PTA  $\geq$  1 hour; d) 1 to 4 years post injury; e) English spoken as a first language; f) employed part- or full-time for 6 consecutive months prior to injury; g) uninvolved in litigation; and i) no pre-injury neurological or psychiatric problems. Individuals with a history of drug or alcohol abuse were allowed to participate in this study if they met the other criteria.

Twenty subjects (five females and fifteen males) participated in this study. Thirteen subjects were recruited from the Trauma Registry at the University of Arizona Medical Center in Tucson, Arizona; five from L.D.S. Hospital in Salt Lake City, Utah; and two from Menorah Park in Cleveland, Ohio. Initial GCS score, duration of PTA, and duration of LOC were obtained for all subjects by medical records, patient report, or guardian report.

Subjects were divided into two groups: employed and unemployed. Employed subjects were employed part- or full-time for 6 consecutive months prior to participation in the study. Unemployed subjects either had attempted to return to work with unsuccessful results or had not returned to work at all following their injury.

Groups were equated for injury severity (initial GCS score; see Table 1). Duration of LOC and PTA were used to determine initial GCS scores when the actual scores were unavailable. Time post injury ranged from 13 months to 48 months. Subjects ranged in age from 24.5-54.8 years for the employed group and 21.6-53.8 years for the unemployed

group. The demographic variables were not significantly different between employed and unemployed subjects.

Subjects were administered the Western Aphasia Battery (WAB; Kertesz, 1982) to rule out aphasia as a factor influencing return to work. Traumatically brain injured subjects were not expected to be aphasic in the traditional sense, given the low incidence of aphasia after TBI (Sohlberg & Mateer, 1989). Thus, subtests that comprise the aphasia quotient (A.Q.) score from the WAB were administered to ensure that the groups were comparable in this regard. The WAB scores were found to be significantly different between groups using a one-tailed t-test ( $t(18) = -1.80, p < .05$ ). Therefore, the WAB scores were entered as a discriminating variable in the final statistical analysis, which is discussed further in the results section.

**Table 1. Subject Demographics: Employed (E) and Unemployed (U)**

Subject		Age (months)		Time post injury (months)		Initial Severity		WAB (A.Q.)	
E	U	E	U	E	U	E	U	E	U
1	11	327	449	21	31	severe	severe	94.9	100.0
2	12	378	513	21	13	severe	severe	99.4	93.6
3	13	364	260	23	26	severe	severe	99.2	96.4
4	14	294	259	18	23	severe	severe	99.6	98.6
5	15	514	426	13	34	moderate	moderate	100.0	95.1
6	16	374	426	40	23	moderate	moderate	100.0	99.8
7	17	490	645	31	26	moderate	moderate	98.8	99.6
8	18	316	580	13	35	mild	mild	100.0	97.3
9	19	627	507	13	48	mild	mild	100.0	94.0
10	20	658	627	32	42	mild	mild	98.8	99.6
<b>M</b>		434.2	469.2	22.5	30.1			99.1	7.4
<b>SD</b>		131.0	135.0	9.2	10.0			1.5	2.5

Subjects were matched by their pre-injury occupational status using the modified Blishen Index (Blishen & McRoberts, 1976; see Table 2). This was done to address potential confounds due to type of work, a factor that has been shown to affect work re-entry in previous research. The Blishen Index was modified by collapsing job titles into four categories: professional (an index score of 60), skilled (an index score of 30-59), labor (an index score of < 30), and student, according to the procedures of Ip, Dornan, & Schentag (1995).

**Table 2. Pre-injury Blishen Index for Employed and Unemployed Subjects**

	Employed	Unemployed
Professional	2 full-time	2 full-time
Skilled	4 full-time	4 full-time
Labor	2 full-time	2 full-time
Student	1 full-time 1 part-time	1 full-time 1 part-time

### **Instruments**

The communication tests used for this study were chosen to reflect everyday workplace demands across a relatively wide range of employment types. The tests measured diverse aspects of communication, including auditory processing, oral language, reading, and writing. Cognitive skills required to complete the communication tasks included organization, reasoning, memory, and attention, as discussed in further detail below. Each subject also was asked to complete a written functional outcome measure and an orally presented work re-entry questionnaire to gather additional information about

independence in daily activities and assist the investigator in completing the modified Blishen Index (Blishen & McRoberts, 1976).

### **Auditory Processing**

Individuals with TBI may have problems with auditory comprehension, attention, and memory (Adamovich, Henderson, & Auerbach, 1985; Hartley, 1995; Ylvisaker, 1992). Hartley (1995) reported that the communication problems associated with these deficits can include difficulty understanding and following conversations, staying on topic, and maintaining appropriate interactions. The SCAN-A: A Test for Auditory Processing Disorders in Adolescents and Adults (Keith, 1994) was selected for this study because the subtests represent auditory processing, memory, and attention demands in everyday listening situations. The SCAN-A was designed to identify central auditory processing disorder. The SCAN-A was normed on 125 subjects between the ages of 12 and 50 years who had passed a 20 dB pure tone audiometric assessment at 500, 1k, 2k, and 4k Hz (Keith, 1994). According to Keith (1994) the SCAN-A could be used to describe auditory processing abilities for planning vocational remediation, and central auditory abilities for individuals who had suffered a “head injury” (manual, p.1).

Four subtests from the SCAN-A were used: Filtered Words (FW; repeating muffled words), Auditory Figure Ground (AF; understanding words in the presence of background noise), and Competing Words and Competing Sentences (CW and CS; both dichotic listening tasks). The SCAN-A is presented on audiotape and takes approximately 20 minutes to administer.

### **Speaking Under Time Pressure**

Spreen & Strauss (1991) suggested that TBI patients may display changes in the speed and ease of speech, due to cognitive inflexibility. Adamovich, Henderson, &

Auerbach (1985), Hartley (1995), and Ylvisaker (1992) reported that following a TBI, individuals may have difficulties with speed of processing, fluency, naming, and memory. The related communication problems can include inappropriately long pauses within discourse, hesitations or filled pauses, difficulty comprehending normal rate of speech, poor topic maintenance, and repetition of ideas (Hartley, 1995). The FAS or verbal fluency test (Spreeen & Strauss, 1991) was selected for the study because it evaluates speed and ease of speech, requiring the subject to generate words under time pressure. These skills are likely to be required for presenting information or answering specific questions at work. The FAS was designed to evaluate the production of words under restricted search conditions (Spreeen & Strauss, 1991), requiring subjects to name as many words as they can beginning with the letter F, A, or S in one minute. The test has been found to correlate with age, education, and scores on the Wechsler Adult Intelligence Scale Verbal IQ test (Wechsler, 1981). The test has been normed on individuals ages 15-75+ (Spreeen & Strauss, 1991).

Another test of speaking under time pressure used in this study was the Rapid Automatized Naming Test of Pictured Objects (RAN; Denckla & Rudel, 1974). The RAN assesses abilities in rapid naming. The test was designed to evaluate naming abilities in 5-10 year old grade school children with dyslexia. Murray (1995) found the RAN to be a useful test for evaluating naming errors in aphasic adults. She constructed 12 sheets of pictured stimuli that were equated for number of syllables and word frequency. Each sheet consisted of 50 items (5 items per row with 10 rows on each page), and subjects were required to name items as quickly as possible. Three stimuli sheets developed by Murray (1995) were used in this study.

### **Oral Narrative Task**

Individuals with TBI may display reduced skills in vocabulary, naming, word fluency, planning, sequencing, and organization of language (Adamovich, Henderson, & Auerbach, 1985; Hartley, 1995; Ylvisaker, 1992). Hartley (1995) stated that these impairments would result in problems at the level of discourse, including the use of words in inappropriate semantic contexts, pauses in discourse due to delayed word retrieval, lack of coherence, wrong words or vague terms, circumlocution, and poorly organized discourse. Thus, as discourse occurs daily in the vocational environment, and verbal interaction with bosses and co-workers is required in all job settings, discourse analysis was selected for the study.

Two topics were chosen by the investigator for the discourse analysis task. The discourse topics were a description of the subject's accident and a retelling of a memorable family event. Analysis was performed on the first 20 T-units, defined by Scott (1988) as a main clause and all subordinate clauses and non-clausal structures attached or embedded with in it. Twenty T-units were found to be sufficient for analysis because scores remained similar for local coherence when greater numbers of T-units were analyzed. Discourse analysis focused on local coherence because pilot data indicated that subjects had difficulty maintaining relationships from utterance to utterance. As stated in VanLeer & Turkstra (in revision), local coherence is determined by the relationship of meaning from one T-unit to the next. The scoring of local coherence was based on a rating system developed by Glosser and Deser (1990). VanLeer & Turkstra (In preparation) modified Glosser and Deser's original 5-point local coherence rating scale to a 3-point scale. Thus, in this study, each T-unit was rated as being completely related (3), generally related (2), or not related (1) to the preceding T-unit. (See Appendix D for examples of local coherence scoring)

### **Reading and Writing**

Adamovich, Henderson, & Auerbach (1985), Hartley (1995), and Ylvisaker (1992) stated that individuals with TBI may have problem solving and organization deficits. In terms of communication, these impairments could lead to disorganization in speech, incorrect sequencing of events, inability to detect main ideas, difficulty evaluating the validity of information, and concrete interpretation of information (Hartley, 1995). The Functional Assessment of Verbal Reasoning (FAVR; MacDonald, In press) was selected to assess these skills in a format that resembled everyday reasoning tasks at work. The FAVR is a nonstandardized clinical reading and writing evaluation tool used to assess the types of verbal reasoning that are required for successful communication in daily life. The purposes of the FAVR are to measure verbal reasoning ability; make predictions about the individual's potential to use verbal reasoning effectively at work, school, or in social situations; detect strengths and weaknesses; provide strategies for intervention; identify breakdowns; and measure improvements over time (manual, p. 9).

Two subtests of the FAVR were used: Planning an event (FAVR-P) and Scheduling (FAVR-S). They were selected because of their resemblance to work tasks. The FAVR-P subtest involves choosing a social event given certain restrictions. The subject is given written instructions and asked to read a paragraph about taking a child to a special event. Certain restrictions about money and time are stated within the paragraph. Next, two pages of an entertainment guide specifying type, price, and time of events are given to the subject, who is then required to choose the most appropriate activity from the guide and to state the reasons for choosing the activity.

The FAVR-S subtest involves sequencing and selecting important daily events. The test includes written instructions, a list of eight activities to schedule, estimated time frames necessary to complete the activities, and messages which assist in prioritizing the

activities. In addition to the activities sheet, the subject is given a daily schedule sheet which divides the day into 30 minute intervals beginning at 9:00 a.m. and ending at 5:00 p.m. The subject is required to schedule the day by deciding what activities should be completed at what time and to give reasons why the time frame was chosen. Examples of similar tasks in the workplace include planning the work day, filling out forms, reading memos, writing short notes or documents, and scheduling specific activities. Two other subtests in the FAVR were not selected for the study because earlier uninjured pilot subjects demonstrated considerable difficulty with these tasks.

The FAVR is scored for time, accuracy, and reasoning strengths and weaknesses. For this study, only the accuracy score was used. For data analysis, scores were converted from letters to numbers from 6 (highest level of accuracy) to 1 (refusal, failed to comprehend or initiate task, no answer). The time score of the FAVR was not used because the FAS and RAN were used to evaluate performance under time pressure. Twenty minutes were given to complete each subtest.

### **Functional Outcome Measure and Work Questionnaire**

The Craig Handicap Assessment and Reporting Technique-Revised (CHART-R; Whiteneck, Charlifue, Gerhart, Overholser, & Richardson, 1992) was completed by each subject. The CHART-R is a functional outcome measure with 32 items in 5 domains (assistance, mobility, transportation, cognition, activities, social relationships, and finances). The measure was initially designed for individuals with spinal cord injuries, although it has been revised to be more appropriate for individuals with head injury.

A work re-entry questionnaire was developed specifically for this study (see Appendix A). The questionnaire was presented orally to determine whether the subject was either employed or attending school, part- or full-time, and to document the skill level of the job, and changes in income or education. Both the CHART-R and the work

questionnaire were used to gather additional information about independence in daily activities and assist the investigator in completing the modified Blishen Index (Blishen & McRoberts, 1976).

### **Procedures**

All subjects were initially contacted and interviewed by telephone. Following the initial interview, appointments for the study were made, and subjects were either sent directions to the testing site, or the investigator was given directions to the subject's home. Subjects in Arizona were individually tested in a quiet room either in the Department of Speech and Hearing Sciences or the subject's home. Subjects in Utah were individually tested in a quiet room in the subject's home, and those in Ohio were individually tested in a quiet room at Menorah Park. Prior to beginning the study, all subjects were required to read and sign a subject consent form (see Appendices B & C). Next, all subjects received a pure tone hearing screening test at 20 dB for 500, 1000, 2000, and 4000 Hz, using a portable audiometer meeting ANSI S3.6, 1989 standards. Finally, the five tests, functional outcome measure, work questionnaire, and discourse tasks were presented in random order to each subject. The session took approximately 2 hours to complete, and subjects were paid fifteen dollars for their participation. All sessions were audiotaped or videotaped.

For administration of the SCAN-A, 10 subjects (seven employed and three unemployed) were tested in an IAC, double wall, audiological test suite, using a Realistic SCT-45 stereo cassette player. The SCAN-A taped stimuli was routed to TDH 50P headphones through a Grason Stadler GSI-16 audiometer, calibrated to meet ANSI S3.6, 1989 standards. The 10 remaining subjects (three employed and seven unemployed) were evaluated using a high quality Sony TC 126 portable stereo cassette player routed to

Radio Shack Optimus headphones (worn by the examiner) and NOVA43 headphones (worn by the subject) via a Y-adaptor as specified by Keith (1994). Specific directions written on the test protocol were read verbatim by the investigator to each subject prior to beginning the SCAN-A. Subjects were required to verbally repeat stimuli during the task.

Although Keith (1994) specified that each subject must pass a pure tone hearing screen at 20 dB, two subjects (subject 5 in the employed group and subject 12 in the unemployed group) had a 45dB loss in the right ear at 4k Hz. Both subjects reported that they previously had undergone a formal audiological exam. However, due to cost, both subjects had refused to follow through with recommendations to obtain hearing aids. The subjects were included because they reportedly were functioning normally in everyday activities without amplification. Their scores on this task were similar to the scores of other individuals who did not have a hearing loss (see Results).

Four subjects (subjects 9 and 10 in the employed group and subjects 17 and 20 in the unemployed group) who participated in the study were over the age of 50. The norms for the SCAN-A ranged from 12 to 50 years. Although norms were unavailable for subjects over the age of 50 years, the scores produced by these subjects were similar to the scores of younger subjects (see Results).

During the FAS, subjects were asked to produce as many words beginning with the letters F, A, and S, as they could given 1 minute per letter. Subjects were instructed not to give proper names beginning with these letters. For the RAN, pictured items were presented one row at a time using a blank sheet of paper to cover extraneous stimuli. Initially, the subject was asked to identify the names of the pictures without being timed. Next, the subject was asked to name the repeated pictures as quickly as possible.

For the CHART-R, written instructions were provided to each subject. The subjects were required to read each question and write appropriate answers. For the

FAVR-P and FAVR-S, subjects were given specific verbal instructions to complete the task and asked to write their responses.

The work questionnaire (Appendix A) was presented orally by the investigator. Elicitation of oral language during the discourse task also was done orally by the investigator. During the discourse task, the investigator provided neutral prompts (e.g. "Can you tell me more?") to encourage discourse production. Throughout the session, the investigator provided positive verbal reinforcement (e.g. "Nice job").

Two subjects (subject 3 in the employed group and subject 15 in the unemployed group) exhibited a mild mixed dysarthria. Dysarthria is a neurogenic motor speech impairment characterized by slow, weak, imprecise, and/or uncoordinated movements of the speech musculature (Yorkston, Beukelman, & Bell, 1988). The employed subject, subject 3, reported that he was unhappy with his speech. However, he also stated that most people at work and in his everyday environment understood him. The unemployed subject, subject 15, reported having no difficulty with his speech. He stated that his family and friends understood him at all times. Both subjects reported that when difficulties with intelligibility occurred during spontaneous conversation with unfamiliar conversational partners, they repeated the unintelligible word for clarification.

## **Data Analysis**

### **Inter-rater Reliability**

Point-to-point agreement for scoring of each test was obtained by having a graduate student, who was trained in administration and scoring of all tests used in this study, score data from 20% of the sessions selected at random. The graduate student double-scored each subject's response during the testing session and reviewed the discourse transcription for accuracy. For the discourse task, a speech-language

pathologist and the investigator identified T-units for 20% of the language transcriptions selected at random. The remaining T-units were identified by the investigator. In addition, a speech-language pathologist and a graduate student rated all the identified T-units for local coherence.

### **Comparison Between Groups**

Individual one-tailed t-tests were completed for all ten communication measures between groups assuming equal variance. This was done to determine if differences existed on the various communication measures between the employed and unemployed groups.

### **Variable Reduction**

Due to the differing effects of each variable, it is difficult to perform a power analysis when using discriminant analysis. However, ten subjects per variable is generally accepted as a rule in studies using discriminant analysis (P. Jones and R. Cruz, personal communication, June 1998). Inter-test correlations were completed to determine if the variables were correlated in an attempt to decrease the number of discriminating variables used in this study. Tests with an inter-correlation of .6 or higher were reviewed in an attempt to reduce variables, given the small sample size. This strategy of reducing and then selecting predictive discriminating variables is similar to that used by Gollaher, et al. (1998) and Ponsford, Olver, Curran, & Ng (1995).

### **Discriminant Analysis**

The hypotheses were tested using discriminant analysis. Discriminant analysis enables the investigator to select the best classification model using various predictor variables. This statistical procedure can provide information about individual and multiple variable contributions made to the discriminant model. Klecka (1980) states that

discriminant analysis allows the investigator to interpret the differences between groups and provides a means to classify any case into the group which it most closely resembles. According to Klecka (1980) discriminant analysis requires that certain assumptions are met. These include: a) the inclusion of two or more groups; b) two or more cases per group; c) a number of variables that is less than the total number of cases minus two; d) variables measured in intervals; e) no variable that is a linear combination of another variable; f) covariance matrices that are approximately equal for each group; and g) groups that were drawn from a population with a multivariate normal distribution on the variables.

All of these assumptions were met using ten discriminant variables. These were: four subtest scores from the SCAN-A (Filtered Words (FW), Auditory Figure Ground (AF), Competing Words (CW), and Competing Sentences (CS)); the total number of words (F + A + S) produced from the FAS; the total A.Q. score from the Western Aphasia Battery (WAB); the time required to complete the Rapid Automatized Naming test (RAN); the total score from analysis of local coherence; and the accuracy scores from the two Functional Assessment of Verbal Reasoning (FAVR) subtests, Planning an event (FAVR-P) and Scheduling (FAVR-S).

Prior to beginning discriminant analysis, inter-correlations were completed for variable reduction, as described above. The remaining discriminating variables were entered into the initial discriminant analysis. As there was no *a priori* hypothesis regarding which variables would best discriminate between the groups, the variables were entered in random order, in a backward stepwise procedure. As Klecka (1980) explains, the backward stepwise procedure begins by removing the individual variable which provides the least univariate discrimination for the model. This process continues with the remaining variables, until either all noncontributing variables have been removed, or the

remaining variables significantly contribute to group classification. A cutoff probability value of 0.5 was selected for inclusion in the model.

After obtaining the variable or variables that best discriminated between the employed and unemployed groups, the model sensitivity, specificity, and accuracy for classifying employed and unemployed individuals was determined. Sensitivity was defined as a true positive result, specificity as a true negative result, and classification rate as the number of cases correctly classified as employed or unemployed by the discriminant model.

Individual employed and unemployed subject test scores for each test and measure are presented in Table 3. The four subtest standard scores (Filtered Words (FW), Auditory Figure Ground (AF), Competing Words (CW), and Competing Sentences (CS)) from the SCAN-A; the total number of words produced from the FAS; the total A.Q. score from the Western Aphasia Battery (WAB); the time required to complete the Rapid Automatized Naming (RAN) test; the total score from analysis of local coherence (L. Coh); and the accuracy scores from the two Functional Assessment of Verbal Reasoning subtests, Planning an event (FAVR-P) and Scheduling (FAVR-S) are included in Table 3.

**Table 3. Subject's Test Scores: Employed (E) and Unemployed (U)**

Subject	Standard Scores of SCAN-A subtests								# of words		Seconds		Accuracy Scores				Total Score		
	FW		AF		CW		CS		FAS		RAN		FAVR-P		FAVR-S		L. Coh		
	E	U	E	U	E	U	E	U	E	U	E	U	E	U	E	U	E	U	
1	11	12	1	13	1	1	1	1	1	6	27	253	137	3	6	2	1	45	40
2	12	5	1	9	5	7	1	9	1	43	19	125	219	5	5	5	1	46	39
3	13	11	5	5	1	4	1	1	1	27	32	102	104	6	3	6	3	46	50
4	14	8	2	9	8	11	1	12	4	33	35	97	216	3	3	6	2	47	48
5	15	5	7	2	9	3	8	12	4	40	21	114	128	3	3	2	3	48	46
6	16	8	11	9	9	10	7	12	12	25	22	101	135	6	3	3	2	49	49
7	17	10	6	13	2	9	10	12	9	24	46	129	166	5	6	3	3	46	45
8	18	12	12	12	1	7	1	9	1	43	22	91	227	6	2	6	2	49	45
9	19	9	2	12	9	11	5	12	12	66	22	82	136	6	2	4	2	39	44
10	20	8	8	5	12	3	10	12	12	46	51	102	92	6	3	3	2	42	46
<b>M</b>		8.8	5.5	8.9	5.7	6.6	4.5	9.2	5.7	35.3	29.7	119.0	156.0	4.9	3.6	4.0	2.1	45.7	45.2
<b>SD</b>		2.5	4.0	3.8	4.2	3.7	4.0	4.5	5.0	16.2	11.2	49.0	48.9	1.4	1.5	1.6	0.7	3.1	3.6

## CHAPTER IV

### RESULTS

#### Inter-rater Reliability

Point-to-point agreement was 99.8% for double-scoring responses on all test items and 99.7% for discourse transcription. All disagreements on scoring and transcription were reviewed and resolved by the investigator.

An inter-rater reliability of 95% was obtained for identification of T-units, and an inter-rater reliability of 77% was achieved when scoring for local coherence using the modified local coherence rating scale (VanLeer and Turkstra; in revision). The latter is comparable to that of Glosser, who achieved 75% inter-rater reliability in her studies (G. Glosser, personal communication, December, 1997).

#### Comparison Between Groups

Individual one-tailed t-tests between groups revealed significant differences on one communication measure, the RAN. All other t-tests were not found to be significant (see Table 4).

**Table 4. One-tailed t-tests between Employed (E) and Unemployed (U) groups**

Measure	M (E)	SD (E)	M (U)	SD (U)	df	t
WAB (A.Q.)	99.1	1.5	97.4	2.5	18	-1.80
FW	8.8	2.5	5.5	4.0	18	-2.19
AF	8.9	3.8	5.7	4.2	18	-1.79
CW	6.6	3.7	4.5	4.0	18	-1.23
CS	9.2	4.5	5.7	5.0	18	-1.67
FAS	35.5	16.2	29.7	11.2	18	-0.90
RAN	119.0	49.0	156.0	48.9	18	1.66*
FAVR-P	4.9	1.4	3.6	1.5	18	-2.02
FAVR-S	4.0	1.6	2.1	0.7	18	-3.35
L. Coh	45.7	3.1	45.2	3.6	18	-0.33

\* $p < .05$

### Variable Reduction

Table 5 presents all of the inter-test correlations, with bolded items indicating high inter-test correlations ( $r \geq .6$ ). When a high inter-test correlation was observed, the test judged to be the most functionally related to communication in work re-entry, and having a low correlation with other tests was selected by the investigator for inclusion. This reduced the number of variables entered into the discriminant analysis from ten to seven. These seven variables were: the total A.Q. score from the Western Aphasia Battery (WAB), three subtest scores from the SCAN-A (Filtered Words (FW), Auditory Figure Ground (AF), and Competing Sentences (CS)); the total score from analysis of local coherence; and the accuracy scores from the Functional Assessment of Verbal Reasoning Scheduling subtest (FAVR-S) and Planning an event subtest (FAVR-P).

Table 5. Inter-correlations (N = 20)

	A.Q.	FW	AF	CW	CS	FAS	FAVR-P	FAVR-S	RAN
A.Q.	1.0								
FW	.27	1.0							
AF	.01	.39	1.0						
CW	.45	.30	.53	1.0					
CS	.47	.14	.43	<b>.72</b>	1.0				
FAS	<b>.60</b>	-.03	.05	.45	.50	1.0			
FAVR-P	.45	.04	.00	.24	.09	.38	1.0		
FAVR-S	.39	.44	.27	.46	.21	.33	.34	1.0	
RAN	-.54	-.10	-.16	<b>-.60</b>	<b>-.62</b>	<b>-.59</b>	-.32	-.51	1.0
L. Coh	.23	.31	.09	.13	.16	.14	-.35	.29	-.18

Note. All inter-correlations of .6 or greater are bolded.

### Discriminant Analysis

Discriminant analysis was performed using the STATA 5.0 (1997) statistical software program. The backward stepwise procedure rejected the Western Aphasia

Battery (WAB) A.Q. score, scores from the Functional Assessment of Verbal Reasoning-Planning an event subtest (FAVR-P), scores from the Auditory Figure Ground subtest of the SCAN-A, and local coherence scores because they did not meet the criterion of 0.5. The three remaining variables were scores from the FAVR-Scheduling subtest, and Filtered Words (FW) and Competing Sentences (CS) subtests of the SCAN-A. The combination of these scores accounted for 49.5% of the variance in scores,  $\chi^2(3, N = 20) = 13.74, p = .00$  (see Table 6).

**Table 6. Backward Stepwise Procedure**

Test	<i>z</i>	<i>p&gt;/z/</i>
FAVR-S	1.59	.11
FW	1.27	.20
CS	1.22	.22

The model using the FAVR-S, FW, and CS subtests correctly classified 85% of subjects as employed or unemployed. The model was able to classify 8 subjects as employed from the actual 10 employed subjects in the study (80% sensitivity), and 9 subjects as unemployed from the actual 10 unemployed subjects in the study (90% specificity).

## **CHAPTER V**

### **DISCUSSION**

The present study considered two questions. First, it was of interest to determine whether employed individuals with TBI performed better on communication measures than unemployed individuals with TBI. Second, the study attempted to identify a single communication measure or combination of measures that could discriminate employed from unemployed adults with comparable severity of injury and type of work. The results of the present study supported the first hypothesis, that employed individuals with TBI would perform better on communication measures than unemployed individuals with TBI. The results also supported the second hypothesis, as a combination of three tests discriminated employed from unemployed adults with TBI.

The following section will address reasons why certain communication tests were better able to discriminate employed from unemployed individuals. Next, the relationship of the results to previous research will be discussed, followed by discussion of the clinical implications of the data, and how the results might relate to future TBI research.

#### **Discriminant Variables**

The total score on the Scheduling subtest of the Functional Assessment of Verbal Reasoning (FAVR-S) was found to be the best discriminator of employed and unemployed individuals. Although difficult (subjects 11 and 12 in the unemployed group gave up on the task), this task appeared to be the most functional, since many work related activities involve the use of multiple communication and cognitive skills. The test required that the individual with TBI use the communication skills of reading and writing, as well as cognitive skills such as problem solving, organization, memory, and attention.

The Planning an event subtest of the Functional Assessment of Verbal Reasoning (FAVR-P) was not a good discriminating variable. Although more employed subjects produced higher scores on this task than unemployed subjects, it did not make a unique contribution to the discriminant model. It may be that the FAVR-P was easier for all subjects to complete, causing a ceiling effect in scores. The subtest required completion of only two questions. Most unemployed subjects were able to correctly identify reasons for choosing a specific event, even though the event that they chose was incorrect. Also, subjects in both the employed and unemployed groups were able to complete the test prior to the 20 minute time limit.

The addition of scores from the Filtered Words (FW) and Competing Sentences (CS) subtests of the SCAN-A (Keith, 1994) increased the discriminating ability from that of the Functional Assessment of Verbal Reasoning-Scheduling (FAVR-S) subtest alone. The model using the three variables correctly classified 85% of the subjects as employed or unemployed (vs. 75% with the FAVR-S alone). These results suggest that if communication is unclear (muffled) and multiple auditory stimuli are presented at the same time, subjects may have problems obtaining work or difficulty in the work place. The FW and CS subtests of the SCAN-A not only required language skills, but also involved cognitive processes such as attention and memory. The FW and CS subtests of the SCAN-A illustrate the importance of the relationship between communication and cognition.

The two other subtests of the SCAN-A, the Auditory Figure Ground (AF) and Competing Words (CW) were not good discriminating variables. Perhaps, less demanding communication and cognitive skills were necessary in order to complete these tasks. For instance, it is possible that disregarding background noise is easier than comprehending muffled sounds. Also, the length and complexity of competing auditory stimuli may affect

processing, which could explain why recalling sentences would be more difficult than single words.

Tasks that involved time pressure were highly correlated with other measures, and thus, were not included in the discriminant analysis. However, it is unlikely that these measures would have added to the model, given the wide range of scores by subjects in both groups. For example, subjects 1 and 9 in the employed group differed greatly in their scores on the FAS. Subject 1 was able to produce 6 words in 3 minutes, and subject 9 was able to produce 66 words in 3 minutes. Their scores revealed similar differences during the Rapid Automatized Naming (RAN) test with subject 1 requiring 253 seconds to complete the task, and subject 9 requiring 82 seconds to complete the task. However, similar results were noted in the unemployed group (subjects 12 and 20). Subject 12 produced 19 words during the three minute FAS task and required 219 seconds to complete the RAN. Subject 20 was able to produce 51 words during the three minute FAS task and required only 92 seconds to complete the RAN. Scores were not related to employment type. However, due to the small sample size used in this exploratory study, it is unknown if the subjects' scores are truly representative of individuals who are employed and unemployed.

Although significant in the one-tailed t-test, the A.Q. score of the WAB was rejected from the model during the backward stepwise procedure of the discriminant analysis. This may be attributed to a ceiling effect for the A.Q. scores. Also, the range of scores within both the employed and unemployed groups was small (94.9-100 for the employed and 93.6-100 for the unemployed) indicating that the groups were highly similar.

The oral narrative task also did not discriminate between employed and unemployed individuals. The scoring system used for local coherence produced a small

range of scores (39-50), with the average score for the Employed Group being 45.7 and the average score for the Unemployed Group being 45.2. The range of scores also was similar between the 2 groups: 39-49 in the employed group and 39-50 in the unemployed group. However, it is interesting to note that although subject 9 in the employed group scored consistently well on all tests, his narrative was rated the lowest among subjects. Surprisingly, subject 13 of the unemployed group was rated as having the best local coherence during oral language tasks (see Table 3). Another possible reason for not finding differences in narratives may be the scoring system used. Although the original 5-point scoring system introduced by Glosser and Deser (1990) had poor inter-rater reliability during scoring trials of pilot data in this study, perhaps the original five point scoring system would have been more sensitive at detecting differences in local coherence.

### **Comparison to Previous Research**

#### **Injury Severity and Sociodemographic Factors**

Cifu, et al. (1997), Ponsford, Olver, Curran, & Ng (1995), and Wehman, et al. (1995) reported that severity of injury greatly affected return to work. This study found that even individuals with mild TBI can continue to have difficulties returning to work after injury. In addition to injury severity, other sociodemographic factor such as age and level of daily functioning (Gollaher, et al., 1998; Cifu, et al., 1997; Greenspan, Wrigley, Kresnow, Branche-Dorsey, & Fine, 1996; Ponsford, Olver, Curran, & Ng, 1995) have been reported to assist in predicting return to work. Subjects in this study ranged in age from 24.5-54.8 years ( $M = 36.2$ ) for the employed group and 21.6-53.8 years ( $M = 39.1$ ) for the unemployed group. In the present study, an interesting finding revealed that two subjects over the age of 50 (subjects 9 and 10) returned to work or the school setting and the two youngest subjects (13 and 14) remained unemployed.

In regard to daily functioning, all employed individuals and eight of the unemployed individuals reported being independent in their daily activities. Two of the unemployed individuals required assistance for transportation. Both were unable to use the public transportation system independently or to drive a vehicle. In this study, three employed subjects (1, 5, & 7) reported continued difficulty with their job or return to school, but nonetheless, continued their employment or education. These individuals stated that they required assistance (e.g., extra time, repetition of instructions, written information) from others in either the work or school setting. Prior to their accident, the subjects were independent in their work or school activities. Due to this change in independence, the subjects reported decreased enjoyment in returning to a familiar job or school setting, and completing the responsibilities associated with the job or academic course work.

Of the unemployed subjects, all ten reported they missed being financially independent. They stated that the inability to make money or to return to a familiar job kept them from being totally independent. Eight of the ten unemployed subjects reported that they would not return to work unless they returned to the same type of job with the same work status and made the same amount of money as prior to injury. It is unknown if these individuals truly wanted to return to their previous job or if the statement was used as a defense mechanism for being unemployed. Three of the ten unemployed subjects reported that they would be satisfied collecting disability if they could not return to work in the future.

### **Neuropsychological Studies**

The results of the present study are in agreement with the findings of Cifu, et al. (1997), and Girard, et al. (1996), who found that memory attention, problem solving, and organization skills were important in predicting successful work re-entry. The three

communication tasks (Functional Assessment of Verbal Reasoning-Scheduling (FAVR-S), Filtered Word (FW), and Competing Sentences (CS)) that were able to discriminate employed from unemployed individuals involved memory, attention, problem solving, and organization skills. The results of this study also are in agreement with Girard, et al. (1996) who stated that no specific variable can predict work re-entry following TBI, instead using a multifaceted approach with a variety of variables is more beneficial. The FAVR-S and the FW and CS subtests of the SCAN-A have demonstrated a multifaceted approach using both communication and cognition.

### **Communication Studies**

Previous studies (Curl, Fraser, Cook, & Clemmons, 1996; Fraser & Wehman, 1995; Wehman, Kregel, Sherron, Nguyen, & Kreutzer, 1993) concerning communication skills and work re-entry suggested that communication was an important component of work re-entry following TBI. However, language and communication deficits related to work re-entry were mentioned only briefly. Therefore, the results gathered from this exploratory study can add information about the relationship between communication and work re-entry to the existing literature.

Although most of the previous studies in the area of neuropsychology have focused on measures at the impairment level, the findings from this study suggest that both impairment and disability based measures such as the FAVR-S can be good discriminating variables. There is a current movement in the field of speech-language pathology toward the use of functional (i.e., disability or handicap level) measures. The recent publication of functional communication measures such as the ASHA Functional Assessment of Communication Skills for Adults (ASHA FACS; Frattali, et al., 1995), Functional Linguistic Communication Inventory (FLCI; Bayles & Tomoeda, 1994), and Communication Profile: A Functional Skills Survey (Payne, 1994) recognize the

importance of evaluating communication at the disability level. Evaluating skills at the disability level provides the professional with the opportunity to discover strengths and weaknesses of the client's communication in a variety of situations. In addition to evaluating communication at the disability level, the present study also described how difficulties with impairments such as attention, memory, auditory processing, problem solving, and organization can affect work re-entry and ultimately translate into a handicap for the survivor (Hartley, 1995).

### **Clinical Implications**

From the data, it appears that individuals with mild, moderate, and severe TBI may continue to demonstrate communication and cognitive impairments and disabilities for months and years post injury. Speech-language pathologists (SLPs) working with individuals with TBI in the rehabilitation setting could incorporate information such as this to help determine which clients might be ready to return to work or school. Functional communication tasks such as the FAVR-S and the FW and CS subtests of the SCAN-A could be easily administered in the rehabilitation setting during the evaluation process. Individuals who performed more accurately on communication tasks involving both impairment and disability level skills (e.g., those requiring a combination of reading, writing, attention, memory, organization, and problem solving) could possibly have a better chance at successfully returning to the work or school environment. Although the subjects in this study were able to complete the communication tasks post one year injury, it is uncertain if individuals with TBI would be able to complete these tasks in the acute stages after injury. A prospective study will be useful in determining the optimal time during recovery to administer work re-entry related communication tasks.

Following the assessment of communication skills necessary for work re-entry, the SLP could make recommendations for restructuring the individual's environment, adapting tools and equipment, and determining remediation and compensatory strategies (e.g., checklists, a daily planner) to assist with residual cognitive and communicative deficits (West, 1995). In addition, speech-language pathologists can assist in educating and training the employer, supervisor, and coworkers about TBI and preparing them for unexpected difficulties that may occur when working with individuals with TBI (Curl, Fraser, Cook, & Clemmons, 1996; Wehman, Kregel, Sherron, Nguyen, & Kreutzer, 1993).

### **Future Research**

Results from this study have confirmed that it is possible to evaluate TBI at both the impairment and disability level using functional communication activities when attempting to predict return to work or school. However, further studies investigating the relationship between communication and work re-entry are needed. This is evident from the small number of communication based work re-entry studies found in the literature. Current studies focus on demographic and neuropsychological predictors and do not thoroughly discuss the implications of communication deficits at the impairment, disability, or handicap levels. Future studies could provide researchers and practicing clinicians with insight into the use of effective evaluation tools to identify both communication impairments and disabilities associated with work re-entry and provide suggestions for functional treatment. As previously noted, future studies should use larger samples and smaller numbers of communication variables, both which are limitations to the present exploratory study. Discriminant analysis using a large number of variables and a small sample size tends to reduce accuracy and efficiency (Klecka, 1980). Also, a prospective

study should be completed prior to generalizing the results to the larger population. Perhaps in studies using larger samples, those variables that did not discriminate employed from unemployed in the current model may be found to classify a greater number of subjects into the correct category.

### **Conclusion**

In summary, this study revealed that employed individuals with TBI performed differently than unemployed individuals on three communication measures, scheduling an event, repeating muffled sounds, and recalling sentences in a dichotic listening task. The combined communication tests correctly classified 85% of the subjects as employed or unemployed.

The present exploratory study investigated communication at the level of impairment and disability. Tasks evaluating both impairment and disability may be more revealing than tasks which strictly evaluate impairments, and may be more practical to administer. Although the results are suggestive, further prospective studies are required to determine their clinical utility.

## APPENDIX A

### WORK RE-ENTRY QUESTIONNAIRE

- |   |           |           |
|---|-----------|-----------|
| 1. Are you presently working?   | yes       | no        |
| 2. If “no” are you currently looking for work?  | yes       | no        |
| 3. How are you supported if you are unemployed?   |           |           |
| 4. Is this the same job you had before your accident?   | yes       | no        |
| 5. If “no” please list your current job   |           |           |
| 6. Please list all of the jobs you have had since your accident and the dates you were employed |           |           |
| 7. Are you working part-time or full-time?  | part-time | full-time |
| 8. How many hours are you currently working?  |           |           |
| 9. Are you making the same amount of money as before your accident?                             | yes       | no        |
| 10. Are you making less or more money since your accident?                                      | less      | more      |
| 11. Since the accident, have you noticed any difficulties while working?                        | yes       | no        |
| 12. Please describe any difficulties that you have noticed.                                     |           |           |

## **APPENDIX B**

### **SUBJECT'S CONSENT FORM**

**Project Title: Communication Abilities and Work Re-entry Following Traumatic Brain Injury**

**I AM BEING ASKED TO READ THE FOLLOWING MATERIAL TO ENSURE THAT I AM INFORMED OF THE NATURE OF THIS RESEARCH STUDY AND OF HOW I WILL PARTICIPATE IN IT, IF I CONSENT TO DO SO. SIGNING THIS FORM WILL INDICATE THAT I HAVE BEEN SO INFORMED AND THAT I GIVE MY CONSENT. FEDERAL REGULATIONS REQUIRE WRITTEN INFORMED CONSENT PRIOR TO PARTICIPATION IN THIS RESEARCH STUDY SO THAT I CAN KNOW THE NATURE AND THE RISKS OF MY PARTICIPATION AND CAN DECIDE TO PARTICIPATE OR NOT PARTICIPATE IN A FREE AND INFORMED MANNER.**

#### **PURPOSE**

**I am being invited to voluntarily participate in the above-titled research project. The purpose of this project is to assess communicative skills in individuals with mild, moderate, and severe traumatic brain injury  $\geq$  1 year after injury to determine if these abilities affect workplace re-entry.**

#### **SELECTION CRITERIA**

**I am being invited to participate because 1) I am an individual between the age range of 18 to 55 years, 2) I was identified by the Trauma Registry at either the University Medical Center, Tucson, AZ, as having had a traumatic brain injury  $\geq$  1 year prior to this date, and 3) I was consecutively employed part- or full-time 6 months prior to the injury. Approximately 60 subjects will be enrolled in this study.**

#### **PROCEDURE**

**If I agree to participate, I understand that I will be asked to complete five communication tests, a work questionnaire, a functional outcome measure, and engage in conversation with the examiner. Total testing time is expected to be about 2 hours and I will be given breaks as needed. Testing can be performed over more than one session, if necessary. Sessions will be audio- and videotaped.**

## **RISKS**

There is minimal risk associated with this study. Fatigue may be caused due to the length of the evaluation.

## **BENEFITS**

No direct benefit is indicated. However, I understand that the results of the testing will be available to me for discussion. Any indication of problems areas in communication skills will be addressed with the investigator. Recommendations will be presented during review of testing results.

## **CONFIDENTIALITY**

I understand that any information about me obtained from this study will be kept strictly confidential and will be destroyed at the end of the study. Information containing personal identifying materials will be kept in locked files, and only Emi Isaki, MS, and her trained assistants will have access to these files. I understand my research records may be subpoenaed by court order. I consent to publication of study results so long as the information is anonymous or disguised so that identification cannot be made.

## **PARTICIPATION COSTS AND SUBJECT COMPENSATION**

There is no cost to participate in the study and I will be paid fifteen dollars for the entire evaluation session.

If I require additional information about the study I may call Emi Isaki, MS, at (520) 621-1969. If I have any questions concerning my rights as a research subject I can call the University of Arizona Human Subjects Committee Office at (520) 626-6721.

## **AUTHORIZATION**

**BEFORE GIVING MY CONSENT BY SIGNING THIS FORM, THE METHODS, INCONVENIENCES, RISKS, AND BENEFITS HAVE BEEN EXPLAINED TO ME AND MY QUESTIONS HAVE BEEN ANSWERED. I UNDERSTAND THAT I MAY ASK QUESTIONS AT ANY TIME AND THAT I AM FREE TO WITHDRAW FROM THE PROJECT AT ANY TIME WITHOUT CAUSING BAD FEELINGS OR AFFECTING MY MEDICAL CARE. MY PARTICIPATION IN THIS PROJECT MAY BE ENDED BY THE INVESTIGATOR FOR REASONS THAT WOULD BE EXPLAINED. NEW INFORMATION DEVELOPED DURING THE COURSE OF THIS STUDY WHICH MAY AFFECT MY WILLINGNESS TO CONTINUE IN THIS RESEARCH PROJECT WILL BE GIVEN TO ME AS IT BECOMES AVAILABLE. I UNDERSTAND THAT THIS CONSENT FORM WILL BE FILED IN AN AREA**

**DESIGNATED BY THE HUMAN SUBJECTS COMMITTEE WITH ACCESS RESTRICTED TO THE PRINCIPAL INVESTIGATOR, EMI ISAKI, MS, HER TRAINED ASSISTANTS, AND AUTHORIZED REPRESENTATIVES OF THE CENTER FOR NEUROGENIC COMMUNICATION DISORDERS AT THE UNIVERSITY OF ARIZONA. I UNDERSTAND THAT I DO NOT GIVE UP ANY OF MY LEGAL RIGHTS BY SIGNING THIS FORM. A COPY OF THIS SIGNED CONSENT FORM WILL BE GIVEN TO ME.**

\_\_\_\_\_  
Subject's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Parent Legal Guardian  
(if necessary)

\_\_\_\_\_  
Date

#### **INVESTIGATOR'S AFFIDAVIT**

I have carefully explained to the subject the nature of the above project. I hereby certify that to the best of my knowledge the person who is signing this consent form understands clearly the nature, demands, benefits, and risks involved in his/her participation and his/her signature is legally valid. A medical problem or language or education barrier has not precluded this understanding.

\_\_\_\_\_  
Signature of Investigator

\_\_\_\_\_  
Date

## APPENDIX C

### LDS HOSPITAL CONSENT FOR PARTICIPATION IN AN INVESTIGATIONAL STUDY

#### **Project Title: Communication Abilities and Work Re-entry Following Traumatic Brain Injury**

#### **GENERAL INFORMATION**

##### **Background Information:**

I am being invited to voluntarily participate in the above-titled research project. The purpose of this project is to assess communicative skills in individuals with mild, moderate, and severe traumatic brain injury  $\geq 1$  year after injury to determine if these abilities affect workplace re-entry. This study involves my participation to complete approximately 2 hours of testing during a single session with breaks given as needed. Testing can be performed over more than one session, if necessary. I understand that I will be asked to complete five communication tests, a work questionnaire, a functional outcome measure, and engage in conversation with the examiner. Sessions will be audio- or videotaped.

##### **Risks or discomforts:**

There is minimal risk associated with this study. Fatigue may be caused due to the length of the evaluation.

##### **Benefits:**

No direct benefit is indicated. However, I understand that the results of the testing will be available to me for discussion. Any indication of problem areas in communication skills will be addressed with the investigator. Recommendations will be presented during review of testing results.

##### **Alternative Treatment:**

No treatment will be provided at anytime during this study.

##### **Questions:**

For questions concerning the research and my rights as a subject, contact Emi Isaki, M.S. (Principal Investigator) at (520) 621-1969 or the University of Arizona Human Subjects Committee Office at (520) 626-6721. If necessary, further information can be obtained from Kendell Nelson, Assistant to the Administrator, (801) 321-1968.

**DESCRIPTION OF SPONSORING/GRANTING AGENCY**

This doctoral study is being conducted under the auspices of the University of Arizona, in Tucson, AZ. The Principal Investigator is a doctoral candidate at the University of Arizona in the Department of Speech and Hearing Sciences. A small grant from the Graduate College at the University of Arizona was awarded to pay subjects for participation in this study. No other funding is associated with the study.

**FINANACIAL DISCLOSURE**

There is no cost to participate in the study, and I will be paid fifteen dollars for the entire evaluation session.

**CONSENT**

I understand that participation in this study is voluntary and that my refusal to participate will involve no penalty or loss of benefits to which I would otherwise be entitled and that I may discontinue participation at any time without penalty or loss of benefits to which I would otherwise be entitled.

I understand that my participation in this study may be terminated by the investigator without regard to my consent if I do not meet the subject criteria for inclusion in the study. I understand that if I decide to withdraw from this study, arrangements will be made for an orderly termination and I will be informed of any consequences which may occur upon my decision to withdraw. I understand that new findings which develop during the course of the research which may relate to my willingness to continue participation will be provided to me.

I understand that the particular procedure described above may involve risks to me which are currently unforeseeable.

Records will be held in confidence by the Principal Investigator, representatives of the Center for Neurogenic Communication Disorders at the University of Arizona, and the Institutional Review Board. Any release of information derived from these records to scientific organizations, medical journals, etc. will be done only without identification of the subjects.

I have read the foregoing and my questions have been answered. I desire to participate in this study and accept the benefits and risks. I give permission for information gathered in this study to be released to Emi Isaki, M.S., her trained assistants, and authorized representatives of the Center for Neurogenic Communication Disorders at the University of Arizona.

---

**Date** **Signature of Subject**

---

**Date** **Witness**

**If the subject is a minor or otherwise unable to consent, the following should be included:**

**Upon consideration of the possible benefits and risks, as outlines, I approve participation of (subject's name) \_\_\_\_\_ in this study.**

**I also give permission for information gathered in this study to be released to Emi Isaki, M.S., her trained assistants, and authorized representatives of the Center for Neurogenic Communication Disorders at the University of Arizona.**

---

**Date** **Signature**

---

**Relationship to Subject**

---

**Date** **Witness**

## APPENDIX D

### EXAMPLES OF LOCAL COHERENCE SCORING (VanLeer & Turkstra, in revision)

Local coherence is determined by maintaining the relationship of meaning from one T-unit to the next.

#### Score of 3

The topic of the preceding utterance is completely related to the next T-unit by elaboration; temporal sequencing; enumeration of related examples; or maintaining the same actor, subject, action, or argument as the focus. For example, "I think a month before I got out. That's when I started remembering things."

#### Score of 2

The topic of the preceding utterance is generally related to the next T-unit, but with a shift in focus from the subject or activity of the preceding utterance; or the utterance is referentially vague or ambiguous so the relation to the preceding utterance must be inferred. For example, "I was in the middle lane. Other people keep going around."

#### Score of 1

The topic of the preceding utterance is not related to the next T-unit. There may be a radical topic shift, a comment on discourse, or an unintelligible utterance. For example, "I was semi-conscious then they say. Rehab was good when I could get down there."

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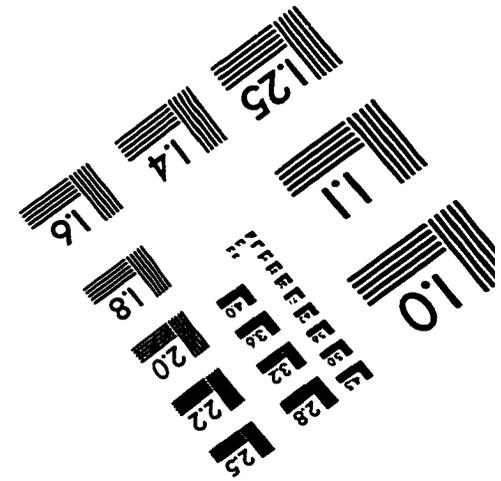
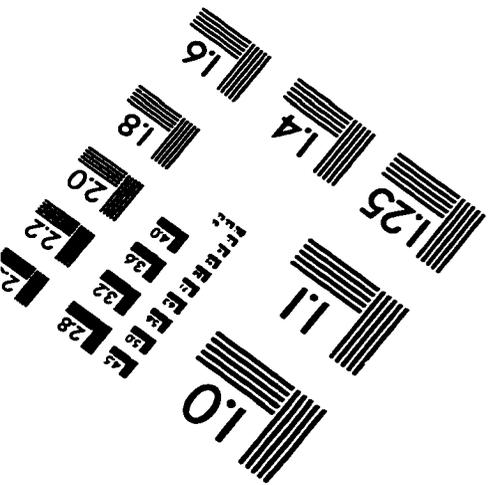
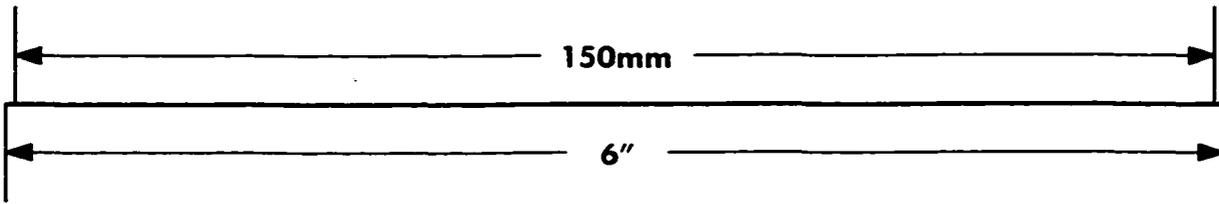
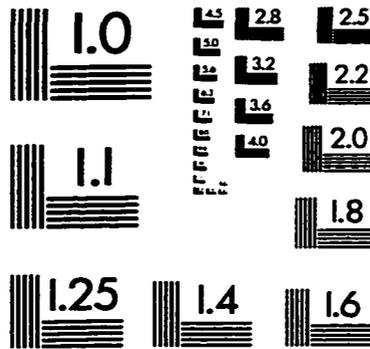
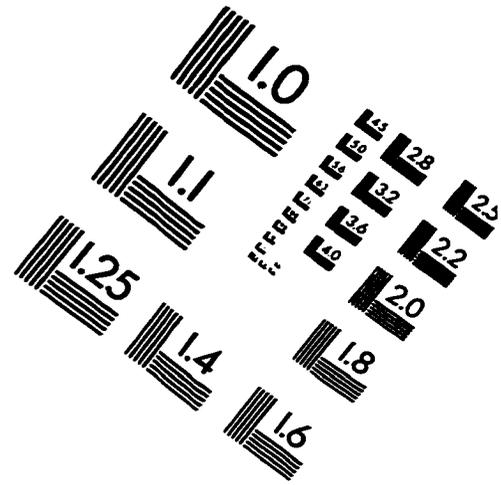
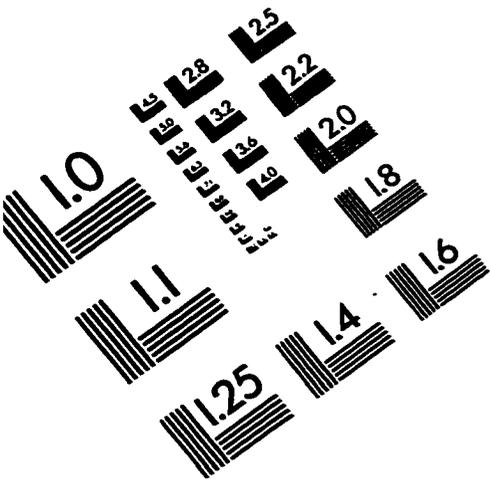
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