Nonstandardized Assessment Approaches for Individuals with Traumatic Brain Injuries

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ABSTRACT

Nonstandardized assessment procedures serve a variety of purposes, including determining competencies in domains for which there are no standardized tests, describing performance in the context of real-world settings and activities, and exploring the effects of systematic changes in communication and cognitive demands and partner supports. This article reviews evidence on the use of nonstandardized procedures for the assessment of individuals with traumatic brain injury and offers recommendations for the use of the procedures that are supported by the available evidence.

KEYWORDS: Traumatic brain injury, assessment, nonstandardized, functional, cognition, communication, discourse, social cognition, pragmatics

Learning Outcomes: Upon completion of this article, the reader will be able to (1) define terminology associated with the assessment of individuals with traumatic brain injury (TBI), (2) summarize the rationale for the use of nonstandardized assessment procedures for individuals with TBI, (3) identify which discourse analyses should be included when monologic or conversational discourse is examined in individuals with TBI, (4) summarize the use of collaborative contextualized hypothesis testing for individuals with TBI, and (5) summarize the key limitations of nonstandardized assessment procedures.

This is one of two articles devoted to reviewing clinical practice for the assessment of cognitive-communicative disorders following traumatic brain injury (TBI). The first assessment article (Turkstra et al,[1] in this issue) pertained to use of standardized tests. The present article reviews nonstandardized assessment procedures. These articles are part of a series devoted to examining evidence-based clinical practice in neurogenic communication disorders, initiated in 1997 by the Academy of Neurologic Communication Disorders and Sciences (ANCDS) (see www.ancds.org).

Several assessment purposes are currently best served by nonstandardized procedures. These include (1) determining competencies

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in domains for which there are no standardized tests (e.g., discourse), (2) describing performance in the context of real-world settings and activities, (3) identifying cognitive and communication demands of relevant real-world contexts, (4) describing the communication and support competencies of everyday communication partners, and (5) exploring the effects of systematic changes in communication and cognitive demands and partner supports. Thus, there are compelling reasons to examine the evidence for nonstandardized assessment approaches.

First, the relevant terminology is defined. The sections that follow address nonstandardized procedures and their rationales. The information included in this summary is derived from studies of nonstandardized procedures, published expert opinion, and a survey of speech-language pathologists who work with individuals with cognitive-communication disorders.

DEFINITIONS

Discussions of assessment are often plagued by a lack of clarity regarding the purpose of the assessments under discussion and by a lack of precise definitions of relevant terminology. In this section we offer operational definitions of key types of assessment.

Standardized versus Nonstandardized

A standardized assessment is one in which the procedures for administering test items are prescribed and well defined. All other assessments are nonstandardized.

Norm Referenced versus Criterion Referenced

A norm-referenced test is one that yields results that can be quantitatively compared with performance of a normative sample (e.g., age-corrected scores and standard scores based on a normal comparison group). A criterion-referenced test is one that yields results that are compared with a standard other than performance of a normative sample. For example, results of a Piagetian test of cognitive development may place a child in a developmental category defined by Piagetian theory but not yield a score that relates a child's performance to age norms. The Western Aphasia Battery is another example of a criterion-referenced test. The goal is to identify individuals with aphasia and determine aphasia severity rather than to place individuals with aphasia on a continuum with a normal comparison group.

Formal versus Informal

Although these terms are used in a variety of senses, we define a formal assessment tool as one that has systematically applied procedures, whereas an informal assessment lacks defined procedures. In this sense, the broad category of formal measures includes both standardized measures with specifically prescribed administration procedures and other systematic assessments such as functional behavior assessment.

Static/Descriptive versus Dynamic/Experimental

A static or descriptive measure yields a description of performance, participation, or context conditions without attempting to identify the factors that influence (positively or negatively) the quality of performance or the success of participation. The term "dynamic assessment" has been used in many senses, including flexible assessment and test-teach-test assessment.[2] As we use the term, dynamic assessment is *experimental* in the sense that it attempts to identify the effects of factors (e.g., strategies, task modifications, context factors, environmental supports) that may influence performance. Dynamic assessment can be used for diagnostic purposes (e.g., "process assessment" as described by Kaplan[3]) but typically has the goal of generating an effective and efficient intervention plan. For the purposes of this article, the term *static* includes measures that are descriptive and the term *dynamic* includes measures that are experimental.

Initial versus Outcome

Initial assessments are used to document baseline abilities, performance, and participation

prior to intervention. Ongoing assessments are used to document progress in relation to goals and to refine the intervention plan in an ongoing manner. Outcome assessment is used to document the final effects of intervention (or passage of time) at a discrete time.

RELATED TERMINOLOGY

World Health Organization International Classification of Functioning Categories

In its most recent iteration, the World Health Organization (WHO)[4] proposed three broad categories for describing diseases and injuries and their effects: body structure and functions (generally corresponding to the previous term "impairment"), activities and participation (corresponding to "disability" and "handicap"), and context (environmental and attitudinal). In the case of each of the three categories, there exists the possibility of static/descriptive and dynamic assessments, thus yielding a total six categories of assessment within the WHO system. A functional measure, as we use the term, may document strengths and weaknesses at the level of personally relevant everyday activities, participation in relevant contexts of life, and relevant factors outside the person (context factors) that affect performance and participation in those contexts. For example, for a static measure at the level of context, one might wish to document the effects of partners' communication styles on the performance and participation of the individual with disability. At the same level, a dynamic measure may explore effects of strategies and context supports. For example, one could examine experimentally the degree to which a partner's style can be modified to become more supportive and the effects of proposed modifications on the individual's performance and participation.

In this article, our focus is primarily on assessments that are functional; at the level of activity, participation, or context; and implemented for purposes of planning and monitoring intervention. It should be noted that one and the same assessment could be functional or not, depending on its use and interpretation. For example, performance on the "Cookie Theft Picture" stimulus item from the Boston Diagnostic Aphasia Examination[5] could be used to judge perceptual skills, organizational skills, syntax and word-finding abilities, and the like. Alternatively, it can be used to judge a person's ability to communicate effectively and efficiently relevant information to a communication partner in an organized manner under relatively supportive communication conditions. In the latter case, it would be considered a functional measure.

Subjective and Objective Quality of Life

Research on social outcome after TBI has incorporated both subjective and objective measures of quality of life (QOL). Subjective QOL measures are "insider-defined" measures of outcome,[6] focusing on the individual's perceptions of well-being. By contrast, objective QOL measures focus on markers of social well-being in the individual's culture, including outcomes such as employment, marriage, and independence.

PURPOSES OF ASSESSMENT

The multidimensional nature of assessment has led to substantial confusion in clinical practice as well as in the literature associated with the management of individuals with TBI. Without consideration of the terminology just discussed, interpretation of assessment findings is misleading at best. Assessments can be designed to serve several distinct purposes, including diagnosis, prognosis, acquisition of services, legal testimony, research, planning intervention, or monitoring intervention. The present article is focused on assessment procedures designed to facilitate functional and individualized intervention planning and monitoring of progress for persons with TBI. It considers nonstandardized measures that target body structures and functions, activities, participation, or contexts; are formal or informal, static or dynamic; and are used for an initial, ongoing, or outcome assessments. All of these assessments share the characteristic of not having

been standardized on a normal or clinical sample.

RATIONALE FOR NONSTANDARDIZED ASSESSMENT

The importance of nonstandardized, functional, and context-sensitive assessment is supported by extensive research demonstrating the shortcomings of standardized, office-bound language and neuropsychological testing for individuals with TBI.[7–10] Indeed, Anderson and colleagues[11] describe the dissociation between test performance and everyday functioning as a defining feature of frontal lobe injury, noting that the "dissociation between severe dysfunction in daily activities and good performances on standardized cognitive tests provides both an important diagnostic indicator as well as a major challenge in the evaluation of persons with prefrontal dysfunction" (p. 289). Similarly, Ewing-Cobbs and colleagues[12] found that in a cohort of children with TBI, although standardized achievement test scores had returned to normal by 6 months after injury, 79% had either repeated a grade or required special education assistance at a 2-year follow-up. Perrott and colleagues[13] observed that among children with moderate to severe TBI, poor behavioral outcome was associated with only one of six IQ variables (digit span) and only one of nine neuropsychological tests (the Contingency Naming Test[14]). Furthermore, the TBI group did worse than sibling controls on behavioral measures but not on neuropsychological tests.

Functional or situational assessments have also been compared with testing conducted in clinical settings for purposes of predicting vocational and community reentry for adults with TBI. LeBlanc and colleagues[15] compared neuropsychological assessment findings with situational vocational assessments for 127 individuals with TBI. The results indicated that situational assessments were more effective than standardized testing at predicting vocational success. In addition, the authors found relatively weak correlations between the situational evaluations and the neuropsychological assessments. They emphasized that situational evaluations are critical, particularly for the assessment of executive functions. Starch and Falltrick[16] reached similar conclusions in a report of three case studies. These authors observed that in all three cases, skills identified as being important for successful community reentry and judged to be intact in the clinical setting were noted to be impaired in home settings. They concluded that because rehabilitation and adjustment to brain injury are ongoing, assessment and intervention should be community based.

In a review of the ecological validity of neuropsychological tests, Chaytor and Schmitter-Edgecombe[17] noted that although several studies found statistically significant relationships between standardized tests and measures of everyday cognitive skills, the magnitude of these relationships was typically weak. They listed a variety of factors that could limit a test's predictive and ecological validity, including the test environment (e.g., the distraction-free environment and supportive behavior of the examiner may mask functional cognitive and emotional problems), constructs that a test measures (e.g., there is disagreement about the definition of executive functioning and how it should be measured), behavior sampling (e.g., the testing process may collect a small sample of a person's range of behavior and may not stress attentional, memory, and organizational skills to their point of functional weakness), compensatory strategies (e.g., a person may successfully employ a compensatory strategy to accomplish a task in everyday life but be prevented from using it in the testing environment), and noncognitive factors (i.e., many persons with brain injury have behavioral and emotional deficits that may compound their cognitive deficits). The authors concluded that it no longer seemed appropriate to ask simply "are neuropsychological tests ecologically valid?" but rather one should ask "which tests have the most ecological validity and in which circumstances?"

The general conclusion that can be drawn from the evidence just discussed is that when the primary goals of assessment are to identify real-world disability and to plan and monitor intervention, office-bound language and neuropsychological testing must be supplemented

by nonstandardized, real-world assessment procedures.

NONSTANDARDIZED ASSESSMENT PROCEDURES CURRENTLY IN USE FOR INDIVIDUALS WITH TRAUMATIC BRAIN INJURY

The authors began by surveying speech-language pathologists regarding their assessment practices. Thirty individuals working in a variety of clinical settings completed a survey on their use of informal, nonstandardized, or functional measures for the assessment of individuals with TBI. Detailed results are available on the ANCDS Web site (www.ancds.org). These clinicians reported using 28 different tasks or procedures ranging from observation to discourse analysis to administration of subtests from published assessment batteries, with a high proportion of the reported falling in the last category. This preliminary evidence suggested that nonstandardized techniques were common among clinicians working in this area. As noted in the introduction, the nonstandardized use of standardized tests is not discussed here. Rather, this review focuses on the nonstandardized procedures that have been described in the research literature or published expert opinion.

DISCOURSE ANALYSIS

The communicative deficits of individuals with TBI are frequently difficult to delineate. Performance on aphasia batteries may give the impression that their communicative skills are intact. However, interactions with many of the same individuals leave the listener with the sense that they are off target, tangential, and disorganized or, in some cases, have very little to say. The overestimated communicative performance of these individuals is a function of the limited scope and ceiling effect of aphasia batteries, which were never intended to assess the subtle types of deficits many individuals with TBI demonstrate. Most aphasia batteries assess language function at the single word or sentence level, at which most individuals with TBI have little difficulty.[18] Recent investigators of communicative ability in brain-injured adults have instead applied discourse analyses to describe these deficits. In the sections that follow, several discourse studies of children and adults with TBI are reviewed. Two primary types of discourse are described, monologic or noninteractive (e.g., descriptive, narrative, procedural) and conversational.

Monologic Discourse

The authors reviewed 19 studies pertaining to monologic discourse sampling. These studies included over 400 children, adolescents, and adults ranging in age from 7 to 69 years. With regard to elicitation tasks employed for discourse sampling, the most common were narratives, such as story retelling, story generation, and personal event retelling,[19–31] followed by procedural discourse[26,28,32–34] and finally picture description.[30,35,36] A variety of analysis procedures were employed. The most commonly applied were measures of cohesion, that is how meaning is tied across sentences,[23–25,27,29,31,32,37] and sentence-level grammatical complexity.[20–22,26,27,29,30,38] Six studies used analyses of coherence, the thematic unity of a text,[22,25,27,31,37] amount and accuracy of information or content[20,28,33,34,36]; and story grammar.[21–23,29] Additional analyses included measures of productivity and efficiency,[22,26,30,34] propositional analyses,[19,21,25,34] and lexical selection.[27,28]

Identification of Useful Analysis Procedures

Although discourse analyses are useful for identifying subtle communicative deficits in individuals with TBI, the broad array of tasks and analyses that have been described in the literature has resulted in confusion when attempting to select the best discourse sampling and analysis procedures. However, because discourse analysis can be extremely time consuming, it is important that clinicians who choose to invest their time in such procedures obtain the biggest return for their efforts. In an effort to address this issue, the authors evaluated three factors in the 19 studies reviewed: interjudge reliability, consistency of findings

across studies, and potential to distinguish impaired from normal discourse.

INTERJUDGE RELIABILITY

Of the 19 studies reviewed, 15 reported interjudge reliability scores, with most falling within an acceptable range of 0.80 or above. The two studies reporting reliability scores below 0.80 were those of Glosser and Deser,[27] who reported a reliability of 0.79 for thematic coherence, and Hartley and Jensen,[28] who reported reliability of 0.76 for lexical selection and 0.60 for substitution and ellipsis combined. It should be noted that other investigators have encountered similar difficulties with scoring reliability of cohesive categories.[29] These investigators have opted instead to judge the adequacy of each occurrence of a cohesive tie and calculate a cohesive adequacy score (i.e., complete ties divided by total number of cohesive ties). Interjudge reliability for this measure is typically much higher.[23] Overall, these findings suggest that other than the difficulty in identifying specific cohesive devices, interjudge reliability is not a limiting factor in choosing a discourse analysis procedure.

CONSISTENCY OF FINDINGS

A consistent finding in many studies is that individuals with TBI have less verbal output during monologic discourse tasks[20–22,28,30] and that the overall efficiency of their discourse is diminished.[20,26,30,34,35] Coherence is another discourse measure in which there is general agreement regarding impairments noted after TBI,[25,27,37] although Van Leer and Turkstra[31] noted that their participants with TBI were no worse than a matched group of normal teens. Measures of content accuracy and organization also show consistent impairments in the descriptive, procedural, and story narratives of individuals with TBI[21,22,24,26,28,30,34] as well as an increased number of irrelevant propositions.[34,37] Along similar lines, there is agreement in several reports that TBI results in problems with story components and grammar.[20–22,24,36,38]

By contrast, mixed findings have been reported with regard to syntactic analyses, with some studies reporting decreased grammatical complexity[21] or increased grammatical errors[27] and others finding sentence-level grammar to be comparable to that of normal controls.[22,29] Similarly, although there is evidence that TBI disrupts the use of cohesive devices,[24,25,28,29,39] other studies have noted cohesion to be relatively intact.[23,27] Deficits of cohesion appear to be influenced by the elicitation task, with some individuals demonstrating impairments in story generation but not in story retelling[29] and others with impairments in story retelling.[25] Task or condition effects have also been reported for coherence measures, with better coherence being noted in a personal versus a current events narration.[31] Overall, the measures of verbal productivity and efficiency, content accuracy and organization, story grammar, and coherence were all noted to be sensitive measures of impaired discourse performance after TBI.

DISTINGUISHING IMPAIRED PERFORMANCE FROM NORMAL

Without question, the primary limitation to the use of discourse analyses, particularly for individuals with TBI, is the lack of normative data. One may argue that normative data are not important if the goal is to document progress as opposed to making a diagnosis, but in either case it is important to have confidence that the discourse performance that is being labeled "impaired" is distinctly different from that of individuals without brain injury. In a follow-up study, discriminant function analyses (DFA) were employed to determine the accuracy of selected measures of narrative discourse for classifying participants into their respective groups.[40] The participants consisted of 32 adults with TBI and 43 noninjured adults. The measures that contributed most to the discrimination procedure included story grammar (in story generation and retelling), sentence length (in story generation), and grammatical complexity (in story retelling). The results indicated that the story narrative measures correctly classified 70% of the participants, 64.5% of the TBI group and 74.4% of the noninjured group. The overlap in the performance of the TBI and control groups may be due in part to the broad range of education represented in both groups. A greater degree of overlap in discourse performance has been reported

by other investigators. For example, Body and Perkins[20] derived composite scores from several discourse measures including content organization for 20 adults with TBI and 20 controls, and although there were significant group differences, only 3 individuals with TBI fell outside the normal range. These studies need to be replicated in a prospective manner, but it appears that measuring the amount and organization of content was more important in distinguishing impaired from normal discourse than measures of language form.

CONVERSATIONAL DISCOURSE

Twelve studies of conversational discourse were identified, involving 200 children and adults ranging in age from 6 to 61 years. Among the many analysis procedures used, the most common was a rating scale, such as Damico's[41] Clinical Discourse Analysis[42,43] or Prutting and Kirchner's[44] Pragmatic Protocol.[45,46] More objective analyses examined such dimensions as prompt frequency and turn duration,[47] topic management,[38,39,48] response appropriateness,[38,48] intonation units,[39,49] compensatory strategies,[50] and phonologic and lexical production, syntax, and productivity.[51,52]

Pragmatic rating scales are typically employed during live or videotaped interactions.[41,44,45,53–56] Although there is overlap among dimensions rated within these scales, each scale has a rather novel approach to looking at conversation. For example, some scales rate both nonverbal behaviors (e.g., intonation, facial expression, eye contact, gesture) and verbal communication (conversation initiation, turn taking, topic maintenance, response length, presupposition, and referencing),[54] whereas others focus on specific aspects of the verbal message, such as intelligibility, sentence formation, and coherence of narrative.[45] The Pragmatic Protocol, a theoretically based scale developed for children, focuses on aspects of pragmatics such as utterance acts (e.g., vocal intensity, voice quality, prosody), propositional acts (e.g., lexical selection, word order, stylistic variations), and illocutionary and perlocutionary acts (e.g., speech acts, topic, turn taking).[44,46] Other scales, such as Damico's Clinical Discourse Analysis, are questionnaires that are completed during an observation or from personal knowledge. They ask questions such as, "Does [the] client make rapid and inappropriate changes in conversational topic without clues to the listener, or fail to attend to cues for conventional turns, interrupting frequently or failing to hold up his or her end of the conversation?" Although these scales are potentially useful tools for rating communicative behaviors, most require training to achieve acceptable reliability, many are not well defined and have checklist items that do not represent continuous variables, and none are supported by adequate data on "normal" performance.

Identification of Useful Analysis Procedures

The sampling and analysis of conversational discourse are often more appealing to many clinicians because of the interactive nature of conversation and the fact that it occurs on a daily basis. However, like analysis of monologic discourse, analysis of conversational discourse can be time consuming. Consequently, it is important to identify the most useful analysis procedures. To address this, the authors examined the 12 studies on conversational discourse for interjudge reliability, consistency of findings, their potential to distinguish normal from impaired conversational performance, and the influence of context.

INTERJUDGE RELIABILITY

Interjudge reliability was reported for seven of the eight studies that described objective measures of conversation and ranged from 0.67 to 1.0. The measures that fell below 0.80 included aspects of Mentis and Prutting's[39] very complex analysis of topic management and Jordan and colleagues'[51] measures of frequency and type of disruptions within conversation. Reliability scores for the four studies that used rating scales ranged from .75 to 1.0, with the lower scores for Erhlich and Barry's[45] scale. These results suggest that, in general, adequate interjudge reliability can be achieved for conversational analysis procedures.

CONSISTENCY OF FINDINGS

Although few of the studies used the same measures, the results could be classified into

two broad categories: (1) decreased initiation[48] and maintenance of conversational topics[39,48] and (2) errors of content conveyed during conversation, including findings of verbal disruptions and problems with word finding,[51] errors in the transfer of information,[33] and decreased response adequacy.[38,48] Conversations of individuals with TBI were characterized by more turns and shorter, less complex utterances.[48,52] Overall, measures of content and topic management appeared most useful for identifying conversational impairments.

Two studies using pragmatic rating scales identified subtle communication impairments in the presence of near-normal scores on standardized language batteries.[45,46] In addition, these two studies revealed that, regardless of injury severity, individuals with TBI demonstrated a higher incidence of pragmatic errors that normal controls. It is important to note the scales' limitations, however, as discussed previously.

DISTINGUISHING IMPAIRED PERFORMANCE FROM NORMAL

Coelho and colleagues[40] applied DFA to narrative discourse data to examine how accurately various measures of conversation could identify group membership of the 32 adults with TBI and 43 noninjured adults. The two primary measures that contributed most to the between-groups discrimination were comments (utterances that were not necessarily direct responses to questions but kept the conversation flowing) and response-plus utterances (utterances that provided more information than was requested). The TBI group had fewer comments and more response-plus utterances than the controls. The results indicated that the conversational measures correctly classified more than 77% of the participants, 78% of the TBI group and 72% of the noninjured group.[40] Once again, it is important to note that the performance of the noninjured group overlapped that of the TBI group. The two measures that made the greatest contribution to the DFA procedure, comments and adequate-plus utterances, are consistent with the two general categories of results presented earlier for the objective conversational measures. The measure "comments" fits within the category of decreased initiation and maintenance of conversational topic, and the number of adequate-plus utterances fits into the category related to relevance of conversational content.

EVALUATION OF COMMUNICATION CONTEXT

Togher and colleagues[57–59] have written extensively about the potential influences of various dimensions of the communicative context on conversational performance. As described by these authors, context is a combination of three components: field, mode, and tenor. Field pertains to the nature of the social interaction taking place (e.g., a speech versus a conversation with friends). Mode refers to the modality by which the discourse is produced (e.g., written or oral). Tenor describes those who are involved in the interaction, their relationship to each other, and their roles or status (e.g., teacher and student, two strangers, clerk and customer).[58] Two additional components are genre, which pertains to the influence of culture on language (i.e., the step-by-step structure that is followed to achieve goals), and ideology, which is the participants' biases and personal perspectives. As a speaker produces an utterance, he or she makes choices about what is to be said and how it will be said, and this is influenced by the listener and situation. Togher and colleagues stated that these contextual factors should be considered in the analysis of conversational exchanges.

GENERAL CONCLUSIONS REGARDING DISCOURSE ANALYSES

1. The review of 18 studies of *monologic* discourse in individuals with TBI identified analysis procedures for which consistent findings of impairment have been reported. These included analyses of productivity and efficiency of verbal output, content accuracy and organization, story grammar, and coherence. Analyses of syntax, grammatical complexity, and cohesion yielded inconsistent findings across the studies reviewed.

2. The review of 12 studies of *conversational* discourse following TBI indicated that few of the studies used similar measures. The variety of measures employed could be grouped into two categories: measures of initiation and measures of manipulation of content. Overall, measures of content and topic management appeared most useful for identifying conversational impairments.
3. Pragmatic rating scales are useful in that they may capture real-world communication difficulties. However, most scales require a period of training before they can be used reliably and many scales are weak in basic psychometric properties.
4. The interpretation of discourse analyses must consider context factors.
5. Measures of conversational discourse appear better able to discriminate TBI and non–brain-injured groups than measures of monologic discourse. This may be accounted for by the interactive nature of conversation as well as social factors that appear to make this genre more sensitive to the cognitive-communicative impairments of individuals with TBI.
6. There is a need for further research to establish the ecological validity of discourse measures outside the experimental settings in which data are typically collected.

NONSTANDARDIZED ASSESSMENT OF SOCIAL COGNITION

As is evident from the preceding review, there have been many studies focusing on *production* aspects of communication. By contrast, there has been considerably less attention to measuring *comprehension*, particularly for pragmatic aspects of communication. This aspect of communication falls within the domain of "social cognition," which includes the cognitive processes required for the perception and comprehension of social stimuli and the ability to use the products of these processes to make social decisions. There are no norm-referenced tests of social cognition, so typically it is assessed with either nonstandardized measures (e.g., clients' responses to "what if…" social scenarios) or standardized tasks from the research literature. The latter are primarily from the area of autism,[60–62] although a few tasks have been standardized for individuals with TBI[63,64] and other neurogenic communication disorders.[65–68] This is a relatively new area of clinical assessment in TBI, and much work remains to be done before it is possible to establish an evidence base for clinical practice.

CONTEXTUALIZED HYPOTHESIS TESTING

In several publications, Ylvisaker and colleagues[69,70] proposed the use of an assessment process referred to as collaborative contextualized hypothesis testing. This process has its conceptual roots in three distinct traditions: (1) the dynamic assessment movement in educational psychology dating back to the work of Vygotsky[71] and elaborated by Feuerstein,[72] Lidz,[2] and others; (2) process assessment as practiced in adult neuropsychology[3]; and (3) functional behavior assessment as practiced by behavioral psychologists. Dynamic assessment has been validated as a procedure used to derive instructional methods and supports for individual students.[73]

Functional behavior assessment has long been used to derive effective behavioral interventions.[74,75] Indeed, functional behavior assessment is considered an integral and critical component of behavioral interventions, including most of those reviewed by Ylvisaker and colleagues (this issue). What follows is a rationale for each component of collaborative, contextualized hypothesis-testing assessment when the goal is creation and monitoring of a program of cognitive, behavioral, communication, and/or educational/vocational interventions and supports.

Why Test Hypotheses?

When complex individuals experience academic, vocational, or social difficulty, there are inevitably alternative possible explanations for their difficulty and alternative possible interventions or supports that might help. Failure to perform any given real-world task effectively (e.g., reading a chapter and

answering questions, maintaining a social conversation, effectively organizing a work task) can be explained by reference to a wide variety of possible breakdowns. As a corollary, a variety of modifications and supports hold the potential to improve performance. In the case of individuals with TBI, this variety is exaggerated by the potentially bewildering pattern of damaged and preserved parts of the brain, often accompanied by complex emotional and behavioral reactions after the injury and frequently by some type of disability before the injury. Therefore, without experimentation it is never possible to know with certainty how to interpret failure on a test or other task or what recommendation would be most effective in improving performance. In Table 1, failure on a reading task is used to illustrate the need for dynamic experimentation.

Why Collaborate in Testing Hypotheses?

Ideally, educational, vocational, and social-communication assessments include contributions from all of the members of the professional team (including assistants) as well as family members, the person with disability, and possibly others. The most obvious reason to promote collaboration in assessment is that it increases the number of people available to interact with and observe the individual in varied contexts, to brainstorm about hypotheses that need to be tested, to test those hypotheses, and to apply the results of the experiments to planning and implementing intervention. Related to this advantage, collaborative assessment in this shared professional territory helps to promote collegiality and cohesion within teams of professionals.

Table 1 Potential Hypotheses That Might Explain Failure on a Reading Comprehension Task. Hypothesis-Testing Assessment Is Designed to Rule in or Rule out Potential Hypotheses

Physical Problems
Fatigue, hunger, pain, illness, overmedication, undermedication, subclinical seizures
Sensory/Perceptual Problems
Visual acuity impairment, visual perceptual impairment, problem with tracking/scanning
Cognitive/Executive Function Problems
Attention: Inadequate sustained attention, distractibility/weak filtering, inability to divide attention, difficulty shifting from the previous task (''stuck in set'')
Orientation: Unclear orientation to task
Working Memory: Insufficient space in working memory to hold the task instructions, reading strategies, and information from the paragraph
Self-Monitoring: Failure to recognize that the task is difficult and requires special strategic effort
Organization/Integration: Difficulty organizing information to comprehend the text, to understand how details relate to each other, to understand how the questions relate to the text, or to formulate an organized answer
Cognitive Problems
Memory: Difficulty encoding the information for subsequent storage and retrieval, storing information long enough to answer the questions, or retrieving information from storage to answer the questions
General Speed of Information Processing: Slow processing of information
Knowledge Base: Insufficient background knowledge to comprehend the passage
Language Problems
Unable to comprehend the vocabulary or syntax of the text or questions; difficulty retrieving words to answer the questions
Academic (Decoding) Problems
Impaired or nonfluent decoding of printed language
Emotional/Motivational/Behavioral Problems
Depression, anxiety, fear, anger, general lack of motivation, oppositionality, or euphoria

In addition, if staff and family members who interact with the person on a daily basis are active collaborators in identifying what causes breakdowns in functioning and what can be done to improve performance, the likelihood of their compliance with the recommendations that emerge from this assessment is increased. In contrast, when staff and family members are simply told what to do by a specialist who has unilaterally completed an assessment (which may appear mysterious to other staff and family members), they often understandably resist these instructions and follow their own instincts. This may be due to a genuine difference of opinion, a lack of understanding, or simple oppositionality. Collaborative assessments hold the promise of diminishing all of these sources of noncompliance, much as they do in the field of applied behavior analysis.

Finally, collaborating with individuals with disability in assessment serves two purposes: (1) it helps them understand their disability and its connection to the intervention and support program and (2) in some cases, it helps to overcome the person's oppositionality. Ylvisaker, Szekeres, and Feeney[76] offered a tool for student self-assessment and participation in developing educational intervention and support plans.

Why Test Hypotheses in the Real Contexts of the Individual's Life?

Hospital personnel, educators, parents, and others often observe that the behavior of many individuals with TBI is inconsistent, varying from day to day and situation to situation. The contributors to this inconsistency are often elusive. However, factors that are relatively predictable in their negative effect on performance include fatigue, cognitive or social stress, anxiety, depression, complexity and novelty of the task, organizational demands of the task, environmental interference, lack of motivation, and others. It is in part for this complex of reasons that many individuals with frontal lobe injury perform better on standardized tests in a controlled testing environment than in stressful real-world contexts. The supportive interactive manner of the examiner, clear orientation to the tasks, elimination of environmental distractions, use of relatively short tasks, and use of tasks that do not require integration of multiple sources of information or retention from day to day combine to elevate performance in a person who may have difficulty performing effectively on real-world tasks in a busy classroom or workplace or in a stressful or novel social situation.

Furthermore, formal testing situations rarely require that individuals initiate behavior on their own (they are told when to start and stop), inhibit irrelevant behavior (the examiner generally keeps the individual on task), monitor and evaluate performance (the examiner evaluates the results), or think of clever ways to succeed that may be outside the limits of the test (e.g., asking to take notes when listening to a paragraph during a test of auditory comprehension). It is for these reasons that many clinicians have characterized examiners as "prosthetic frontal lobes" and have questioned the validity of test results for persons with frontal lobe injury. Alternatively, people with TBI may perform poorly on test tasks that are unfamiliar or unmotivating and proceed to perform surprisingly well in real-world educational or vocational settings, given the support provided by familiar routines and motivating tasks.

Therefore, it is critical that educational and vocational assessments include procedures designed to identify carefully and systematically strengths and weaknesses of the individual's performance in relation to a variety of contextual variables, including settings, people, times of day, activities, materials, instructions, and supports. It is especially important for rehabilitation hospital staff to simulate an educational or vocational setting and activities prior to making educational or vocational recommendations.

Procedures that enhance sensitivity to context can include the primary evaluator making structured and unstructured observations in varied settings and also obtaining reports from others through standardized questionnaires or informal interviews. It is most useful, however, to engage everyday people in the individual's life (e.g., family members, therapists, teachers, assistants) in the process of collaborative hypothesis testing. In addition to ensuring that

the assessment is relevant to planning intervention, this practice has the other advantages associated with collaboration and hypothesis testing (listed earlier).

Why Continue the Exploration in an Ongoing Manner?

Following severe TBI, neurologic change may continue for months and often longer. Because this change can be rapid in the early months after the injury, the results of formal assessments may be invalid (for purposes of planning instruction or intervention) by the time the testing is completed and interpreted and the reports are written and disseminated. Second, even in the absence of neurologic change, individuals with TBI often have very complex profiles of ability and need, necessitating frequent modification and refinement of their rehabilitation, vocational, and educational programs. Ongoing dynamic assessment contributes to this process. Third, it is well known that TBI in children and adolescents, especially with prefrontal injury, is associated with consequences that may not be noted for months or years after the injury.

Fourth, the individual's psychological reactions after a life-altering injury are never completely predictable and can vary over time. Therefore, ongoing assessment of emotional reactions to the injury and life after the injury is a responsibility of the intervention team. Finally, the person's response to placements, supports, and specific intervention plans can vary over time. For example, one-on-one support may be a useful during the early weeks after an individual's return to work or school but later may become unnecessary (or a possible contributor to learned helplessness). For all of these reasons, a system for ongoing dynamic assessment is preferable to (or at least supplements) an assessment that captures only one or a small number of discrete points in the individual's life after the injury.

COMMUNICATION CHECKLISTS

The checklists developed by Hartley[77] are examples of tools designed to evaluate communication in everyday contexts. In this section, we report on the interjudge reliability, consistency of findings, and discrimination ability of several of these checklists. The first considered was the General Behavioral Observation Form,[77(p. 234)] which asks raters to characterize an individual's cognitive functions (e.g., attention, executive functions/metacognition, processing and response speed, emotional control, drive and motivation, and memory) as "within normal limits," "not able to judge," or "area of need" and provide comments. Each cognitive skill is divided into subskills or characteristics. For example, there are three items for memory: repetition needed, reauditorization, and confabulation/intrusions.

Hartley created an Environmental Needs Assessment checklist (also reproduced in reference 77) for the evaluation of living/family, general community, work, and educational environments. This checklist asks respondents to evaluate current and projected environmental characteristics, such as type of setting and activities that will be expected of that individual or provided by others (e.g., meal planning, home repairs, going to restaurants or social service agencies, note taking in class), and to comment on the social interactions of the examinee (e.g., appropriateness, responsiveness to needs of others). A regular contact person is identified, and there is space to add information about current and projected educational plans as well as work placement information. For each activity, the respondent is asked to rate the individual's level of independence on a five-point scale from totally independent to totally dependent.

A third assessment tool is the Checklist of Listening Behaviors.[77] This checklist asks the respondent to rate the frequency of a list of listening behaviors in conversation. The checklist items include maintaining a proper level of arousal, inhibiting thoughts, maintaining eye gaze toward the speaker, refraining from interrupting, and asking for clarification when unsure of a message. Judgments are made on a five-point scale from "almost never" to "always" and the respondent is given space to provide comments on each item.

Hartley[77] also reviewed checklists published by others, such as the Pragmatic Protocol,[32] and presented tables of skill and cueing

hierarchies that could be adapted as checklists for evaluation. For example, she created a table relating communication behaviors to underlying cognitive functions that could serve as framework for evaluation of cognitive-communication ability.

Identification of Useful Analysis Procedures

Interjudge reliability. No interjudge reliability scores were reported for any of Hartley's checklists.

Consistency of findings. There are insufficient studies of Hartley's checklists to report on the consistency of findings.

Potential to distinguish impaired from normal functioning. Once again, although no studies have been published that used Hartley's checklists to distinguish participants with TBI from noninjured participants, the face validity of these procedures appears high.

COMMUNICATIVE PROFILING SYSTEM

The Communicative Profiling System (CPS)[78] was developed to describe and analyze communicative and social interaction and to assist in organizing management planning for individuals with aphasia. Although the CPS has never been described as a measure for individuals with TBI, this procedure has great potential for documenting decreased socialization, a real-world consequence of TBI frequently neglected in treatment programs. The procedures involve a stepwise and cyclical system that moves from a broad description of behaviors, people, and situations to a more narrow focus on communicative behaviors and contexts deemed important to the individual being profiled. Data are derived from ethnographic interviews supplemented by participant observations. These data are then used to plot profiles of the individual's social network and create a general behavioral inventory, affective inventory, and participation inventory. Using these procedures, Damico and Simmons-Mackie have profiled participants' social networks before and after the onset of aphasia. What is typically seen after onset is a network that has shrunk and lost "nodes." The nodes represent either social situations the individual no longer feels comfortable participating in or people the individual no longer sees or interacts with socially. These pre- and postonset social network profiles are then used to plan intervention activities directed toward reexpanding an individual's social networks.

Identification of Useful Analysis Procedures

Interjudge reliability. The CPS has not yet been published as a formal scale, so no data regarding its interjudge reliability are currently available.

Consistency of findings. There are few published reports on the use of the CPS; therefore, the consistency of findings cannot be ascertained.

Potential to distinguish impaired from normal functioning. The CPS was not designed to discriminate impaired from normal functioning. Rather, it is intended to be used to obtain baseline information to compare changes in an individual's social network over time.

ANALYSIS OF COMMUNICATION PARTNER COMPETENCIES

Ylvisaker and colleagues[79] presented a list of communication partner competencies derived from an extensive literature on parent-child interaction in developmental cognitive psychology. Studies of normal cognitive development in children have shown that parents who converse with their children using a responsive and supportive style of interaction facilitate the cognitive development of their children in domains that include memory, organized thinking, problem solving, and organized language.[80–85] Landry and colleagues[86,87] showed that a positive parental style of interaction facilitated cognitive and executive system development in normal and high-risk children and that this style can be taught to parents who do not possess it naturally. All of the studies were conducted within a generally Vygotskyan framework in which facilitative

conversations are considered "scaffolding" for cognitive growth or recovery.

Many of these studies have focused on socially coconstructed (i.e., parent-child) narrative conversations about jointly experienced past events. However, the facilitative effects of this style can be associated with conversations about any topic, including problem-solving interaction. Conversely, a nonsupportive, performance-oriented style of interaction can elicit negative behavior from individuals who feel threatened by ongoing "tests." Furthermore, a style of interaction that is disjointed and poorly organized around extended topics can contribute to fragmentation in the thinking of cognitively challenged individuals.

Ylvisaker organized the checklist of competencies—associated with an interactive style that is known to facilitate cognitive development—under two headings: elaboration and collaboration. An elaborative style is one in which the partner shows the child or person with cognitive impairment how to remember, organize, reflect, and problem solve at a higher level. A collaborative style is one in which the conversational relationship is symmetrical and reciprocal and not "performance oriented." This list of competencies has been used in assessing communication partners (e.g., direct care staff in residential or community-based rehabilitation programs) and in the training of partners of both children and adults with TBI. However, neither the validity of the assessment nor the effectiveness of the training has been systematically studied with these populations. Thus, supportive data are available only from studies of other populations.

Blosser and Neidecker[88] created the Communication Style Identification Checklist to provide a "systematic method for helping people analyze and describe their own interactive communication manner and style."[89(p. 131)] Blosser and DePompei[89] recommended its use either as a format for discussion or for a professional to use independently. The scale invites the respondent to characterize his or her communication style in several categories, including speech rate, length and complexity of sentences, word choice, attentiveness during conversations, organization of conversations, and patience while waiting for a response. The respondent then evaluates how each characteristic might affect the communication of the partner with a communication disorder.

A useful companion to the Communication Style Identification Checklist is a worksheet for a child or adolescent to complete, titled "Let Us Know How to Help You."[89] This worksheet appeals to the child's expertise as the "best judge of how other people can cause problems for you or help you do better" (p. 133). It includes 10 questions that lead the child to identify problems at home, school, or work; reactions to those problems; problem classroom situations (e.g., noise); and what teachers and classmates can do to help or what they do that causes problems. The worksheet ends with a request for three skills that child would like to improve and a request to "tell five things that are great about you that you wish other people would know" (p. 133).

Systemic Functional Linguistics (SFL) describes language as a series of choices.[90,91] Togher and colleagues[57–59] studied whether participants with TBI and a comparison group of uninjured adults altered their communicative behavior with different conversational partners who varied in terms of familiarity (e.g., an information operator at a bus station, a policeman, their mother, or a therapist). The authors found that therapists and mothers gave less information to those with TBI, therapists asked fewer questions of those with TBI and generated more clarifications and checking utterances with this group, and the police asked more questions of the TBI group than the comparison group. In regard to individuals with TBI versus their uninjured peers, the results were as follows: (1) the TBI group produced more information in the police encounter and some of the information offered was inappropriate (i.e., more information than was requested); (2) they provided more information in their interactions with the police than in those with the therapists or the operators at the bus station, in part because of the greater number of questions produced by the police; (3) TBI group participants provided less information to their mothers, as the mothers did not request much information from them; (4) they requested more information from the therapists and generated more requests for clarifications

than did their uninjured peers; and (5) they asked for clarifications more with the police than with their mothers or the operators at the bus station. Overall, the results indicated that the discourse performance of the participants with TBI varied according to their conversational partner. These and other findings of Togher and colleagues illustrate the promise of SFL for revealing competencies and limitations in individuals with TBI in a variety of real-world contexts.

Identification of Useful Analysis Procedures

Interjudge reliability. No interjudge reliability scores have been reported for either the Ylvisaker et al[79] or Blosser and Neidecker[88] checklists. Togher and colleagues have reported intra- and interjudge reliability scores for the SFL procedures ranging from 82 to 96%.

Consistency of findings. There are insufficient studies of the Ylvisaker et al[79] and Blosser and Neidecker[88] checklists to report on the consistency of findings. Togher and colleagues have been the only group to report on the application of SFL procedures to the study of discourse impairments. Their findings have demonstrated that the elaborate SFL analysis procedures are useful for delineating the complex interactions of participants and context in discourse.

Potential to distinguish impaired from normal functioning. No studies have been published that used the Ylvisaker et al[79] or Blosser and Neidecker[88] checklists to distinguish participants with TBI from uninjured participants; however, the checklists appear to have strong face validity. The SFL analyses have consistently documented group differences between TBI and matched control groups for various dimensions of interactional discourse.

SUMMARY AND RECOMMENDATIONS

Nonstandardized, functional, and context-sensitive assessment is an important component of the evaluation of individuals with TBI. This conclusion is based on the observation that individuals with TBI often demonstrate limitations in everyday activities despite good performance on standardized cognitive and language tests. When the primary goals of assessment are to identify real-world disability and plan and monitor intervention, office-bound language and neuropsychological testing must be supplemented by nonstandardized, functional assessment procedures. Evidence for the use of nonstandardized assessment procedures was compiled from a review of studies and published expert opinion as well as a survey of speech-language pathologists working with individuals with TBI. On the basis of this evidence, the following recommendations are offered:

1. For individuals with cognitive-communicative disorders after TBI, there is substantial evidence to support the assessment of communication beyond what is included in standardized aphasia or child language batteries. When *monologic* discourse is assessed, the literature to date supports inclusion of analyses of productivity and efficiency of verbal output, content accuracy and organization, story grammar, and coherence. For *conversational* discourse, analyses should include measures of initiation and manipulation of content during interactions. In all instances, it is critical to consider the potential influences of context (i.e., nature of the social interaction, modality by which the discourse is produced, and the relationship and roles of participants in the interaction).
2. Impairments of social cognition present significant barriers to community reintegration. Ongoing research is needed to develop measures that address how individuals with TBI make social decisions in real-life situations.
3. There is extensive evidence in the TBI literature that collaborative contextualized hypothesis testing should be used for planning behavioral interventions and supports. Further, dynamic assessment applied to other related populations supports the notion of applying this technique for TBI in domains other than behavior. Finally, collaboration and context sensitivity have content validity in relation to the characteristics of the population when the goal is planning

behavioral interventions and supports, although no specific procedures have been validated.
4. Limited research has been conducted on the competencies of communication partners who interact with individuals with TBI. Application of exchange structure and generic structure analyses have been shown to be useful for delineating complex interactional patterns. Various checklists related to the assessment of communication partners have apparent content validity but need additional study and should be used judiciously.
5. Checklists pertaining to the communication environment and environmental demands have face validity; however, they require ongoing study and findings should be interpreted with caution.

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REFERENCES

1. Turkstra L, Coelho C, Ylvisaker M. The use of standardized tests for individuals with cognitive-communication disorders. Semin Speech Lang 2005;26:215–222
2. Lidz CS. Dynamic Assessment: An Interactional Approach to Evaluating Learning Potential. New York: Guilford Press; 1987
3. Kaplan E. A process approach to neuropsychological assessment. In: Boll T, Bryant BK, eds. Clinical Neuropsychology and Brain Function: Research, Measurement, and Practice. Washington, DC: American Psychological Association; 1988:125–167
4. World Health Organization. International Classification of Functioning, Disability and Health. Report. Geneva, Switzerland: World Health Organization; 2001
5. Goodglass H, Kaplan E, Barresi B. Boston Diagnostic Aphasia Examination. 3rd ed. San Antonio, TX: Psychological Corporation; 2000
6. Brown M, Gordon WA. Quality of life as a construct in health and disability research. Mt Sinai J Med 1999;66:160–169
7. Burgess PW, Alderman N, Evans J, Emslie H, Wilson BA. The ecological validity of tests of executive function. J Int Neuropsychol Soc 1998;4: 547–558
8. Norris G, Tate RL. The Behavioral Assessment of the Dysexecutive Syndrome (BADS): concurrent and construct validity. Neuropsychol Rehabil 2000;10:33–45
9. Rath JF, Simon D, Langenbahn DM, Sherr RL, Diller L. Measurement of problem-solving deficits in adults with acquired brain damage. J Head Trauma Rehabil 2000;15:724–733
10. Wilson BA. Goal planning rather than neuropsychological tests should be used to structure and evaluate cognitive rehabilitation. Brain Impairment 2003;4:25–30
11. Anderson SW, Damasio H, Tranel D, Damasio AR. Long-term sequelae of prefrontal cortex damage acquired in early childhood. Dev Neuropsychol 2000;18:281–296
12. Ewing-Cobbs L, Fletcher JM, Levin HS, Iovino I, Miner ME. Academic achievement and academic placement following traumatic brain injury in children and adolescents: a two-year longitudinal study. J Clin Exp Neuropsychol 1998;20:769–781
13. Perrott SB, Taylor HG, Montes JL. Neuropsychological sequelae, familial stress, and environmental adaptation following pediatric head injury. Dev Neuropsychol 1991;7:69–86
14. Anderson PJ, Anderson VA, Northam EA, Taylor HG. Standardization of the Contingency Naming Test (CNT) for school-aged children: a measure of reactive flexibility. Clin Neuropsychol Assess 2000;1:247–273
15. LeBlanc JE, Hayden ME, Paulman RG. A comparison of neuropsychological and situational assessment for predicting employability after closed head injury. J Head Trauma Rehabil 2000;15: 1022–1040
16. Starch S, Falltrick E. The importance of a home evaluation for brain injured clients: a team approach. J Cog Rehabil 1990;3:28–32
17. Chaytor N, Schmitter-Edgecombe M. The ecological validity of neuropsychological tests: a review of the literature on everyday cognitive skills. Neuropsychol Rev 2003;13:181–197
18. Coelho CA, Liles BZ, Duffy RJ. The use of discourse analyses for the evaluation of higher level traumatically brain-injured adults. Brain Inj 1991; 5:381–392
19. Biddle KR, McCabe A, Bliss LS. Narrative skills following traumatic brain injury in children and adults. J Commun Disord 1996;29:447–469
20. Body R, Perkins MR. Validation of linguistic analyses in narrative discourse after traumatic brain injury. Brain Inj 2004;18:707–724

21. Brookshire BL, Chapman SB, Song J, Levin HS. Cognitive and linguistic correlates of children's discourse after closed head injury: a three-year follow-up. J Int Neuropsychol Soc 2000;6:741–751
22. Chapman SB, Culhane KA, Levin HS, et al. Narrative discourse after closed head injury in children and adolescents. Brain Lang 1992;43: 42–65
23. Coelho CA. Story narratives of adults with closed head injury and non-brain injured adults: influence of socioeconomic status, elicitation task, and executive functioning. J Speech Lang Hear Res 2002; 45:1232–1248
24. Coelho C, Liles B, Duffy R. Discourse analyses with closed head injured adults: evidence for differing patterns of deficits. Arch Phys Med Rehabil 1991;72:465–468
25. Davis GA, Coelho CA. Referential cohesion and logical coherence of narration after closed head injury. Brain Lang 2004;89:508–523
26. Galski T, Tompkins C, Johnston MV. Competence in discourse as a measure of social integration and quality of life in persons with traumatic brain injury. Brain Inj 1998;12:769–782
27. Glosser G, Deser T. Patterns of discourse production among neurological patients with fluent language disorders. Brain Lang 1990;40: 67–88
28. Hartley LL, Jensen PJ. Narrative and procedural discourse after closed head injury. Brain Inj 1991; 5:267–285
29. Liles BZ, Coelho CA, Duffy RJ, Zalagens MR. Effects of elicitation procedures on the narratives of normal and closed head-injured adults. J Speech Hear Disord 1989;54:356–366
30. Stout CE, Yorkston KM, Pimentel JI. Discourse production following mild, moderate, and severe traumatic brain injury: a comparison of two tasks. J Med Speech-Lang Pathol 2000;8:15–25
31. Van Leer E, Turkstra L. The effect of elicitation task on discourse coherence and cohesion in adolescents with brain injury. J Commun Disord 1999;32:327–349
32. Mentis M, Prutting CA. Cohesion in the discourse of normal and head-injured adults. J Speech Hear Res 1987;30:88–98
33. Snow P, Douglas J, Ponsford J. Procedural discourse following traumatic brain injury. Aphasiology 1997;11:947–967
34. Turkstra LS, McDonald S, Kaufmann PM. Assessment of pragmatic communication skills in adolescents after traumatic brain injury. Brain Inj 1996;10:329–345
35. Ehrlich JS. Selective characteristics of narrative discourse in head-injured and normal adults. J Commun Disord 1988;21:1–9
36. Tucker FM, Hanlon RE. Effects of mild traumatic brain injury on narrative discourse production. Brain Inj 1998;12:783–792
37. McDonald S. Pragmatic language skills after closed head injury: ability to meet the informational needs of the listener. Brain Lang 1993;44:28–46
38. Coelho CA, Youse KM, Le KN. Conversational discourse in closed-head-injured and non-brain-injured adults. Aphasiology 2002;16:659–672
39. Mentis M, Prutting CA. Analysis of topic as illustrated in a head-injured and a normal adult. J Speech Hear Res 1991;34:583–595
40. Coelho CA, Youse KM, Le KN, Feinn R. Narrative and conversational discourse of adults with closed head injuries and non-brain-injured adults: a discriminant analysis. Aphasiology 2003; 17:499–510
41. Damico J. Clinical discourse analysis: a functional language assessment technique. In: Simon CS, ed. Communication Skills and Classroom Success: Assessment of Language-Learning Disabled Students. San Diego, CA: College-Hill; 1985:125–150
42. Prince S, Haynes WO, Haak NJ. Occurrence of contingent queries and discourse errors in referential communication and conversational tasks: a study of college students with closed head injury. J Med Speech-Lang Pathol 2002;10:19–39
43. Snow P, Douglas J, Ponsford J. Conversational discourse abilities following severe traumatic brain injury: a follow-up study. Brain Inj 1998;12:911–935
44. Prutting C, Kirschner D. A clinical appraisal of the pragmatic aspects of language. J Speech Hear Disord 1987;52:105–119
45. Ehrlich J, Barry P. Rating communication behaviors in the head-injured adult. Brain Inj 1989;3: 193–198
46. Milton SB, Prutting CA, eds. Appraisal of Communication Competence in Head Injured Adults. Minneapolis, MN: BRK Publishers; 1987
47. Bond F, Godfrey HPD. Conversation with traumatically brain-injured individuals: a controlled study of behavioural changes and their impact. Brain Inj 1997;11:319–329
48. Coelho CA, Liles BZ, Duffy RJ. Analysis of conversational discourse in head injured adults. J Head Trauma Rehabil 1991;6:92–99
49. Wozniak RJ, Coelho CA, Duffy RJ, Liles BZ. Intonation unit analysis of conversational discourse in closed head injury. Brain Inj 1999;13:191–203
50. Penn C, Cleary J. Compensatory strategies in the language of closed head injured patients. Brain Inj 1988;2:3–17
51. Jordan F, Ward K, Cremona-Meteyard S. Word-finding in the conversational discourse of children with closed head injury. Aphasiology 1997;11:877–888

52. Campbell TF, Dollaghan CA. Expressive language recovery in severely brain-injured children and adolescents. J Speech Hear Disord 1990;55:567–581
53. Gerber S, Gurland G. Interactive analysis of pragmatic-linguistic abilities in acquired aphasia. Presented at: the annual convention of the American Speech-Language-Hearing Association; November 1990; Seattle, WA
54. Halper AS, Cherney LR, Burns MS, Mogil SI. Clinical Management of Right Hemisphere Dysfunction. 2nd ed. Gaithersburg, MD: Aspen; 1996
55. Roth FP, Spekman NJ. Assessing the pragmatic abilities of children: Part 2. Guidelines, considerations, and specific evaluation procedures. J Speech Hear Disord 1984;49:12–17
56. Roth FP, Spekman NJ. Assessing the pragmatic abilities of children: Part 1. Organizational framework and assessment parameters. J Speech Hear Disord 1984;49:2–11
57. Togher L, Hand L, Code C. Measuring service encounters in the traumatic brain injury population. Aphasiology 1997;11:491–505
58. Togher L, Hand L, Code C. Exchanges of information in the talk of people with traumatic brain injury. In: McDonald S, Togher L, Code C, eds. Communication Skills following Traumatic Brain Injury. Hove, UK: Psychology Press; 1999: 113–145
59. Togher L, Hands L, Code C. Analysing discourse in the traumatic brain injury population: telephone interactions with different communication partners. Brain Inj 1997;11:169–189
60. Baron-Cohen S, Jolliffe T. Another advanced test of theory of mind: evidence from very high functioning adults with autism or Asperger syndrome. J Child Psychol Psychiatry 1997;38:813–822
61. Happe F. An advanced test of theory of mind: understanding of story characters' thoughts and feelings by able autistic, mentally handicapped, and normal children and adults. J Autism Dev Disord 1994;24:129–154
62. Baron-Cohen S, O'Riordan M, Stone V, Jones R, Plaisted K. Recognition of faux pas by normally developing children and children with Asperger syndrome or high-functioning autism. J Autism Dev Disord 1999;29:407–418
63. Turkstra LS, McDonald S, DePompei R. Social information processing in adolescents: data from normally developing adolescents and preliminary data from their peers with traumatic brain injury. J Head Trauma Rehabil 2001;16:469–483
64. Flanagan S, McDonald S, Rollins J. The Awareness of Social Inference Test (TASIT). Sydney, Australia: University of New South Wales; 1998
65. Cuerva AG, Sabe L, Kuzis G, Tiberti C, Dorrego F, Starkstein SE. Theory of mind and pragmatic abilities in dementia. Neuropsychiatry Neuropsychol Behav Neurol 2001;14:153–158
66. Gregory C, Lough S, Stone V, et al. Theory of mind in patients with frontal variant frontotemporal dementia and Alzheimer's disease: theoretical and practical implications. Brain 2002;125:752–764
67. Happe F, Brownell H, Winner E. Acquired 'theory of mind' impairments following stroke. Cognition 1999;70:211–240
68. Rowe AD, Bullock PR, Pokley CE, Morris RG. 'Theory of mind' impairments and their relationship to executive functioning following frontal lobe excisions. Brain 2001;124:600–616
69. Ylvisaker M, Feeney TJ. Collaborative Brain Injury Intervention: Positive Everyday Routines. San Diego, CA: Singular Publishing Group; 1998
70. Ylvisaker M, Gioia G. Cognitive assessment. In: Ylvisaker M, ed. Traumatic Brain Injury Rehabilitation. 2nd ed. Boston, MA: Butterworth-Heinemann; 1998:159–179
71. Vygotsky LS, ed. Mind in Society: The Development of Higher Psychological Processes. Cambridge, MA: Harvard University Press; 1978
72. Feuerstein R. The Dynamic Assessment of Retarded Performers: The Learning Potential Assessment Device, Theory, Instruments, and Techniques. Baltimore, MD: University Park Press; 1979
73. Swanson HL, Lassier CM. A selective synthesis of the experimental literature on dynamic assessment. Rev Educ Res 2001;71:321–363
74. Alberto P, Troutman A. Applied Behavior Analysis for Teachers. 6th ed. Columbus, OH: Merrill Prentice Hall; 2003
75. Hersen M, Bellack AS. Behavioral Assessment: A Practical Handbook. 2d ed. Elmsford, NY: Pergamon Press; 1976
76. Ylvisaker M, Szekeres SF, Feeney T. Cognitive rehabilitation: executive functions. In: Ylvisaker M, ed. Traumatic Brain Injury Rehabilitation: Children and Adolescents. Revised ed. Boston: Butterworth-Heinemann; 1998:221–269
77. Hartley LL. Cognitive-Communicative Abilities following Brain Injury: A Functional Approach. San Diego, CA: Singular Publishing; 1995
78. Damico JS, Simmons-Mackie NN. Communicative profiling system for aphasia. Biennial International Conference of the British Aphasiology Society; September 11–13, 2001; University of Exeter, Exeter, England
79. Ylvisaker M, Sellars C, Edelman L. Rehabilitation after traumatic brain injury in preschoolers. In: Ylvisaker M, ed. Traumatic Brain Injury Rehabilitation: Children and Adolescents. Revised ed. Boston: Butterworth-Heinemann; 1998:303–329

80. Fivush R. The social construction of personal narratives. Merrill Palmer Q 1991;37:59–81
81. Fivush R, Reese E. The social construction of autobiographical memory. In: Conway MA, Rubin DC, Spinnler H, Wagenaar WA, eds. Theoretical Perspectives on Autobiographical Memory. The Hague, The Netherlands: Kluwer Academic Publishers; 1992:115–132
82. Haden CA, Haine RA, Fivush R. Developing narrative structure in parent-child reminiscing across the preschool years. Dev Psychol 1997;33:295–307
83. Hudson JA. The emergence of autobiographical memory in mother-child conversations. In: Fivush R, Hudson JA, eds. Knowing and Remembering in Young Children. New York: Cambridge University Press; 1990:166–196
84. McCabe A, Peterson C. Getting the story: a longitudinal study of parental styles in eliciting narratives and developing narrative skills. In: McCabe A, Peterson C, eds. New Directions in Developing Narrative Structure. Hillsdale, NJ: Erlbaum; 1991:217–253
85. Reese E, Haden CA, Fivush R. Mother-child conversations about the past: relationships of style and memory over time. Cog Dev 1993;8:403–430
86. Landry SH, Miller-Loncar CL, Smith KE, Swank PR. The role of early parenting in children's development of executive processes. Dev Neuropsychol 2002;21:15–41
87. Landry SH, Smith KE, Swank PR. The importance of parenting during early childhood for school-age development. Dev Neuropsychol 2003; 24:559–591
88. Blosser J, Neidecker E. School Programs in Speech-Language: Organization and Management. 4th ed. Boston, MA: Allyn & Bacon; 2001
89. Blosser JL, DePompei R. Pediatric Traumatic Brain Injury: Proactive Intervention. Clifton Park, NY: Thompson Learning; 2003
90. Halliday MAK. An Introduction to Functional Grammar. 2nd ed. London: Edward Arnold; 1994
91. Halliday MAK. An Introduction to Functional Grammar. London: Edward Arnold; 1985