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Can high-level inferencing be predicted by Discourse Comprehension Test performance in adults with right hemisphere brain damage?

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Abstract

Background—Adults with right hemisphere brain damage (RHD) can have considerable difficulty in drawing high-level inferences from discourse. Standardised tests of language comprehension in RHD do not tap high-level inferences with many items or in much depth, but nonstandardised tasks lack reliability and validity data. It would be of great clinical value if a standardised test could predict performance on high-level inferencing measures.

Aims—This study addressed whether performance of adults with RHD on the *Discourse Comprehension Test* (DCT; Brookshire & Nicholas, 1993) could predict their performance on a nonstandardised measure of high-level inference in narrative comprehension.

Methods & Procedures—This study used a within-group correlational design. Participants were 32 adults with damage limited to the right cerebral hemisphere, as a result of cerebrovascular accident. Half of the participants were male and half female. Participants averaged 64.5 years of age and 14.2 years of education. Participants listened to narrative stimuli and to yes/no questions about each narrative. Each DCT narrative was followed by the standard 8 questions about stated or implied main ideas or details. The high-level inferencing task contained 6 narrative scenarios from Winner, Brownell, Happé, Blum, and Pincus (1998). Each scenario describes a character who commits a minor transgression and later denies it. Two versions of each story are designed to induce different interpretations of the character's denial. In one version, the character tells a white lie when he is unaware that he was seen committing the transgression. In the other versions, when aware of being seen, the character makes an ironic joke. The narratives were interrupted periodically by comprehension questions.

Four Pearson correlation coefficients were computed, between each of two DCT predictor variables (total accuracy for all comprehension questions; accuracy on questions about implied information) and two indicators of high-level inferencing (total accuracy to answer experimental questions in Joke stories; total accuracy to answer experimental questions in Lie stories).

Outcomes & Results—Correlation coefficients were low-to-moderate, and nonsignificant.

Conclusions—Performance on the DCT by adults with RHD did not predict their high-level inferencing performance, as measured in this study. The issue that motivated this study should be pursued further in light of the potential advantages to be gained, for both clinical and research purposes. It may be, however, that specific measures of various types of high-level inferencing will need to be developed and validated.

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Keywords

Right brain damage; High-level inferencing

High-level inferencing in discourse can be markedly impaired by right hemisphere brain damage (RHD) in adults (e.g., Happe, Brownell, & Winner, 1999; Tompkins, 1995; Winner, Brownell, Happé, Blum, & Pincus, 1998). We define high-level inferencing as the predictions or conclusions that comprehenders draw at the highest level of narrative representation (i.e., the situation model). The situation model represents what a story is about (e.g., Zwaan & Radvansky, 1998), beyond its verbatim or propositional structure. The situation model draws on our back-ground knowledge and other contextual cues and includes elements such as a protagonist's goal and emotional response, and the timeline and spatial framework of the story.

To assess high-level inferencing, investigators and clinicians have relied on specialised, non-standard measures, because existing tests of language function in RHD do not tap inferencing with many items or in much depth. Yet standardised assessment measures afford many clinical and investigative advantages, including their known reliability and validity. If a standardised task that has been thought to be insensitive to high-level inferencing could in fact predict performance on measures of such inferences, that would be of great value. Both clinical and research assessments of high-level inferencing could be streamlined by developing regression equations to predict high-level inferencing performance directly from the results of standardised tests.

The current study was performed to investigate whether one standardised test, the *Discourse Comprehension Test* (DCT, Brookshire & Nicholas, 1993), can predict one type of high-level inferencing processes in adults with RHD. The high-level inferencing processes in this study are those required to answer questions about a character's unstated motives, when that character makes a comment that contradicts an established fact. Prior research on such inferences has referred to them as "theory of mind" inferences (Winner et al., 1998), because they require the comprehender to deduce someone's mental state. We refer to them simply as high-level inferences, because it is not clear that they reflect (only) deductions about "theory of mind". Winner et al.'s original research on such inferences lacked an appropriate control condition to investigate similarly complex, non-theory-of-mind inferences (Brownell & Friedman, 2001).

The DCT was chosen as the standardised test for this study because it is a well-controlled measure of narrative processing that has good psychometric properties, and because it assesses comprehension of both explicitly conveyed and implied information. The high-level inferencing task was chosen to tap comprehension processes that challenge adults with RHD, but also to differ dramatically in some ways from the DCT, as elaborated in the Method section.

METHOD

Participants

Participants were 32 adults with unilateral RHD due to CVA, as confirmed by CT and/or MRI scan reports. They were recruited from eight acute care hospitals and rehabilitation facilities. Table 1 provides group demographic data, clinical characteristics, and lesion sites. We have no data on how many of the participants were diagnosed with cognitive-communicative difficulties, or were known by speech-language pathology or psychology services. Inspection of individual participants' data in this study, for performance on the DCT and on the tests in Table 1, indicates that all participants were impaired on at least one measure. Impairment was determined either in relation to test norms or with reference to the lower two standard deviation boundary for a group of adults without brain damage (tested by Tompkins, Scharp, Meigh, & Fassbinder, 2008c).

Preliminary inclusion criteria were as follows: unilateral hemispheric CVA documented by CT and/or MRI report; a minimum of 4 months post-onset of CVA, and age between 40 and 85 years. Potential participants who met these criteria were interviewed or tested for adherence to four other selection criteria: completing at least 8 years of formal education; being right-handed, monolingual speakers of American English (see Tompkins, Bloise, Timko, & Baumgaertner, 1994, for operationalisations); and passing a hearing screening. Pure-tone air conduction hearing screening was performed with criteria (35dB HL at 500, 1000, and 2000 Hz) that are within 0.5 standard deviation of Harford and Dodds' (1982) means for ambulatory, non-institutionalised older men. If a potential participant passed the hearing screening in only one ear, that individual was also asked to repeat 12 words, each loaded with fricative consonants. If more than one repetition error was made, that individual was excluded from the study. Potential participants were also excluded if they had medically documented evidence of bilateral lesions, brainstem or cerebellar damage, premorbid seizure disorders, head injuries requiring hospitalisation, problems with drugs and/or alcohol, a potentially cognitively deteriorating condition such as Alzheimer's or Parkinson's disease, or psychiatric illness.

Tasks and measures

The comprehension tasks in this study are two of a larger series used in a prior study of narrative comprehension in adults with RHD (Tompkins et al., 2008c). The first task was the DCT, set A stimuli (Brookshire & Nicholas, 1993). Appendix A provides a sample stimulus. The stimuli were audio recorded for this study, and averaged 63.2 seconds in duration. DCT narratives describe "humorous situations that would be familiar to most adults in America" (Brookshire & Nicholas, 1993, p. 6). Each narrative is 14 sentences long and extensively controlled for other structural variables, including number of words, number of subordinate clauses, and ratio of clauses to T-units. Only 1.8 words per passage, on average, are designated "unfamiliar" (i.e., not among the 10,000 most frequent words in printed English according to Carroll, Davies, & Richman, 1971, excluding proper names). Additionally, the texts are relatively "easy" in listening difficulty, as assessed by the Easy Listening Formula (Fang, 1966).

Eight spoken Yes/No questions follow each narrative, and query either directly stated or implied main ideas and details. The questions average 7.8 words in length (range 4–13) and contain no unfamiliar words. They are controlled for ratio of clauses to T-Units and characterised for the extent to which correct answers depend on information in their corresponding narratives, rather than on general knowledge (Tuiman, 1974). Both total accuracy overall (max=40) and total accuracy on the questions about implied information (max=20) served as outcome measures for this task.

The second comprehension task was selected to gauge typical RHD difficulties with input that promotes or induces competing interpretations (Joanette, Goulet, & Hannequin, 1990; Molloy, Brownell, & Gardner, 1990; Tompkins, 1995; Tompkins, Baumgaertner, Lehman, & Fassbinder, 2000; Tompkins, Fassbinder, Lehman-Blake, & Baumgaertner, 2002). This task used narratives from Winner and colleagues (1998), in which a central character's comment (e.g., "I haven't eaten anything fattening all day") contradicts an established fact (that character was seen eating brownies). The stimuli were intended by Winner et al. to evaluate mental attributions or "theory of mind" processing; however, as noted above, it is possible that poor performance by Winner et al.'s adults with RHD is attributable to a more general inference deficit. In any case, the overt contradictions in these stimuli trigger competing interpretations and as such they require cognitive processes that can prove particularly difficult for adults with RHD, including those related to coherence inferencing, reanalysis, and meaning integration.

The stimuli describe scenarios in which a character commits a minor transgression, and is seen doing so by another character (see sample in Appendix B). For example, Jack, who is on a diet, is seen eating brownies by his wife Betty. In Winner et al.'s (1998) study the crucial manipulation was whether Jack knew he was seen. Jack's knowledge determines the intent of his response, when confronted by his wife. Jack's remark, "I haven't eaten anything fattening all day," is a *white lie* if Jack is not aware of being "caught". If he is aware, however, this same remark serves as an *ironic joke*, to alleviate his discomfort. Each narrative has two versions (a Lie and a Joke version), which differ only in the information that indicates Jack's knowledge.

In Winner and colleagues' (1998) study, the narratives were presented in four segments, with a total of six Yes/No questions occurring between segments and at the end of the story (see Appendix B). These questions were identical across the Lie and Joke versions of a single narrative, and were intended to probe comprehension at several levels of processing. According to Winner and colleagues, these questions assessed (1) stated facts (e.g., Did Jack eat some brownies?); (2) first-order beliefs (e.g., Did Betty realise Jack was eating a brownie?); (3) second-order beliefs (Jack's friend asks: "Does Betty know you are breaking your diet?"); (4) second-order follow-ups (e.g., Did Jack think that what he told his friend was really true?); (5) second-order expectations (e.g., When Jack said that to Betty, did he think that Betty would believe him?); and (6) a final interpretation (e.g., was Jack "lying to avoid getting caught" or "joking to cover up his embarrassment"?).

Participants in the current study listened to six of the original Winner and colleagues' (1998) narratives, in both Lie and Joke versions. This subset of stimuli described only minor transgressions, like the example above. We modified the interpretation question by splitting it into two parts, and asked separately whether the character was joking or lying. In addition, we created six filler stories that differed from the experimental stories only in that there was no contradiction between established facts and the character's comment at the end of the story.

To index high-level inference in this study we generated two composite accuracy measures, one for each version of the experimental narratives (Joke, Lie). These measures totalled accuracy on the second-order belief, second-order expectation, and follow-up questions. Fact and first-order belief questions were omitted because adults with RHD in two prior studies (Tompkins et al., 2008c; Winner et al., 1998) had no difficulty with these questions. Interpretation questions were excluded because of an order effect in their presentation.

As noted above, several factors distinguish the DCT and high-level inference tasks. These include the structural and representational properties of the narratives; the arrangement of narratives and comprehension questions; and, perhaps, the nature of the target inferences.

To elaborate, the high-level inference stimuli contain more characters than the DCT stimuli, and these characters enter and leave the active narrative situation and take turns speaking. In addition, the protagonist is not always the first character who is introduced. In these cases a listener has to override standard assumptions about narrative structure. Furthermore, the high-level inference narratives, but not the DCT stories, end in a statement that is literally false and that contradicts earlier material. These structural/ representational features are likely to trigger a number of competing mental activations and requirements for integration.

In terms of the arrangement of narratives and questions, the high-level inference stories are periodically interrupted by comprehension questions. As such, a listener shifts out of the process of building an integrated representation of the story, searches that representation to answer the question, and then moves back into discourse construction and integration processes.

Finally, the DCT and the high-level inference task may differ in the nature of target inferences. The latter was designed to query social cognition inferences, about characters' knowledge and beliefs (Winner et al., 1998). As noted above, it is not clear that difficulties with the high-level inference stimuli would be due solely to deficits in "theory of mind" processing; but social cognition inferences such as these may have cognitive underpinnings that are distinct from those that support non-theory-of-mind inferences (see, e.g., Brownell & Martino, 1998).

Task construction and administration

A practised female speaker audio recorded the stimuli, speaking on average about four syllables/second. She produced the stimuli without specific emphasis on any lexical element. All recordings were made with an Audio-Technica ATR20 vocal/instrument microphone with a constant microphone-to-mouth distance (~ 4 inches). Recordings were made in a double-walled, sound-treated booth. Stimuli were recorded onto a Dell Optiplex GX260 with a Creative SB Live! Value (WDM) sound card using Sound Forge v4.5 software at a sampling rate of 22.05 KHz with 16-bit resolution. The first author and several assistants collaborated with the speaker to achieve recording consistency.

Stimuli were then assembled using E-Prime software (Schneider, Eschman, & Zuccolotto, 2002). For the DCT, a single trial consisted of a trial number followed by a 500 ms pause, the stimulus story, and 4 seconds between each of the eight comprehension questions. The questions were presented in the order prescribed in the test manual.

For the high-level inference task a trial consisted of a trial number followed by a 500 ms pause, a portion of the stimulus story, a 500 ms pause, a comprehension question, and more of the story. This pattern continued until all four parts of the story had been played and the seven comprehension questions were answered. Durations between questions ranged from 2 seconds to 4.5 seconds, depending on question difficulty as inferred from the Winner et al. (1998) data.

Experimental apparatus and procedures

Stimuli were delivered via a Dell Inspiron 5150 notebook computer, using E-Prime. The five DCT stories were randomised by E-prime for presentation to each participant. The six Joke and six Lie texts were the six filler texts and pseudo-randomly arranged into six blocks of three stories each, two experimental and one filler. One version of a text was maximally separated from its other version by at least one stimulus block (with a minimum of seven or more stories between versions) and at least one ancillary task from the clinical assessments listed in Table 1.

High-quality supra-aural earphones (Beyerdynamic DT150) were used to present the stimuli, at a comfortable loudness level selected by each participant via Quick Mixer v1.7.2. Participants indicated their answer to each comprehension question by pressing one of two buttons on a manual response box, labelled "Yes" or "No" in half-inch block letters. E-Prime software generated and stored accuracy data.

Participants were tested in a quiet room, either in their homes or in the first author's laboratory. Five examiners were trained to perform the testing, and only one examiner worked with each participant. Testing was completed over four to five sessions, lasting up to 90 minutes each, over a period of about 3–7 weeks. Order of task presentation, and of blocks in the high-level inference task, was counter-balanced for each participant. The discourse tasks were interspersed with screening and clinical measures, and with experimental tasks for other studies. For each discourse task, participants practised on one example stimulus administered live-voice and one administered via E-Prime. On practice trials, feedback was provided after all questions had been answered. No feedback was given on experimental trials.

RESULTS

Table 2 provides group data on the discourse comprehension measures. Prior to conducting correlational analyses between the DCT measures and the measure of high-level inferencing, we inspected scatterplots and residual plots. These plots indicated no outlying data points, and distributions appropriate for linear analysis.

Pearson correlations were computed to assess the extent to which DCT performance could predict performance on the Joke and Lie measures from the high-level inference task. All correlation coefficients were low-moderate and non-significant for both the total DCT measure —Joke $r(32)=.316$; $p=.078$; Lie $r(32)=.123$; $p=.248$—and the DCT-implied measure—Joke $r(32)=.214$; $p=.240$; Lie $r(32)=.118$; $p=.257$.

Additional Pearson correlations were computed to assess relationships between the four comprehension measures in this study and the demographic and clinical/neuropsychological variables in Table 1. Estimated working memory capacity for language (Tompkins, Bloise, Timko, & Baumgaertner, 1994) was moderately and significantly associated with both total DCT comprehension, $r(32)=-.516$, $p=.002$, and comprehension of questions about implied information on the DCT, $r(32)=-.525$, $p=.002$. Higher DCT accuracy was related to higher working memory capacity (i.e., fewer errors on the working memory task). Performance on the Joke measure of the high-level inference task was associated with delayed story recall, $r(32)=.350$, $p=.044$, and with comprehension of complex syntactic structures: cleft object sentences; $r(32)=.344$, $p=.05$. Higher performance on the Joke measure was related to better delayed story recall and comprehension of complex syntax. No other correlations were significant.

DISCUSSION AND IMPLICATIONS

The results of this study indicate that performance of adults with RHD on one well-standardised measure of discourse comprehension did not predict their performance on one non-standard measure of high-level inferencing. This was the case for total accuracy scores on the DCT and for accuracy on DCT questions about implied information.

One possible reason for the small correlations obtained in this study lies in the potential for increased error variance to be introduced into statistical analyses by non-standard measures of unknown reliability, such as those from the high-level inference task used in this investigation. Error variance is also increased when performance is at chance, as was the case for the Joke measure (53% accuracy). However, this would not affect the correlations between the DCT and Lie measures, because accuracy on the Lie measure was well above chance (83%).

The contributions of other processing impairments also need to be considered in interpreting the results of this study. For example, adults with RHD are routinely found to have smaller working memory capacity for language than adults without brain damage (e.g., Tompkins et al., 1994, 2008c; Tompkins, Scharp, Fassbinder, Meigh, & Armstrong, 2008b). However, this impairment was not associated with the comprehension of the demanding stimuli in the high-level inference task: Auditory working memory for language was associated only with performance on the DCT measures.

Instead, when performance on the Joke measure of high-level inferencing was impaired, delayed story retell and comprehension of complex syntax were also poor. The correlation with delayed story retell makes sense, in light of the length of the high-level inference narratives and the interruptions between the crucial element of these stories (i.e., whether the character knew he had been seen) and later comprehension questions. It is not clear why cleft object sentence comprehension per se would predict performance on the Joke measure, which contains no cleft object sentences. The relationship between high-level inference and complex syntactic comprehension may reflect a more general association between syntactic processing and the comprehension of difficult narratives, such as those in the Joke measure. We assessed participants only on cleft object sentence comprehension because it is the most difficult subset of the syntactic comprehension measure (Caplan, 1987) and because RHD previously has not been associated with deficits in syntactic comprehension (e.g., Tompkins et al., 2008c). This correlation suggests that it may be important to assess the comprehension of other syntactic structures in future studies of high-level inferencing by adults with RHD. This correlation is also consistent with the contention of some theories that the construction of situation models depends on the results of lower-level linguistic processing (see Ferstl, 2007, for discussion of this and opposing views). As such, decrements in syntactic processing may have contributed to decrements in high-level inference processes in the Joke scenarios.

By contrast, accuracy on the Lie measure was not associated with either delayed story retell performance or complex syntactic comprehension. It is likely that top-down knowledge can be used more easily to create situation models for the Lie scenarios than the Joke scenarios. In the Lie scenarios ample past experience with and knowledge of white lies, which are socially common, may also contribute to participants' ability to access the situation models to answer comprehension questions about high-level inferences. If so, decrements in delayed memory and syntactic comprehension may be of relatively little consequence for the Lie measure.

Otherwise, the results of this study may be due to one of or some combination of the built-in distinctions between the DCT and the high-level inference task. As elaborated above, these tasks differ in structural and representational properties of the narratives, the arrangement of the narratives and their comprehension questions and, potentially, the types of target inferences. The issue that motivated this study should be investigated further, with potential confounds like these taken into account. That is, the DCT's predictive power could be evaluated for high-level inference stories that are more similar to the DCT on these types of variables. Despite the negative results in the current study, this would be a valuable pursuit for two reasons. First, a wide variety of inference types and processes may be affected by RHD (e.g., Lehman & Tompkins, 2000), and it would still be useful to be able to streamline assessments. Second, inferencing is central to normal comprehension and to various accounts of comprehension deficits in RHD (e.g., Beeman, 1993; Brownell, Potter, Bihrle, & Gardner, 1986; Lehman & Tompkins, 2000; Tompkins, 1995). At the same time, however, the results of this study may suggest that it will be necessary to develop, validate, and standardise measures of high-level inferencing.

One might argue that the results of this study were predictable, given the differences between the comprehension tasks. Yet the ability of adults with RHD to integrate competing interpretations—which is a central to the structural/representational properties of the high-level inference task—has been found to predict their performance on the DCT (Tompkins et al., 2000). We also chose to use such distinct tasks in this initial study because the potential payoff would be higher, sooner, in this case than if we examined tasks that are distinguishable only to a small degree.

We speculate that in a future study of the extent to which the DCT can predict performance on a non-standard measure of higher-level inferencing, the most important differences to rectify between the DCT and the high-level inference task are those that involve the arrangement of the two types of narratives (uninterrupted, interrupted) and their comprehension questions. Future investigations would also benefit by including a variety of higher-level inferencing measures that span a range of task similarity to and difference from the DCT. One major challenge of such an approach will be to equate this range of high-level inferencing measures on factors that affect the ease with which they are drawn.

APPENDIX A

Sample stimulus from Discourse Comprehension Test (Brookshire & Nicholas, 1993)

Sample Story

Neil Williams was short of money. The new term was about to begin and he didn't have enough money to pay his tuition. So, one day, he walked to his parents' home and borrowed their car. Then he drove to the bank to get a student loan. The loan officer at the bank was a tough old woman who always said she had never made a bad loan. She questioned Neil about his grades, about his sources of income, and about his plans for a job when he graduated. Things looked grim for Neil, especially when the woman asked for collateral because all Neil had to offer was his old wreck of a car. Finally the woman said to him that she wasn't convinced that he really needed the money. Neil thought hard. He had to convince the woman that he really did need the money. "Well," he said, "For lunch today I had a macaroni sandwich." The woman looked at him with surprise. Then she took out a form and began writing. Finally she looked at Neil and said, with a smile, "You obviously need a loan—or someone to cook for you."

Comprehension Questions (and correct answers)

Was Neil a high school student? (No, Implied main idea)

Did Neil's parents live nearby? (Yes, Implied detail)

Did Neil go to the bank to get a loan? (Yes, Stated main idea)

Did Neil need the money to start a new business? (No, Stated main idea)

Did Neil own a car? (Yes, Stated detail)

Did Neil go to the bank in the morning? (No, Implied detail)

Did Neil tell the woman that he had a cheese sandwich for lunch? (No, Stated detail)

Did Neil get the loan? (Yes, Implied main idea)

APPENDIX B

Sample stimulus from Winner et al. (1998)

Sample Story: Jack and the Brownie

Betty baked some brownies for the church bake sale. She told her husband Jack not to eat a single one because he was on a strict diet. Then she went out to the store. While she was gone, her husband's friend came over. Jack was hungry and couldn't stick to his diet. When his friend left to go to the bathroom, Jack started eating the brownies.

Fact Question—Did Jack eat some brownies?

Meanwhile, Betty had forgotten something and came back home. Just as she was about to open the door, she saw Jack through the kitchen window, biting into a brownie.

First-Order Belief Question—Did Betty realise that Jack was eating a brownie?

Joke Version: Betty walked into the kitchen. She looked angrily at Jack as he was chewing and held a half-eaten brownie in his hand. Betty walked out of the room. Jack's friend returned from the bathroom and asked Jack, "Hey, does Betty know that you are breaking your diet?"

Lie Version: Jack did not see that Betty was watching him. As Jack was eating, his friend returned from the bathroom and asked him, "Hey, does Betty know that you are breaking your diet?"

Second-Order Belief Question—What do you think Jack told his friend? Yes or No?

Second-Order Follow-Up Question—Did Jack think that what he told his friend was really true?

Betty came back into the kitchen. She asked Jack, "Are you having a hard time sticking to your diet?" Jack replied, "I haven't eaten anything fattening all day."

Second-Order Expectation Question—When Jack said that to Betty, did he think that Betty would believe him?

Interpretation Question—When Jack said, "I haven't eaten anything fattening all day," was he: (a) lying to avoid getting caught, or (b) joking to cover up his embarrassment?

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TABLE 1

Demographic and clinical characteristics of study participants

Characteristics	*RHD (*N=*32)*
Age (years)	
Mean (*SD*), Range	64.5 (11.8), 42–85
Gender	
Male	16
Female	16
Education (years)	
Mean (*SD*), Range	14.2 (3.1), 9–22
Lesion site (from CT/MRI report)	
Right cortical anterior	3
Right cortical posterior	10
Right cortical anterior + posterior 5	
Right basal ganglia	8
Right thalamus	1
Right subcortical mixed	2
Right MCA (unspecified)	3
Lesion type (from CT/MRI report)	
Thromboembolic	17
Lacunar	2
Haemorrhagic	13
Months post-onset	
Mean (*SD*), Range	52.2 (50.9), 4–167
*PPVT-R[a]	
Mean (*SD*), Range	157.3 (11.3), 132–173
*Complex Syntactic Comprehension (Cleft Object Sentences) [b]	
Mean (*SD*), Range	9.5 (.78), 7–10
*Auditory Working Memory for Language[c]	
Word recall errors	
Mean (*SD*), Range	13.2 (7.0), 1–27
*Behavioural Inattention Test[d]	
Mean (*SD*), Range	137.0 (13.5), 85–146
*Visual Form Discrimination[e]	
Mean (*SD*), Range	28.1 (3.5), 20–32
*Judgment of Line Orientation[f]	
Mean (*SD*), Range	22.2 (5.2), 9–30
ABCD[g] Story Retell	
*Immediate Retell	
Mean (*SD*), Range	13.2 (2.5), 7–17
Delayed Retell	
Mean (*SD*), Range	12.7 (3.1), 5–17

RHD = right hemisphere brain damage; anterior = anterior to Rolandic fissure; posterior = posterior to Rolandic fissure.

[a]PPVT-III = Peabody Picture Vocabulary Test-III; Dunn & Dunn (1997); maximum =175.

[b]Caplan (1987); maximum =10; cleft object sentence subset.

[c]Tompkins et al. (1994); maximum errors =42.

[d]Wilson, Cockburn, & Halligan (1987); maximum =146; neglect cutoff =129.

[e]Benton, Sivan, Hamsher, Varney & Spreen, (1983); age & gender corrected score; maximum =35.

[f]Benton, Hamsher, Varney, & Spreen (1983); maximum =32.

[g]ABCD = Arizona Battery for Communication Disorders in Dementia; Bayles & Tomoeda, (1993); maximum =17.

*significantly poorer than a matched, non-brain-damaged control group (by independent *t*-test, $p<.05$).

TABLE 2

Descriptive data (*M*, *SD*, range) on comprehension measures

	RHD (N=32)	
*DCT-Total accuracy (maximum =40)	33.84 (3.26)	Range 27–39
*DCT-Implied question accuracy (maximum =20)	16.00 (2.21)	Range 12–20
*High-level inference Joke accuracy (maximum =18)	9.47 (3.20)	Range 4–17
High-level inference Lie accuracy (maximum =18)	15.12 (2.43)	Range 10–18

RHD = right-hemisphere-damaged. DCT = Discourse Comprehension Test (Brookshire & Nicholas, 1983).

*RHD data are significantly lower than those of a matched, non-brain-damaged control group, reported in Tompkins et al. (2008c).