

**NARRATIVE COMPREHENSION IN ADULTS WITH RIGHT HEMISPHERE  
BRAIN DAMAGE: THE ROLE OF COHERENCE AND THEME ORGANIZATION**

by

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*Background:* In 1990, Hough conducted a study investigating the role of theme organization on discourse comprehension in adults with right hemisphere brain damage (RHD). She reported that participants with RHD performed significantly worse when the theme of a narrative was delayed until the end, compared to when the theme was at the beginning. RHD participants also performed significantly worse on these tasks compared to participants with left hemisphere brain damage and normal controls. However, manipulations to delay the theme also resulted in narratives that lacked coherence and violated the rules of narrative structure.

*Aims:* The current study examined if controlling for differences in coherence between original and delayed-theme narratives would eliminate discrepancies in comprehension in the two conditions.

*Methods & Procedures:* Participants were 10 adults with unilateral RHD and five without brain damage. Participants listened to experimental and filler narratives. Experimental narratives consisted of original-theme narratives and delayed-theme narratives that were manipulated to delay the theme while maintaining story coherence. Filler narratives consisted of original-theme narratives and delayed-theme narratives that were not controlled for coherence. All narratives were followed by three yes/no questions pertaining to main ideas and details. Several ancillary tasks were also included to further classify participants and to analyze alternative explanations for performance.

*Outcomes & Results:* Accuracy data revealed that as predicted, there was no significant difference in performance on experimental original-theme and delayed-theme narratives for the RHD group. There was a trend towards poorer comprehension of filler delayed-theme narratives compared to original-theme narratives. These results support the hypothesis that poor comprehension on delayed-theme narratives in Hough's study was a result of differences in coherence rather than theme organization. However, analysis of ancillary tasks revealed a significant correlation between estimated capacity for auditory working memory and performance on delayed-theme narratives. These results imply that even with coherence accounted for, delaying the theme of a narrative is more taxing on mental processing, thus decreasing comprehension in RHD participants with particularly low working memory capacity.

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## PREFACE

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## **1.0 INTRODUCTION**

Traditionally, language processing has been considered predominantly a left-hemisphere function (Geschwind, 1970). Research involving aphasic patients who sustained damage to the left hemisphere has revealed impairments on the phonological, lexical, semantic, and syntactic levels of either language production or comprehension (Ferstl, Walther, Guthke, & Von Cramon, 2005). However, patients with right hemisphere brain damage (RHD) also exhibit language deficits, and research involving this population has revealed an important role of the right hemisphere in language processing (Tompkins, 1995). Patients with RHD have often been cited as having difficulties at the discourse level of communication, including grasping the main idea or theme of a story, revising initial interpretations, and appreciating the punch line of a joke (Birhle, Brownell, & Powelson, 1986; Rehak et al., 1992). RHD patients often have trouble integrating information into a coherent unit; rather, they approach discourse in a literal, piecemeal fashion (Brownell & Martino, 1998).

### **1.1 DISCOURSE COMPREHENSION AND RIGHT HEMISPHERE BRAIN DAMAGE**

There are various factors that seem to influence discourse comprehension of RHD patients, including emotional and structural variations of the text. Rehak et al. (1992) found that story

interest had a stronger effect on measures of comprehension performance for RHD patients than for normal controls. They compared performance on “dull” and “interesting” versions of narratives and found that RHD patients were more successful at processing the interesting stories compared to the dull ones. Compared to control subjects, RHD patients were also significantly less likely to use main clues and triggers to predict story outcomes when the story was dull.

Moreover, the authors found that RHD patients performed better when narratives were presented in a canonical (suspense) structure rather than non-canonical (surprise) structure. In the canonical suspense structure, events were presented in sequential order, as they occurred in time. The suspense was generated by the character in the story not having all the information. In the non-canonical surprise structure, the narrative was altered so that knowledge of an important early event was withheld from the reader until the end. Once this information was revealed, the reader had to go back and reinterpret the events.

Birhle, Brownell, Powelson, & Gardner (1986) also found that RHD patients had difficulty revising their initial interpretation once relevant information was revealed. In their study, RHD subjects approached a nonverbal cartoon completion task in a sequential, piecemeal fashion. The subjects were able to appreciate isolated meanings, but when presented with the final, correct funny conclusion to the cartoon, were less likely to go back over the material to revise their initial interpretation. When instructed to choose the final frame that makes the cartoon funny, RHD patients were particularly drawn to surprising humorous endings that were not coherent with the rest of the comic. Brownell, Michel, Powelson, and Gardner (1983) also found that RHD patients recognize that a joke must end in surprise and can choose a surprising ending, but they lack the ability to establish an alternative interpretation that links the ending coherently to the rest of the joke.

Brownell, Potter, Bihrlé & Gardner (1986) presented subjects with two sentences that together formed an interpretation that was different from one sentence alone. In other words, hearing the second sentence required subjects to revise their initial inference that was formed based on the first sentence alone. The authors measured ability to revise initial interpretation by presenting subjects with inference questions. They found that compared to normal controls, RHD patients had more difficulty answering inference questions, especially those that probed the initial inference. They also looked at performance when the two sentences were presented in variable orders. The RHD patients performed worse when the “misleading” information was presented in the first sentence, further illustrating a difficulty with revising initial interpretation.

The above studies suggest that RHD patients have trouble with narrative and discourse comprehension when an initial interpretation must be revised, or alternative meanings must be established to achieve coherence. One proposed theory regarding such comprehension deficits is a “suppression deficit hypothesis.” This theory states that RHD patients are impaired at suppressing alternate or contextually inappropriate meanings compared to normal older persons, which contributes to discourse comprehension difficulties (Tompkins, Baumgaertner, Lehman, & Fossett, 1997; Tompkins, Lehman, & Baumgaertner, 1999; Tompkins, Blake, Baumgaertner, & Jayaram, 2004). Another theory that accounts for impaired performance in drawing inferences is the “coarse semantic coding” hypothesis (Beeman, 1993, 1998; Beeman, Bowden, & Gernsbacher, 2000). While the suppression deficit hypothesis suggests an impairment in comprehension due to *too many* competing semantic meanings, the coarse semantic coding hypothesis posits that RHD patients have impaired comprehension due to a *lack of* semantic information. This theory is based on the notion that the right hemisphere activates a diffuse and widespread network of associations and secondary meanings of words, while the left hemisphere

focuses on the initial and/or dominant meanings of words. Thus, when an individual suffers RHD, the ability to access alternative and diverse semantic relations is diminished, leading to the observed impairments in revising initial interpretations and making certain inferences.

The cognitive neuroscience literature also builds on behavioral studies of RHD patients and seeks to determine the neural underpinnings of right hemisphere language functions. For example, St. George, Kutas, Martinez, & Sereno (1999) conducted an fMRI study that revealed greater activation in the right hemisphere during comprehension of ambiguous narratives without titles compared to the same passages with titles. Specifically, greater activity was observed in the right middle temporal sulcus and bilaterally in the inferior temporal sulcus. The right inferior frontal region was also mildly implicated. The no-title condition was considered more taxing on the processes required to achieve global coherence, and thus implicates the right hemisphere's role in this language function. Similarly, Nichelli, et al. (1995) conducted a PET study and found that right inferior frontal gyrus and right middle temporal gyrus were activated when subjects were asked to comprehend the moral of an Aesop's fable.

## **1.2 THE ROLE OF THEME ORGANIZATION: HOUGH (1990)**

Hough (1990) conducted a study of narrative comprehension in right and left hemisphere brain-damaged subjects that is often cited in the literature. She presented subjects with short auditory narratives that either had the theme at the beginning (original-theme) or the end (delayed-theme) of the passage. She found that RHD patients were less accurate at answering questions about the passage and identified significantly fewer central themes when the theme was delayed until the end of the narrative compared to when the theme was presented at the beginning. In examining

the errors, RHD patients-- especially those with anterior damage-- produced more embellishments and confabulations than LHD patients. Hough concluded that the RHD patients were unable to use a macrostructure to integrate the discourse into a coherent narrative, especially when the theme was delayed. Instead, they relied on a microstructure, recalling isolated details from the narratives. These results are similar to the above-reviewed literature, as the RHD patients had trouble with discourse comprehension when important information was revealed after their initial interpretations. They performed better when the narratives followed a sequential, canonical structure.

Hough's study is widely cited in the literature to support theories of the right hemisphere's role in language comprehension. Some of these studies examine behavioral tasks of RHD patients and others examine neuroanatomical findings. For example, Ferstl, Rinck, & von Cramon (2005) performed an fMRI study to directly map the neural correlates of narrative comprehension. They focused on the idea of situation model building, which involves integrating the current discourse with both previous discourse and with general world knowledge. Subjects listened to narratives, half of which contained global inconsistencies, while local coherence was maintained. Global inconsistencies were either chronological or emotional. The authors cite Hough's study as an example of behavioral data implicating the right hemisphere's role in inferring a theme when its presentation is delayed. They suggest that the delayed presentation prevented subjects from setting up an appropriate situation model, resulting in the impaired performance. Results of the fMRI study revealed that hearing an inconsistent word elicited activation in the right anterior temporal lobe.

Several authors have cited Hough's work as support for theories relating to behavioral findings in patients with RHD. Beeman's work on the "coarse semantic coding" theory (Beeman

1998; Beeman et al., 2000), discussed earlier, references Hough's research to describe the discourse comprehension difficulties of patients with RHD. Beeman points to the fact that these patients have difficulty organizing their recall of discourse, and that they have difficulty stating the main idea of a narrative, especially when it is presented at the end.

Hough's findings were cited in a paper describing the development and evaluation of a diagnostic tool for story comprehension, the Story Comprehension Test (SCT, Ferstl, Walther, Guthke, & von Cramon, 2005). The authors identify two "critical components" of text comprehension: inferencing and the extraction of a macrostructure. They refer to Hough's research as evidence that RHD patients are impaired at creating a macrostructure during narrative comprehension, along with the prerequisite ability of distinguishing main ideas from details.

Schneiderman, Murasugi, & Saddy (1992) also cite Hough's study as evidence that RHD patients are impaired in forming an appropriate macrostructure. The authors extend these findings to discourse production. They presented subjects (RHD, LHD and normal controls) with a series of sentences and instructed them to form a coherent story. The subjects were given the themes of half of the stories. Results showed that both normal controls and LHD subjects benefited from the theme sentence, while RHD patients did not.

Hough's study has been cited in the autism literature as well, which likens the communication deficits of people with autism to those with right hemisphere brain damage (Osonoff & Miller, 1996; Sabbagh, 1999). For example, Sabbagh (1999) cites Hough's research as an example of the difficulty RHD patients have with using later-occurring information to update their comprehension of main themes in discourse. Preliminary studies of individuals with autism have found similar deficits in organizing discourse. Sabbagh proposes a theory that the



communicative deficits demonstrated by both RHD patients and autistic individuals are related to an inability to integrate communicative intentions with language comprehension and production.

Despite the fact that it is widely cited in the literature, there are limitations to Hough's study that question the validity of its results. Mainly, Hough's manipulation of the stimuli is an area of concern. In order to delay the theme presentation, Hough manipulated the narrative passages in two ways. If the first sentence was the central theme, Hough simply moved it to the end of the narrative. Alternatively, the theme was removed from the first and/or second sentences and either incorporated into the last sentence or presented as the closing sentence. This is problematic because the rules of narrative structure and story coherence were disrupted when the theme was delayed in this manner. Besides delaying the theme of the narrative, other aspects of canonical narrative structure were altered as well, and it is not clear which manipulations were responsible for the decreased comprehension.

### **1.3 NARRATIVE STRUCTURE AND COHERENCE**

According to Merritt & Liles (1987), a narrative includes a setting, initiating event (IE), internal response (IR), attempt, direct consequence (DC), and reaction. The setting involves a central character, location, context, or character's habitual state. The IE begins a goal-based episode sequence in the story and causes the main character(s) to respond. The IR describes a character's physiological state, is causally related to an IE, and leads to a plan sequence. The attempt represents a character's overt action toward resolving the situation or achieving a goal. The DC marks the direct attainment or non-attainment of a character's goal and is the result of an attempt. Lastly, the reaction defines how a character feels about the attainment or non-

attainment of a goal. By simply shifting the first sentence or two of a narrative to the end of the passage, there is the potential to violate the rules of narrative structure. For example, consider the following delayed-theme narrative from Hough's study:

Glen always seemed to be getting into some kind of trouble.  
One of Pete's friends came by on his bicycle and stopped to talk to Pete.  
Glen headed for the street but Pete caught him in time.  
Then Glen started running up the concrete stairs to their house.  
Before Pete could get to him, Glen fell and scraped his knee.  
Glen was screaming as Pete's parents pulled in the driveway.  
Pete had been watching his little brother in the front yard while his parents went shopping.

Without a setting introducing the two characters, there is a discontinuity in the first two sentences, with the first one describing Glen and the second one switching to Pete without first introducing a second character. Thus, the delayed theme presentation violates the rules of narrative structure in its absence of a setting.

Story coherence is another important factor in discourse comprehension. Local coherence is achieved when the information being presented directly relates to the information that immediately precedes and follows it. On the other hand, global coherence refers to the ability to connect current information with information presented earlier, or with one's world knowledge (Albrecht & O'Brien, 1993; Lehman & Schraw, 2002). Discourse psychologists have suggested that the most important factor in maintaining local coherence is overlap between a noun-phrase argument in the current information and an argument in previous text (Graesser, Millis, & Zwaan, 1997). Consider the following two sentences: *My sister likes to play the piano. She practices three hours a day.* In these sentences, the pronoun *she* refers to the argument *my sister*, and the two sentences are connected by argument overlap.

Research on text comprehension has suggested that poor coherence negatively impacts the reader's comprehension (Beck Beck, McKeown, Omanson, & Pople, 1984). Some examples of poor coherence include ambiguous, distant, or indirect referents; lack of clear relationships between events; and concepts that are introduced without providing a proper background (Beck et al., 1984).

Zwaan, Langsten, & Graesser (1995) also characterize several areas of possible discontinuities in stories:

1. Spatial Discontinuity: The spatial setting of the present information is different from that of the preceding event.
2. Temporal Discontinuity: The present information occurs either much later or earlier in time than the preceding event.
3. Causal Discontinuity: The present information is not causally related to the preceding information.
4. Intentional Discontinuity: The present information is not part of the same plan as the preceding information.
5. Protagonist Discontinuity: The character involved in the present information is different from the characters in the preceding information.

Zwaan et al. (1995) found that reading time for an event increased as the number of discontinuities for that event increased. In other words, poorer local coherence resulted in increased reading time, suggesting those passages were more difficult than those with good local coherence. In developing her delayed-theme narratives, Hough did not account for breaks in local coherence and the resultant stimuli contained many of Zwaan's areas of discontinuity.

#### **1.4 SPECIFIC AIMS**

The results from Hough's study are confounded by a difference in coherence between original-theme and delayed-theme narratives. Thus, it cannot be determined if the RHD subjects in Hough's study performed poorly due to the delayed-theme structure or whether it was due to a lack of narrative coherence. The goal of the current study was to determine if a lack of local coherence-- rather than a delayed-theme organization-- accounted for poor narrative comprehension for the RHD group. Delayed-theme narratives were carefully manipulated to maintain coherence despite the shift of the main theme from the beginning of the narrative to the end. It was hypothesized that when coherence was controlled for, the RHD subjects would not perform significantly different on the two conditions (original-theme vs. delayed-theme).

## **2.0 METHODS**

### **2.1 PARTICIPANTS**

Fifteen adults participated in the study. Ten individuals had right hemisphere brain damage (RHD) as a result of a cerebral vascular accident (CVA). CT or MRI brain scan and clinical diagnosis confirmed that the CVA was contained to the right hemisphere of the brain. Participants with RHD were at least 4 months post-onset of CVA. Potential RHD participants were excluded if there was evidence of bilateral, brainstem, or cerebellar lesions; a cognitively degenerative disease such as Parkinson's or Alzheimer's; or a premorbid psychiatric disorder.

Five non brain-damaged (NBD) adults were included as a control group to ensure that there were no obvious problems with the stimuli. Exclusions included previous neurological episodes or conditions, and psychiatric disorders. NBD participants were screened for cognitive deficits using the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975), and were required to score 28 out of 30 possible points.

By self report, all participants met the following criteria: between the ages of 40-85; native English speakers; right-handed; have completed at least eight years of formal education; and have no history of substance abuse.

All participants were determined to have sufficient hearing sensitivity to complete the auditory tasks. They passed a pure-tone air conduction hearing screening at 35dB HL at 500, 1000, and 2000 Hz. Those who failed the hearing screening in one ear were also asked to repeat 12 words, each of which was loaded with fricative consonants. A score of 11/12 words was required to pass the hearing screen.

**Table 1. Clinical Characteristics of Participant Groups**

	RHD Group (N=10)	NBD Group (N=5)
Age (years)		
Mean	65.40	67.60
SD	13.48	6.73
Range	45-81	59-77
Education (years)		
Mean	14.80	14.4
SD	3.16	2.61
Range	12-20	12-18
Gender		
Male	4	2
Female	6	3
Months Post-Onset		
Mean	90.30	Not Applicable
SD	53.21	
Range	25-195	
Lesion Type		Not Applicable
Thromboembolic	5	
Hemorrhagic	5	
Lesion Site		Not Applicable
Right Cortical Posterior	4	
Right Cortical Mixed	2	
Right Subcortical	3	
Right MCA	1	
Auditory Working Memory for Language <sup>a</sup> (word recall errors)		
Mean	15.30	8.60
SD	7.53	5.73
Range	3-26	0-14
Discourse Comprehension Test <sup>b</sup>		
Mean	33.80	36
SD	3.29	4.12
Range	28-37	29-39
Discourse Comprehension Test- Implied Questions		
Mean	16.10	17.20
SD	2.56	3.11
Range	12-20	12-20

Caplan Syntax Task <sup>c</sup>		
Mean	14.20	15
SD	1.87	1.00
Range	10-16	14-16
Behavioural Inattention Test <sup>d</sup>		
Mean	136.60	143.80
SD	10.22	1.79
Range	110-143	142-146
*Auditory Double Simultaneous Stimulation <sup>e</sup> - Binaural Accuracy		
Mean	3.80	7.60
SD	3.46	0.55
Range	0-8	7-8

RHD=right hemisphere brain damage; NBD=non-brain damaged; anterior= anterior to Rolandic fissure; posterior= posterior to Rolandic fissure; <sup>a</sup>Tompkins et al. (1994; maximum errors=42); <sup>b</sup>Brookshire & Nicholas (1993; maximum score-total = 40, maximum score-implied = 20); <sup>c</sup>Caplan (1987; maximum score= 16); <sup>d</sup>Wilson, Cockburn, & Halligan (1987; maximum=146; neglect cut-off= 129) <sup>e</sup>adapted from Shisler et al. (2004) & Shisler (2005; maximum= 8). \*= significant difference by independent t-test, p<0.01

## 2.2 STIMULI DEVELOPMENT

Stimuli were created based on the original Hough (1990) narratives. Hough used 32 8-sentence narratives that were at or below a sixth grade reading level. She first conducted a pilot study with 15 non-brain-damaged adults to identify the main ideas of the narratives. She then created the delayed-theme narratives in two ways. If the initial sentence was the central theme, she shifted the sentence to the end of the narrative. Otherwise, she removed the main idea from the first and/or second sentence and either incorporated it into the final sentence or presented it as the final sentence.

### 2.2.1 Stimulus Exclusions

The original-theme narratives from Hough's study were accessible, although the delayed-theme narratives were not. However, the list of main ideas for each narrative was available and was

used to recreate the delayed-theme narratives. In doing so, a number of problems arose related to stimulus coherence. 18 narratives were excluded, for the following reasons:

1. *The main idea was not in the first two sentences of the narrative.* This was the case in fourteen of the original narratives. This is problematic because Hough reported that she extracted the main theme for the first and/or second sentences of each narrative. However, in fourteen of the narratives, the main idea that was identified by the pilot study occurred later in the story, and thus shifting the first and/or second sentences would not result in a delayed theme. For example, the following is an original narrative:

Bob moved into an apartment on the west side of Raleigh.  
He moved there from Nebraska where he had been going to college.  
Bob didn't know any of his neighbors.  
He decided the best way to meet them was to have a party.  
He planned it for seven o'clock the following Friday night.  
He posted flyers near the mailboxes and elevators.  
The party was a big success.  
Bob met many interesting people and made some new friends.

The pilot study identified “not knowing neighbors” as the main idea of this story. The main idea, then, is not revealed until the third sentence. Thus, the narrative was excluded.

2. *The moved main idea created an episode shift and thus did not cohere with what immediately preceded it.* This was the case in two narratives. For example, consider the following original narrative:

Jack went to the school gymnasium every day at 3:30 in the afternoon.  
He was having problems learning how to play basketball.  
The coach offered to help him after school.  
Jack dribbled down the court and threw the ball toward the hoop.  
Jack missed many baskets but the coach said he was improving.  
Jack was glad no one could see him practicing.  
Suddenly he heard a loud cheering noise.  
His friend, Gail, was sitting in the bleachers watching him.



When the main idea, “Jack had problems learning to play basketball” is shifted to the end of this narrative, this creates an episode shift from Gail back to Jack and results in a lack of local coherence.

3. *There was a recurring main idea, so extracting it from the first sentence didn't delay it until the end.* This was the case in one narrative:

Barbara decided to take her dog, Bugs for a walk.  
Bugs had been scratching at the door and barking loudly.  
Barbara walked the dog to the nearby park.  
Bugs appeared to be happy and began running, dragging Barbara behind her.  
Barbara was tired and sat down on a bench.  
Bugs was whimpering and pulling on the leash.  
Barbara decided to let Bugs run more and took off her leash.  
She realized that this was a bad idea when Bugs chased a cat up a tree.

The main idea of this story, as identified in Hough's pilot study, is “taking a dog for a walk.” However, the third sentence again states that Barbara walked the dog.

4. *The main idea encompasses too many aspects of the story, and by delaying it there would be no foundation for integration.* This was the case in 1 narrative:

The Browns drove five hours to their cottage in the upper peninsula in Michigan.  
They spent three weeks there every year during the month of August.  
The four children enjoyed swimming, boating, and water skiing during this time.  
The Browns visited with old friends who also had cottages there.  
This year they had bought a new powerboat which they were looking forward to using.  
The Browns were also going to do some camping in the Porcupine Mountains.  
They brought along some sleeping bags and a tent.  
The Browns had to be back home in Toledo by September 1 because that is when school started.

The main theme of this narrative, as identified in Hough's pilot study is “Browns vacation every August at their cottage in Michigan.” This main idea contains four

aspects of the situation model, as opposed to other passages whose main ideas contain only one or two. By delaying all of this information until the end of the story, the narrative sounds like a series of random sentences about the protagonist. There is no foundation to connect the sentences and form a coherent narrative.

### 2.2.2 Modifications to Maintain Coherence

Delayed-theme versions of the remaining 14 narratives were created by shifting the main idea from the first and/or second sentences to the end of the narrative. However, in order to maintain and enhance coherence in these narratives, a variety of modifications were necessary. Modifications to maintain coherence included the following:

1. *Maintaining referential specificity: Adjusting the use of proper names vs. pronouns and articles to maintain coherence.* When the theme was delayed by moving the first sentence to the end, this often left the narrative beginning with a pronoun with no referent. There were also problems with the use of indefinite and definite articles, which required modification. For example, consider the following delayed-theme introductory sentence:

**He** planned to take **this** trip during the month of April.

There is no referent for either “he” or “this.” Instead, we begin the narrative with the following sentence:

**Mr. Smith** planned to take **a** trip during the month of April.

2. *Establishing the setting minus the main idea in cases when shifting the main idea to the end also eliminates the setting.* One of the rules of narrative form is an established setting. However, moving the main idea to the end of the narrative sometimes also eliminated the setting. In these instances, a setting was established that did not contain the main idea. For example, consider these first two sentences of a narrative:

[Alice was away on business in Detroit for two weeks.]

She had accomplished a lot of work, but was eager to get home.

When the first sentence, which contains the main idea, is moved to the end, we are left with the second sentence introducing the narrative. This sentence does not establish the setting that Alice is out of town, which is important to the rest of the narrative. Instead, the delay-theme narrative was modified by including the setting in this sentence:

Alice had accomplished a lot of work while she was out of town.

By making these modifications, the listener has an established setting of Alice being out of town, without revealing the main idea that she was on a business trip in Detroit. Modification #1 was also used to eliminate the pronoun referent ambiguity.

3. *Adding a content neutral phrase such as “after all” or “even so” to connect the moved initial sentence with the preceding idea.* Without adding content neutral phrases, some moved sentences sounded out of place, or contradictory to the preceding sentence. By adding these phrases, the moved sentence cohered with the sentence preceding it. For example, consider the following last two sentences of a delayed-theme narrative:

Dave’s wrist was broken and he could not play for the rest of the season.

[Even so,] Dave had enjoyed joining his softball team this year

Without adding the phrase “even so,” these statements are disconnected and perhaps even contradictory.

4. *Maintaining temporal sequence to avoid temporal discontinuities.* Some sentences had time markers that required alterations due to the placement in the narrative. Sentences in the beginning of the story often referred to the future, and when they were shifted to the end needed to be switched to the past tense. For example, the main theme of one narrative was contained in the following sentence:

He had a very hectic day **ahead of him**.

At the beginning of the passage, this time marker is appropriate. However, shifting this sentence to the end of the narrative results in a time sequence that is out of order. Thus, the sentence is changed to:

His very hectic day **was finally over**.

In some passages, maintaining temporal sequence simply involved modifying verb tense, such as changing “found” to “had found.” Neutral time phrases, such as “before that” and “in the end” were also sometimes used to establish or maintain a temporal sequence.

5. *Maintaining the active narrative line when the delayed main idea would have switched focus.* For example, consider the following delayed-theme concluding sentences:

Pam turned around and smiled when she saw her boyfriend singing and holding the cake.

They (her family) had taken her out for a special dinner to celebrate her birthday.

In order to maintain an active narrative line, the final sentence was modified to keep Pam in focus. Thus, the two sentences become:

Pam turned around and smiled when she saw her boyfriend singing and holding the cake.

She had enjoyed this special dinner for her birthday celebration.

In this example, the theme of Pam celebrating her birthday is delayed while still maintaining an active narrative line.

6. *Omitting redundant detail when delayed-theme sentences became long and unwieldy.*

In order to prevent delayed-theme narratives from containing sentences that were unnecessarily long and awkward, there were two instances where redundant information was omitted. Consider the following sentence:

She had been unhappy earlier because she had not received any Valentine's [candy, flowers, or cards] gifts.

This sentence sounded long and awkward, so "candy, flowers, or cards" was replaced with "gifts." Similarly, in a different passage, "temperature above 102" was replaced with "fever."

7. *Omitting a causal clause that was irrelevant to the theme of the story in order to maintain parallel syntax for the original and delayed-theme narratives.* In one instance,

it was necessary to omit a causal clause from both the original and delayed narratives in order to keep the syntax as parallel as possible. Consider the sentence:

Joe and Dave golfed every Wednesday [because this was Joe's day off from work].

The phrase in brackets could not be included in the delay-theme narrative without reducing its coherence. Thus, it was omitted from both versions of the narrative in order to maintain a close match in syntax between original and delayed-theme narratives.

Although many modifications had to be made, much effort was taken to retain as much of Hough's original stimuli as possible. Wording was not altered, other than to enhance coherence, even when other phrasing would have sounded better. Narrative length was maintained, as was the balance of proper names and pronouns.

### **2.2.3 Coherence Judgment**

A pilot study was conducted to ensure that coherence was equivalent for the delayed-theme and original-theme narratives. A total of 40 narratives were included: 15 original-theme narratives, 15 delayed-theme versions of these narratives, and 10 fillers. Filler narratives were constructed using original stimuli that were excluded from the current study. Fillers were created to represent varying degrees of story coherence, with some a random collection of sentences, and others more cohesive stories. Two blocks of narratives were created to control for order effects, with half of the participants assigned to each block. Narrative order was pseudorandomized to ensure that no more than 3 consecutive trials were of the same category (original, delayed, filler). When this occurred, the fourth consecutive number was placed at the next available slot that fit

within these rules. The second block was created by reversing the order of the narratives, so that for any given narrative the delayed-theme version was presented first for half the participants and the original-theme was presented first for the other half.

A total of 16 non-brain damaged adults (eight per list) participated in the study. Participants were at least 18 years of age, native English speakers, and had no history of neurological deficits. Participants listened to each narrative read aloud by the author. They were then asked to make a judgment using a five-point scale as to how well the sentences fit together to form a coherent story, one being “not at all” and five being “extremely well” (see appendix A). Three practice trials were first completed to ensure understanding of the task.

Delayed-theme narratives were considered coherent if the average rating fell within 0.50 points of its original counterpart. Results from the first round of the pilot study revealed five delayed-theme narratives that differed from their original counterparts by more than 0.50 points. One passage was discarded due to exclusion number seven described above, and the remaining four narratives were revised to enhance coherence. Eight new participants were recruited to make judgments about the coherence of these four delayed-theme narratives and their original counterparts. Results from the second round of piloting revealed that one delayed-theme narrative still did not score within 0.50 points of its original counterpart and that narrative was discarded as well.

After the pilot study, 12 sets of narratives remained. Differences in coherence ratings ranged from 0.13 to 0.49, with an average difference of 0.29. Despite careful stimulus control, paired *t*-test revealed a significant difference between original and delayed-theme passages [ $t(11) = 8.34, p < .0001$ ], with the delayed theme passages having less coherence. Thus, it was necessary to partial out coherence when analyzing the results of the main study.

## 2.3 STIMULI

### 2.3.1 Experimental and Filler Tasks

The experimental stimuli consisted of 12 narratives taken from Hough's (1990) study (Appendix B) and the 12 delayed-theme versions of these narratives created for this study with enhanced coherence (Appendix C). Filler stimuli included six different original narratives from Hough's study and six delayed-theme versions of these narratives, created without regard to coherence (Appendix D). As the actual delayed-theme passages from Hough's study were not available, they were recreated following the methods outlined in Hough's paper.

Comprehension of the narratives was tested by asking three yes/no questions after the presentation of each passage (Appendix E). Three types of yes/no comprehension questions were created: 1. Explicit central theme of the narrative, 2. Inferred central theme of the narrative, and 3. Detail about the narrative. The explicit and inferred central theme questions refer to the first two main ideas that were identified by normal participants in Hough's pilot data. Questions were created so that there were an equal amount of yes and no answers.

### 2.3.2 Task Construction

A female speaker audio recorded the narratives and yes/no questions, all at an average speaking rate of about four syllables per second. Stimuli were produced with a consistent, neutral tone. Several graduate students collaborated with the speaker to achieve recording consistency, and adjustments were made as necessary. All recordings were made with an Audio-Technica ATR20 vocal/instrument microphone with a constant microphone-to-mouth distance (approximately four



inches). Recording was done 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 22.05KHz with 16-bit resolution.

Sound Forge v4.5 software was used to assemble the stimuli. A single trial consisted of a trial number followed by a 500-ms pause, the narrative, a 650-ms pause, the word “questions” followed by another 500-ms pause, and then the three yes/no questions, each followed by a 500-ms pause, during which the experimenter paused the trial until the participant answered. The 36 trials for the entire task were pseudorandomized into six blocks, each containing four experimental narratives and two filler narratives. Three blocks contained only original-theme narratives and the other three blocks contained only delayed-theme narratives. The first yes/no question was always the inferred central theme question, and the order of the other two questions were randomized.

## **2.4 EXPERIMENTAL APPARATUS AND PROCEDURES**

Testing took place during two sessions, lasting up to 75 minutes each, between one and two-weeks apart. Participants were tested in a quiet room, either in their homes or in the laboratory. All testing was conducted by the author. All auditory stimuli were delivered via Windows Media Player on a Dell Inspiron 5150 notebook computer, through high quality supraural earphones at a comfortable loudness level selected by the participant via Quick Mixer v1.7.2.

### 2.4.1 Experimental Task

Participants were instructed that they were going to hear a series of short stories, each followed by three yes/no questions pertaining to the story. Participants first practiced the task with a live-voice example followed by three recorded practice narratives, to ensure understanding of the task procedures. Participants answered the yes/no questions by pressing one of two labeled buttons (Yes/No) on a manual response box. The experimenter manually recorded responses on a response form. The experimenter paused the audio file after each question to allow the participant ample time to respond to each question.

Original and delayed-theme narratives and fillers were presented in six blocks of six narratives each, with three blocks containing only original narratives and three blocks containing only delayed-theme narratives. All the narratives of one theme condition were presented on the same day (i.e. three blocks of delayed-theme narratives on Day 1 and three blocks of original narratives on Day 2), so that participants did not hear two versions of the same narrative in one session. Several additional measures were taken to disguise the repetition of the narratives. First, the names of characters in the narratives were different in the original and delayed-theme versions of the narratives. Second, experimental blocks were interspersed with ancillary measures (see table 2). Additionally, filler passages were added to increase the amount of stimuli. The order of administration of the theme conditions (original, delayed) was counterbalanced across participants, and order of stimulus block presentation within sessions was randomized for each participant.

## 2.4.2 Ancillary Tasks

Ancillary tasks were administered to further characterize the participants and to control for alternate interpretations of performance on experimental tasks. The following tasks were interspersed with the experimental narrative blocks:

1. *Behavioural Inattention Test* (Wilson, Cockburn, & Halligan, 1987), to test for visual neglect. This test includes line bisection, cancellation, and drawing tasks.
2. *Working Memory Capacity for Language* (Tompkins, Bloise, Timko, & Baumgaertner, 1994), a task with preliminary reliability and validity data (Lehman & Tompkins, 1998). Participants heard short sentences (e.g., "You sit on a chair") and indicated by pressing a labeled button whether each sentence was true or false. At the same time, they remembered the final word of each sentence until the examiner asked them to recall those words. For the recall component of this task, participants had to hold in mind anywhere from 2-5 words at a time. Participants first completed a live-voice example followed by two recorded practice sets. The task consisted of 12 sentence sets.
3. *The Discourse Comprehension Test* (DCT, Brookshire & Nicholas, 1993) to assess general comprehension. This test is similar in format to the experimental procedure, as participants listened to narratives and answered yes/no questions about the stated and implied main ideas and details. It is well-validated for RHD and older NBD adults. Participants first completed a live voice example followed by a recorded practice narrative. The task consisted of five narratives each followed by eight yes/no questions.
4. *Caplan Syntax Task* (Caplan, 1987), to assess syntactic processing capabilities. Participants listened to single sentences that vary in grammatical complexity, but that all describe one character doing something to or with another character (e.g., pushing, kissing, etc). Participants

were asked to demonstrate these actions, using paper figures that represent each character.

Participants first completed two live-voice examples followed by five recorded practice trials.

The task consisted of two blocks, each containing eight trials. The order of block administration was counterbalanced across participants.

5. Auditory Double Simultaneous Stimulation (DSS) task to assess auditory neglect and extinction.

This task was adapted from the work of Shisler (2005) and Shisler, Gore, & Baylis (2004). The auditory double simultaneous stimulation task consisted of the presentation of the letter “e” or “o” to either the right ear only, left ear only, or binaural presentation. The same female speaker who recorded the experimental passages also recorded the stimuli for this task, under the same recording conditions. A single trial consisted of a trial number followed by a 500-ms pause, then either the letter “e” or “o” presented to the specified ear(s). One block of 24 trials was assembled using Audacity software, consisting of eight presentations to the left ear only, eight presentations to the right ear only, and eight binaural presentations. Both letter and location of stimuli were randomized across the 24 trials. Participants were first screened for right/left discrimination abilities, and given explicit instructions in performing the task. The participants indicated which ear they heard the stimuli in by pressing a labeled button presented in a vertical visual array.

**Table 2. Order of Administration**

<b>Session 1</b>	<b>Session 2</b>
Hearing Screen	Narrative Block
MMSE (NBD only)	Caplan Syntax Block
Narrative Block	Narrative Block
BIT Subtests 1-3	Caplan Syntax Block
Narrative Block	DCT
DSS Task	Narrative Block
BIT Subtests 4-6	Working Memory Task
Narrative Block	

### 3.0 RESULTS

This study sought to determine whether RHD's poor comprehension of delayed-theme narratives in Hough's (1990) study was a result of theme manipulation alone, or whether poor narrative coherence was a factor. The major research question addressed in this study was: Does enhancing the coherence of delayed-theme narratives eliminate the discrepancy in comprehension performance on delayed-theme vs. original-theme narratives for individuals with right hemisphere brain damage?

To address this question, delayed-theme narratives with enhanced coherence were created. Participants' comprehension of both the delayed-theme and original-theme narratives was tested using yes/no questions pertaining to explicitly stated main ideas, inferred main ideas, and details. Performance was measured by total accuracy scores on comprehension questions for each of the conditions. A within-subject group design was implemented, where RHD participants' performance on delayed-theme narratives was compared to their performance on original-theme narratives.

To further validate the findings, filler passages were included in the comprehension task. These included original-theme narratives from Hough's (1990) study along with their delayed-theme counterparts that were constructed without regard to coherence. Participants' performance on original-theme fillers was then compared to their performance on delayed-theme fillers.

Additionally, performance on coherence-enhanced (experimental) delayed-theme narratives was compared to performance on non-coherence enhanced (filler) delayed-theme narratives.

### 3.1 PRELIMINARY ANALYSIS

#### 3.1.1 NBD Group

Five NBD participants were included in the study to ensure that there were no obvious problems with the stimuli. Frequencies and percentages of experimental and filler narratives are reported in tables 3-6.

**Table 3. Frequencies for Delayed Experimental Condition- NBD Group**

Number Correct (out of 36)	Frequency	Percent
34	2	40
35	3	60

**Table 4. Frequencies for Delayed Filler Condition- NBD Group**

Number Correct (out of 18)	Frequency	Percent
16	1	20
17	4	80

**Table 5. Frequencies for Original Experimental Condition- NBD Group**

Number Correct (out of 36)	Frequency	Percent
33	2	40
34	1	20
35	1	20
36	1	20

**Table 6. Frequencies for Original Filler Condition- NBD Group**

Number Correct (out of 18)	Frequency	Percent
17	1	20
18	4	80

### **3.1.2 RHD Group**

Mean accuracy scores were calculated for original and delayed-theme experimental stimuli as well as for original and delayed-theme filler narratives. The distributions for these variables were inspected by calculating ratios of skewness and kurtosis to their respective standard errors. None of the absolute values of these ratios exceeded two, suggesting that the data approximated a normal distribution (Dixon, Brown, Engelman, & Jennrich, 1990). Preliminary analyses were then conducted to examine gender differences in performance on experimental tasks. Independent *t*-tests revealed no significant differences in performance based on gender, and thus subsequent data was analyzed with gender collapsed.

## **3.2 PRIMARY ANALYSIS**

All primary analyses were conducted only on the RHD group, as the primary experimental question focused on the performance of this group under two conditions: original-theme and delayed-theme narratives.

### 3.2.1 Descriptive Data

Descriptive data for the RHD group are summarized in Tables 7-9, below.

**Table 7. Mean Number Correct, Standard Deviations, and Ranges for Original and Delayed Experimental Conditions**

Theme Condition	Mean Number Correct (out of 36)	SD	Range
Original Experimental	34	1.63	31-36
Delayed Experimental	34	1.25	32-36

**Table 8. Mean Number Correct, SD, and Ranges for Original and Delayed Filler Conditions**

Theme Condition	Mean Number Correct (out of 18)	SD	Range
Original Filler	16.70	1.34	15-18
Delayed Filler	15.60	2.12	12-18

**Table 9. Mean Proportion Correct for Delayed-Theme Experimental and Filler Conditions**

Theme Condition	Mean Proportion Correct	SD	Range
Delayed Experimental	0.94	0.04	0.89-1.00
Delayed Filler	0.87	0.12	0.67-1.00

### 3.2.2 Statistical Analysis

Accuracy data was analyzed using an a priori paired *t*-test. For the experimental tasks (Table 7), there was no significant difference in performance on original-theme narratives ( $M=34$ ,  $SD=1.63$ ) and delayed-theme narratives ( $M=34$ ,  $SD=1.25$ ),  $t(9) = 0.00$ ,  $p=1.00$ . For filler tasks, (Table 8) there was again no significant difference between performance on original-theme narratives ( $M=16.70$ ,  $SD=1.34$ ) compared to delayed-theme narratives ( $M=15.60$ ,  $SD=2.12$ ),



though there was a trend towards poorer comprehension of delayed-theme narratives,  $t(9)= 2.09$ ,  $p= 0.07$ .

Performance was also analyzed for delayed-theme experimental and filler narratives by proportion correct (Table 9). There was a significant difference between performance on delayed-theme experimental narratives ( $M=.94$ ,  $SD= 0.03$ ) compared to delayed-theme filler narratives ( $M=0.87$ ,  $SD= 0.12$ ), with better performance on experimental narratives,  $t(9)= 2.43$ ,  $p= 0.04$ .

### **3.3 PREDICTORS OF PERFORMANCE**

#### **3.3.1 Correlations**

Several other analyses were conducted examining correlations between performance on ancillary tasks and experimental tasks.

##### **3.3.1.1 Working Memory**

Pearson correlations addressed the relationship between word recall errors on the auditory working memory task ( $M= 15.30$ ,  $SD= 7.52$ ) and two experimental outcome measures: comprehension scores for the delayed-theme experimental narratives and for the original-theme experimental narratives. For an alpha level of 0.05, the correlation with delayed-theme narratives was statistically significant,  $r(8)= -0.67$ ,  $p= 0.03$ , while the correlation for original-theme narratives was not,  $r(8)= -0.48$ ,  $p= 0.16$ . This indicates a negative relationship between estimated working memory for language and comprehension of delayed-theme narratives. In

other words, the more errors made on the working memory task (lower estimated working memory), the poorer the performance on comprehension of delayed-theme narratives, but not original-theme narratives.

Because pilot testing revealed a significant difference in coherence ratings between original-theme narratives and delayed-theme narratives, it was necessary to partial out the coherence ratings to determine if this pattern of correlations could be attributable to the coherence difference. With coherence ratings partialled out, there remained a statistically significant correlation between word recall errors on the auditory working memory task and performance on delayed-theme narratives  $r(8) = -0.67, p = 0.03$ . Thus, the patterns of correlation between auditory working memory and narrative comprehension cannot be attributed to differences in narrative coherence ratings.

### **3.3.1.2 Auditory Double Simultaneous Stimulation Task**

Accuracy data for the DSS task was broken into three different scores, each with a possible maximum score of eight: monaural left presentation ( $M=7.90, SD=0.32$ ); monaural right presentation ( $M=7.80, SD=0.42$ ); and binaural presentation ( $M=3.80, SD=3.46$ ). Additionally, extinction scores were calculated for the binaural stimuli, with left extinction ( $M=1.90, SD=2.88$ ) indicating how often a binaural stimulus was reported only in the right ear, and right extinction ( $M=2.30, SD=2.98$ ) indicating how often a binaural stimulus was reported only in the left ear.

Pearson correlations were calculated to address the relationships between performance on the DSS task and comprehension scores for the delayed-theme and original-theme experimental and filler narratives. There was a statistically significant correlation between accuracy in the binaural condition and comprehension of delayed-theme experimental narratives, corrected for

coherence,  $r(8)=0.80$ ,  $p= 0.006$ . There was a marginally significant correlation between accuracy in the binaural condition and comprehension of original-theme experimental narratives,  $r(8)= 0.63$ ,  $p=0.051$ . There was a statistically significant correlation between accuracy in the binaural condition and comprehension of original-theme filler narratives,  $r(8)=0.68$ ,  $p= 0.03$ . There was no significant correlation between accuracy in the binaural condition and comprehension of delayed-theme filler narratives,  $r(8)=0.40$ ,  $p= 0.26$ .

### **3.3.1.3 Behavioural Inattention Test**

Pearson correlations were calculated to address the relationships between performance on the BIT and comprehension scores on original-theme and delayed-theme experimental and filler narratives. None of the correlations were statistically significant, indicating no relationship between these measures.

Pearson correlations were also conducted to address the relationship between performance on the BIT, a measure of visual neglect, and performance on the DSS task, a measure of auditory neglect. There was a statistically significant relationship between scores on the BIT ( $M=136.60$ ,  $SD= 10.22$ ) and accuracy for a stimulus in the right ear,  $r(8)= 0.83$ ,  $p= 0.001$ , indicating that the poorer the score on the BIT, the less accurate for right monaural stimuli. There was a statistically significant relationship between scores on the BIT and right extinction,  $r(8)=-0.58$ ,  $p= 0.04$ , indicating that the poorer the score on the BIT, the more right extinction of binaural stimuli.

### **3.3.1.4 Discourse Comprehension Test**

Pearson correlations were calculated to address the relationships between performance on the DCT and comprehension of experimental and filler narratives. Performance on the DCT was

analyzed both in terms of total accuracy and accuracy for only the implied questions. There were no significant correlations between total accuracy on the DCT (M=33.80, SD=3.29) and any experimental or delayed narratives, all  $p > 0.07$ . However, there was a statistically significant relationship between accuracy on the implied questions of the DCT (M=16.1, SD=2.56) and comprehension of delayed experimental narratives,  $r(8) = 0.70$ ,  $p = 0.03$ , indicating that the less accuracy for implied questions on the DCT, the poorer comprehension of delayed experimental narratives.

#### **3.3.1.5 Caplan Syntax Task**

Pearson correlations were also conducted to address the relationships between comprehension of experimental and filler narratives and accuracy on the Caplan Syntax Task (M=14.20, SD=1.87). There were no statistically significant correlations, all  $p > 0.17$ .

#### **3.3.1.6 Education**

Pearson correlations were conducted to address the relationships between years of education (M=14.80, SD=3.16) and performance on experimental and filler comprehension tasks. There were no statistically significant findings, all  $p > 0.17$ , indicating that there is no association between years of formal education and performance on experimental and filler comprehension tasks.

#### **3.3.1.7 Age**

Pearson correlations were conducted to address the relationships between age and performance on experimental and filler comprehension tasks. There was a statistically significant relationship between age (M=65.40, SD=13.48) and performance on the delayed-theme filler narratives,  $r(9) = -0.69$ ,  $p = 0.03$ , indicating that as age increased, comprehension of delayed-theme filler

narratives decreased. No other experimental or filler tasks significantly correlated with age,  $p > 0.17$ .

### 3.3.2 Categorical Variables

#### 3.3.2.1 Site of Lesion

Tables 10 and 11 provide descriptive data on the narrative variables for four subgroups based roughly on lesion site. Examination of the means and ranges of performance on the original and delayed-theme experimental and filler narratives suggests that the right subcortical group performed poorest on all tasks, but this observation is highly tentative, given the very small sample sizes in each lesion group.

**Table 10. Means and Ranges of Performance on Experimental and Filler Tasks by Lesion Site**

Lesion Site	Original-Theme Experimental (Max=36)	Delayed-Theme Experimental (Max=36)	Original-Theme Filler (Max=18)	Delayed-Theme Filler (Max=18)
Right Cortical Posterior (N=4)	<b>M=33.50</b> (31-36)	<b>M=34.25</b> (32-36)	<b>M=17.25</b> (15-18)	<b>M=16</b> (12-18)
Right Cortical Mixed (N=2)	<b>M=35.50</b> (35-36)	<b>M=34</b> (33-35)	<b>M=16.50</b> (15-18)	<b>M=17.50</b> (17-18)
Right Subcortical (N=3)	<b>M=33.33</b> (32-34)	<b>M=33.33</b> (33-34)	<b>M=16</b> (15-17)	<b>M=14</b> (13-15)
Right MCA (N=1)	<b>M=35</b>	<b>M=35</b>	<b>M=17</b>	<b>M=15</b>

**Table 11. Means and Ranges of Performance on Delayed-Theme Conditions (Proportion Correct) by**

**Lesion Site**

Lesion Site	Delayed-Theme Experimental	Delayed-Theme Filler
R Cortical Posterior (N=4)	<b>M=0.95</b> (0.89-1.00)	<b>M=0.89</b> (0.67-1.00)
Right Cortical Mixed (N=2)	<b>M=0.94</b> (0.92-0.97)	<b>M=0.97</b> (0.94-1.00)
Right Subcortical (N=3)	<b>M=0.9259</b> (0.92-0.94)	<b>M=0.78</b> (0.72-0.83)
Right MCA (N=1)	<b>M=0.97</b>	<b>M=0.83</b>

**3.3.2.2 Type of Lesion**

Independent *t*-tests revealed there were no significant effects of lesion type (thromboembolic vs. hemorrhagic, see table 2) on comprehension of experimental or filler narratives, all  $p > 0.40$ .

Descriptive data revealed no patterns in performance.

## **4.0 DISCUSSION**

### **4.1 EXPERIMENTAL TASK PERFORMANCE**

This study was conducted to determine if enhancing the coherence of delayed-theme narratives would result in improved comprehension by adults with RHD. In a previous study (Hough, 1990) narrative comprehension was significantly poorer for the delayed-theme condition compared to the original-theme condition for adults with RHD. It is possible, however, that the discrepancy in comprehension abilities was a result not of a delayed- theme condition, but a lack of story coherence. Thus, for this study, delayed-theme narratives were carefully manipulated to maintain coherence despite the shift of the main theme from the beginning of the narrative to the end. The hypothesis was that once story coherence was controlled for, adults with RHD would perform equally well on original-theme and delayed-theme narratives.

Due to the inherent difficulty of interpreting a null outcome, this study also built in two contrasts that were expected to be significant. First, for the filler narratives it was predicted that participants would perform significantly poorer on the delayed-theme condition, as these narratives were manipulated without regard to local coherence. Second, participants were expected to perform significantly better on experimental delayed-theme narratives compared to filler delayed-theme narratives, as the former maintained local coherence despite the delayed theme.

In terms of the primary hypothesis, the RHD participants in this study performed as expected. There was no significant difference between performance on original-theme narratives and delayed-theme narratives on experimental tasks.

In order to further validate these results, a number of filler stimuli were included, which consisted of some of Hough's (1990) original-theme narratives and their delayed-theme counterparts, which were constructed without regard to coherence. A discrepancy in performance was expected between these two conditions, as the delayed-theme narratives lacked coherence. While there was no significant difference in performance between the two filler conditions, there was a trend for poorer comprehension of the delayed-theme narratives. As there were a smaller number of filler stimuli compared to experimental stimuli (6 pairs vs. 12 pairs, respectively), it is possible that a larger number of filler stimuli would have yielded statistically significant results.

Performance on delayed-theme experimental narratives was also compared to performance on delayed-theme filler narratives by comparing the proportion correct in these two conditions. RHD participants performed significantly better on experimental delayed-theme narratives than filler delayed-theme narratives, further supporting the hypothesis that enhancing narrative coherence enhances comprehension.

## **4.2 ROLE OF THEME ORGANIZATION AND WORKING MEMORY**

Although the results support the hypothesis that difficulties comprehending delayed-theme narratives are eliminated by enhancing coherence, ancillary tests revealed that in certain cases, the delayed theme is a factor in narrative comprehension. There was a negative relationship



between estimated working memory for language and comprehension of delayed-theme narratives, indicating that the more errors made on the working memory task (lower estimated working memory), the poorer the performance on comprehension of delayed-theme narratives. This correlation remained significant for delayed-theme narratives when differences in coherence were accounted for, indicating that theme condition-- not differences in coherence-- was responsible for this relationship. Thus, the delayed theme is a factor for RHDs who have especially low working memory capacity. For these individuals, the delayed-theme narrative organization presumably overtaxes their working memory and consequently impairs comprehension.

These results are consistent with Just and Carpenter's (1992) capacity-constrained comprehension theory. According to this theory, working memory only plays a role in comprehension when processing demands approach or exceed the limits of an individual's capacity. Working memory capacity is defined as the total amount of activation that can be allocated to support information processing and storage concurrently. When a task is more demanding, more activation is consumed, and fewer cognitive resources remain for carrying out further processing or storage. Thus, for less demanding tasks that do not require a lot of activation, working memory capacity is not exceeded and language comprehension would not be affected. However, when working memory capacity is overtaxed by a demanding task, performance on language comprehension tasks may decline. This was true for the results of the current experiment. The delayed-theme condition placed extra processing demands on study participants, and for participants who have low working memory capacity, these demands exceeded their limits and comprehension was decreased. However, this relationship between

working memory and discourse comprehension did not exist for original-theme narratives, as they were less demanding and did not require excessive cognitive processing.

Similar results were found with RHD participants in a study examining working memory and inference revisions (Tompkins et al., 1994). In this study, RHD participants were presented with two discourse comprehension tasks. The first task involved two versions of stories that required inferences about characters' attitudes. In the first version, the mood was congruent throughout, i.e., a pleasant situation with a pleasant comment about that situation. In the second version, there was an inconsistency in mood between the first two sentences, which set the situation, and the second two sentences, which commented on the situation. Participants answered questions regarding facts and inferences following each story. In the second task, stimuli were two sentences where the first sentence led to one inference but the second sentence required a revision of this inference. After hearing each sentence pair, participants answered two factual questions and two inferential questions. Results revealed that there was a significant correlation between working memory and discourse comprehension only for the task that was considered to be the most demanding on discourse processing, the one with the incongruent attitudinal stimuli. This relationship was not significant for the less cognitively demanding tasks.

### **4.3 COMPARISON TO HOUGH'S (1990) STUDY**

Comparison of performance of the adults with RHD in the current study to performance in Hough's (1990) study, indicates that the RHD group in the current study performed higher overall. The filler condition in the current study was expected to replicate the experimental condition in Hough's study. However, the RHD group in the current study scored a mean of

86.67 per cent correct on the delayed filler condition, while Hough's RHD group scored a mean of 52.19 per cent correct on the delayed-theme condition. There are several possible explanations for the discrepant findings between the two studies.

One possible reason for the discrepancy in results between the two studies is differences in performance measures. The current study measured narrative comprehension with yes/no questions, while the Hough study measured comprehension with a combination of multiple choice questions (four choices) and verbal report of main ideas. With the yes/no questions there is a higher probability of being correct by chance, but only one RHD participant had any scores near chance (67% on delayed-theme filler narratives), so this is not a major problem. Additionally, having multiple choice answers to a question increases the complexity of the task, as it introduces additional foils. The multiple choice answers Hough presented included an unrelated plausible incorrect response, a related but incorrect response, an unrelated nonsensical response, and the correct response. The task of reading four statements and choosing the correct answer is likely more mentally taxing than answering yes or no to one statement. Along the same lines, the accuracy results for Hough's participants are collapsed over the multiple choice and verbal response conditions. The RHD participants in Hough's study were found to have confabulatory and embellished errors in the verbal response condition, which lowered their overall accuracy score.

Another possible reason for the discrepancy in results is that the participants in the current study have milder deficits than the participants in Hough's study. Unfortunately, there is little information on Hough's participants to allow direct comparisons with the participants in the current study. Both RHD groups were considered chronic, although Hough's participants ranged from 5-49 months post-onset with a mean of 20.40 months, while the participants in this study

ranged from 25-195 months post-onset, with a mean of 90.30 months. Additionally, Hough divided the RHD group into those with anterior lesions and those with posterior lesions, and found that while both groups had difficulty with narrative comprehension, the anterior group had more difficulty producing central themes, produced significantly more errors in the verbal response condition, and had a significantly lower percentage of correct verbal responses. Given the significantly discrepant performance of anterior RHD participants in Hough's study, the fact that there were no purely "anterior" participants in the current study may explain some of the differences in performance in the two studies.

#### **4.4 AUDITORY DOUBLE SIMULTANEOUS STIMULATION**

Included in this study was an auditory double simultaneous stimulation (DSS) task to assess for auditory extinction and/or neglect. Extinction is the phenomenon in which patients fail to report a stimulus in the contralesional field when stimulation is presented in both fields simultaneously. However, these patients are able to report a stimulus in the contralesional field when that is the only stimulus present. This is in contrast to neglect, in which patients fail to respond to a stimulus in the contralesional field whether or not there is simultaneous presentation of another stimulus (Heilman, Valenstein, & Watson, 2000). The auditory DSS task in the current study was adapted from the work of Shisler (2005) and Shisler et al. (2004).

The results of the DSS task for the current study are difficult to interpret. Accuracy in the binaural condition distinguished the NBD from the RHD group, indicating that the RHD group was not as accurate in reporting binaural stimuli. However, given that the RHD participants have right hemisphere lesions, it would be expected that binaural stimuli would yield extinction

of the left auditory stimulus. This was not the case, as there was overall a greater amount of right extinction. Additionally, there was a significant correlation between right extinction and performance on the BIT, a measure of visual attention and neglect. This is an interesting finding, because while the auditory extinction was not in the expected hemifield, there was a relationship between performance on measures of auditory and visual attention.

One possible explanation for the unusual results is that perhaps the participants who exhibited “extinction” of the right stimuli actually had better hearing sensitivity in the left ear, and thus detected the signal that was more audible. With only screening audiometric data, it is not known if the stimuli were heard equally well in both ears. However, there are a few reasons why this is not a likely explanation for the findings. First, the RHD group performed significantly worse on binaural accuracy compared to the NBD group. If unequal hearing was responsible for the DSS results, one would expect that at least one member of the NBD group would also have unequal hearing in both ears, and favor the more salient stimuli. This was not the case, as out of the five NBD participants, two participants had only one error each on the binaural condition. This is in stark contrast to the RHD group, where seven out of ten participants had three or more errors, including three participants who had zero accuracy. More careful examination of the data revealed that both NBD participants were inaccurate only on the first binaural stimulus. Thus, it is possible that once they heard the contrast between a binaural stimulus and the following stimulus, they were able to complete the rest of the task error-free.

Additionally, because all participants had their hearing screened, a broad judgment could be made with regard to a “better” ear, as it was acceptable to fail the screening in one ear and remain in the study by repeating a series of words. Examination of the screening data reveals that there is no direct link between failing a screening in one ear and reporting binaural stimuli in

only that same ear. For example, there was a participant who failed the screening in her left ear but demonstrated right extinction for all 8 binaural stimuli, thus reporting left to all. There were also other participants who at least some of the time demonstrated “extinction” in the ear that passed the screening; if the DSS results were purely due to unequal hearing, this would not be the case.

#### **4.5 SUGGESTIONS FOR FUTURE INVESTIGATION**

There are several ways in which the current study can be improved in future research. The hypothesis of this study was that controlling for coherence differences between original-theme and delayed-theme narratives would result in no significant differences in comprehension between the two theme conditions. Although this hypothesis was confirmed, it is a null hypothesis and required further validation to substantiate it. To provide support for the findings, filler narratives were included to compare comprehension of original-theme narratives to delayed-theme narratives that were constructed without regard to coherence. Significantly poorer comprehension on the delayed-theme fillers compared to original-theme fillers would have validated the results. However, while this was the trend, the results were not significant. Thus, additional filler stimuli are needed to determine if the trend for poorer comprehension of delayed-theme filler narratives compared to original-theme narratives reaches significance.

The DSS task could be improved in several ways. First, a practice round with feedback before the experimental task should be included. This way, participants would be aware of what each condition sounded like before they started the task. Practice sets with feedback were administered prior to all other experimental and ancillary tasks but were overlooked for the DSS

task. Next, a greater amount of trials would provide more data to further investigate the unexpected extinction of right stimuli in the binaural condition. Lastly, it would be informative to obtain pure tone auditory thresholds of each ear for all participants. This audiometric data could be used either to adjust presentation levels of the stimuli to ensure equal salience in each ear, or for data analysis to examine the relationship between pure tone thresholds and DSS performance.

Additionally, it would be interesting to include additional RHD participants, such as those with anterior lesions, more severe deficits, and fewer months post-onset. The inclusion of participants with anterior RHD would allow a determination of whether there are any differences in performance between anterior and posterior lesions as reported by Hough (1990). For significant results, it would probably be necessary to increase the sample size of participants with posterior RHD as well. The addition of RHD participants who are more severe and fewer months post-onset may help to account for differences in performance between similar tasks in the current study and Hough's study. Although both studies included only chronic patients, there was a large difference in months post-onset, with Hough's participants on average being more recent. While it is not expected that chronic patients would vary based on months post-onset, it would be interesting to compare a group of patients who are "newly chronic" (between four and six months post-onset) to a group that is over 12 months post-onset, to see if this had any effect on the poorer performance in Hough's study.

## 4.6 SUMMARY AND CONCLUSIONS

In this study, adults with right hemisphere brain damage did not demonstrate impairments on comprehension of narratives with a delayed theme, compared to narratives with normal theme organization. This is in contrast to a study by Hough (1990), who found that delaying the theme of a narrative resulted in poorer comprehension. The narratives in the current study were manipulated to delay the theme while maintaining story coherence, while delayed-theme narratives in Hough's study were created without regard to story coherence. Thus, it is believed that the poor performance in Hough's study was not due to delayed-theme organization but rather poor story coherence. To further support this claim, performance on the coherence-enhanced delayed-theme experimental narratives was significantly better than on the delayed-theme filler narratives that did not maintain coherence. However, for individuals with RHD who had an especially low capacity for verbal working memory, the delayed-theme condition did impair narrative comprehension, presumably due to excessive cognitive demands. Further research is warranted to validate the results of this study and to investigate differences in performance between similar tasks in the two studies.



**APPENDIX A**

**PILOT STUDY PARTICIPANT RATING FORM**

**On a scale from 1-5, where 1 is “not at all” and 5 is “extremely well” please RATE HOW WELL THE SENTENCES FIT TOGETHER TO FORM A STORY.**

	<b>Not At All</b>				<b>Extremely Well</b>
Example 1:	1	2	3	4	5
Example 2:	1	2	3	4	5
Example 3:	1	2	3	4	5

	<b>Not At All</b>				<b>Extremely Well</b>
Passage 1:	1	2	3	4	5
Passage 2:	1	2	3	4	5
Passage 3:	1	2	3	4	5
Passage 4:	1	2	3	4	5
Passage 5:	1	2	3	4	5
Passage 6:	1	2	3	4	5

RATE HOW WELL THE SENTENCES FIT TOGETHER TO FORM A STORY

	<b>Not At All</b>			<b>Extremely Well</b>	
Passage 7:	1	2	3	4	5
Passage 8:	1	2	3	4	5
Passage 9:	1	2	3	4	5
Passage 10:	1	2	3	4	5
Passage 11:	1	2	3	4	5
Passage 12:	1	2	3	4	5
Passage 13:	1	2	3	4	5
Passage 14:	1	2	3	4	5
Passage 15:	1	2	3	4	5
Passage 16:	1	2	3	4	5
Passage 17:	1	2	3	4	5
Passage 18:	1	2	3	4	5
Passage 19:	1	2	3	4	5
Passage 20:	1	2	3	4	5
Passage 21:	1	2	3	4	5
Passage 22:	1	2	3	4	5
Passage 23:	1	2	3	4	5
Passage 24:	1	2	3	4	5
Passage 25:	1	2	3	4	5
Passage 26:	1	2	3	4	5
Passage 27:	1	2	3	4	5

RATE HOW WELL THE SENTENCES FIT TOGETHER TO FORM A STORY

	<b>Not At All</b>				<b>Extremely Well</b>
Passage 28:	1	2	3	4	5
Passage 29:	1	2	3	4	5
Passage 30:	1	2	3	4	5
Passage 31:	1	2	3	4	5
Passage 32:	1	2	3	4	5
Passage 33:	1	2	3	4	5
Passage 34:	1	2	3	4	5
Passage 35:	1	2	3	4	5
Passage 36:	1	2	3	4	5
Passage 37:	1	2	3	4	5
Passage 38:	1	2	3	4	5
Passage 39:	1	2	3	4	5
Passage 40:	1	2	3	4	5

## **APPENDIX B**

### **ORIGINAL NARRATIVES FROM HOUGH'S (1990) STUDY (ORIGINAL-THEME EXPERIMENTAL NARRATIVES)**

Note: A few minor changes as noted in the Methods section have been made to the original narratives.

Narrative 1:

Mary found a stray dog on the street.

At first the dog was afraid of her.

He would run away every time Mary would walk toward him.

The dog gradually became more friendly.

He slowly began to stay in the same room with Mary and let her touch him for a second.

Mary was soon able to pet and scratch the dog.

The dog began climbing on her lap and falling asleep.

Mary decided that she would ask her mother if she could keep the dog.

Narrative 2:

Jim woke up on Thursday morning with a headache and an upset stomach.

He also had a fever .

He called his office and told the secretary that he would not be coming to work.

Then Jim called his doctor who told him to come to his office.

The doctor diagnosed Jim as having the flu.

The doctor recommended that Jim stay in bed for a few days and take aspirin every four hours.

He also suggested that Jim drink plenty of liquids.

Jim left the doctor's office, went home, and climbed in bed.

Narrative 3:

Dave decided to join a softball team this year.

The first game of the season was at the end of April.

Dave had to practice batting and fielding to get in shape for the season.

His team lost the first game but Dave had two singles.  
Dave was asked to pitch the next game.  
Dave's team lost again and he was asked to play outfield for the following game.  
A fly ball was hit to Dave and it hit his wrist.  
Dave's wrist was broken and he could not play for the rest of the season.

Narrative 4:

John walked down the road to the high school.  
It was his first day attending this school.  
His family has just moved to this neighborhood over the weekend.  
John felt lonely walking through the school halls with no one to talk with.  
John went to his first class, chemistry, and sat in the back of the room.  
After class, a girl walked over to him and introduced herself.  
Her name was Denise and she offered to show him around the school.  
John decided that this place was not going to be so bad after all.

Narrative 5:

Scott decided to give his dog Rosie a bath.  
Rosie was a sheepdog that weighed 100 pounds.  
Her coat was matted and she had to be brushed out before the bath.  
Scott filled the tub with water and dragged Rosie into the bathroom.  
He placed Rosie in the tub and shampooed her coat.  
Rosie started shaking and Scott and the bathroom became wet and messy.  
Rosie jumped out of the bathtub and started rolling on the carpet outside the bathroom.  
Scott remembered why he disliked giving Rosie a bath.

Narrative 6:

Dr. Harris woke up very early on Friday morning.  
He had a very hectic day ahead of him.  
He ate breakfast and went to his office.  
Dr. Harris treated patients who had minor medical problems during the morning.  
He ate lunch with a friend who is a dentist and has an office next door.  
Dr. Harris performed surgery on a woman with a broken leg in the afternoon.  
He also went to the hospital to check on one of his patients who had pneumonia.  
Dr. Harris came home from work and was glad it was the weekend.

Narrative 7:

Alice was away on a business trip in Detroit for two weeks.  
She had accomplished a lot of work but was eager to get home.  
She arrived at the airport on time and boarded the plane for Miami.  
Alice was tired and decided to take a nap.  
When she awoke the plane had already landed.  
She quickly gathered her things and left the plane.  
Alice was unhappy when she did not see her husband waiting for her.  
Suddenly, he snuck up on her and kissed her on the cheek.

Narrative 8:

Pam was sitting in a restaurant with her family.  
They had taken her out for a special dinner to celebrate her birthday.  
After everyone had finished eating, they gave Pam some presents.  
She received a new tennis racquet and two sweaters.  
Pam was very happy and thanked everyone for the gifts.  
She did not notice a man walking towards her with a cake.  
Suddenly, Pam heard a man singing "Happy Birthday."  
She turned around and smiled when she saw her boyfriend singing and holding the cake.

Narrative 9:

Susan was sitting at her desk in her office.  
She was unhappy because she had not received any gifts on  
Valentine's day.  
She thought that her fiancé would send her something but it was getting close to five  
o'clock.  
Just before five, there was a knock on her door.  
Her secretary walked in with two huge baskets of roses.  
She was followed by a handsome man who was also carrying flowers.  
Susan jumped up and ran over to kiss Paul, her fiancé.  
Susan was sorry that she ever doubted him on Valentine's day.

Narrative 10:

Mr. Smith wanted to take a trip to France.  
He planned to take this trip during the month of April.  
This vacation would last two weeks.  
He went to a travel agency to make the necessary arrangements.  
The travel agent made hotel reservations and scheduled a round trip flight to Paris.  
The agent also reserved a car for Mr. Smith so he could visit other parts of the country.  
Mr. Smith wanted to see the Eiffel Tower and visit the Left Bank in Paris.  
He also wanted to visit the cities of Cherbourg, Marseilles, and Nice.

Narrative 11:

Ann planned a surprise party for her husband, Tom.  
Tom's birthday was on a Wednesday.  
She invited twelve of their friends to come for dinner at 6:30 that night.  
Tom had plans to work late that night and forgot to call Ann.  
The dinner guests arrived and were ready to eat but Ann didn't know what happened to  
Tom.  
Tom finally arrived at his party at 8:00.  
Ann was angry because some of his dinner was cold and the rest of it was overcooked.  
Tom was still surprised and the guests had a great time.

Narrative 12:

Joe and Dave were good golfers.  
They golfed every Wednesday.

Both of them usually shot in the high 80's on 18 holes.  
Last Wednesday, they both had their best game ever.  
Dave was hitting long, straight shots on the fairways.  
Joe was always hitting the ball in the hole from anywhere on the green.  
On the 18th hole, Dave had his best shot.  
He hit the ball 375 feet for a hole-in-one.

## APPENDIX C

### DELAYED-THEME NARRATIVES MANIPULATED TO ENHANCED COHERENCE

#### (DELAYED-THEME EXPERIMENTAL NARRATIVES)

##### Narrative 1:

Mary saw a dog one morning.

At first the dog was afraid of her.

He would run away every time Mary would walk toward him.

The dog gradually became more friendly.

He slowly began to stay in the same room with Mary and let her touch him for a second.

Mary was soon able to pet and scratch the dog.

The dog began climbing on her lap and falling asleep.

Mary decided that she would ask her mother if she could keep the dog.

She had found the stray dog on the street.

##### Narrative 2:

Jim woke up on Thursday morning and called his office.

He told the secretary that he would not be coming to work.

Then he called his doctor who told him to come to his office.

The doctor diagnosed Jim as having the flu.

The doctor recommended that Jim stay in bed for a few days and take aspirin every four hours.

He also suggested that Jim drink plenty of liquids.

Jim left the doctor's office, went home, and climbed in bed.

That way, he could get rid of his headache, upset stomach and fever.

##### Narrative 3:

Dave's first game of the season was at the end of April.

He had to practice batting and fielding to get in shape for the season.

His team lost the first game but Dave had two singles.

Dave was asked to pitch the next game.

Dave's team lost again and he was asked to play outfield for the following game.



A fly ball was hit to Dave and it hit his wrist.  
Dave's wrist was broken and he could not play for the rest of the season.  
Even so, Dave had enjoyed joining his softball team this year.

Narrative 4:

John walked down the road to the high school.  
His family had just moved into the neighborhood over the weekend.  
John felt lonely walking through the school halls with no one to talk with.  
He went to his first class, chemistry, and sat in the back of the room.  
After class, a girl walked over to him and introduced herself.  
Her name was Denise and she offered to show him around the school.  
John decided that this place was not going to be so bad after all, [pause]  
even though it was only his first day attending.

Narrative 5:

Scott decided to give his dog Rosie a bath.  
Her coat was matted and she had to be brushed out before a bath.  
Scott filled the tub with water and dragged Rosie into the bathroom.  
He placed Rosie in the tub and shampooed her coat.  
Rosie started shaking and Scott and the bathroom became wet and messy.  
Rosie jumped out of the bathtub and started rolling on the carpet outside the bathroom.  
Scott remembered why he disliked giving Rosie a bath.  
After all, Rosie was a 100 pound sheepdog.

Narrative 6:

Dr. Harris woke up very early on Friday morning,  
He ate breakfast and went to his office.  
Dr. Harris treated patients who had minor medical problems during the morning.  
He ate lunch with a friend who is a dentist and has an office next door.  
Dr. Harris performed surgery on a woman with a broken leg in the afternoon.  
He also went to the hospital to check on one of his patients who had pneumonia.  
Dr. Harris came home from work and was glad it was the weekend.  
His very hectic day was finally over.

Narrative 7:

Alice had accomplished a lot of work while she was out of town.  
She arrived at the airport on time and boarded the plane for Miami.  
Alice was tired and decided to take a nap.  
When she awoke the plane had already landed.  
She quickly gathered her things and left the plane.  
Alice was unhappy when she did not see her husband waiting for her.  
Suddenly, he snuck up on her and kissed her on the cheek.  
Alice had been away on business in Detroit for two weeks.

Narrative 8:

Pam was sitting in a restaurant with her family.

After everyone had finished eating they gave Pam some presents.  
She received a new tennis racquet and two sweaters.  
Pam was very happy and thanked everyone for the gifts.  
She did not notice a man walking towards her with a cake.  
Suddenly, she heard the man singing “Happy Birthday.”  
Pam turned around and smiled when she saw her boyfriend singing and holding the cake.  
She had enjoyed this special dinner for her birthday celebration.

Narrative 9:

Susan was sitting at her desk in her office.  
She thought that her fiancé would send her something but it was getting close to five o'clock.  
Just before five, there was a knock on her door.  
Her secretary walked in with two huge baskets of roses.  
She was followed by a handsome man who was also carrying flowers.  
Susan jumped up and ran over to kiss Paul, her fiancé.  
Susan was sorry that she ever doubted him on Valentine's day.  
She had been unhappy earlier because she had not received any Valentine's gifts.

Narrative 10:

Mr. Smith planned to take a trip during the month of April.  
This vacation would last two weeks.  
He went to a travel agency to make the necessary arrangements.  
The travel agent made hotel reservations and scheduled a round trip flight to Paris.  
The agent also reserved a car for Mr. Smith so he could visit other parts of the country.  
Mr. Smith wanted to see the Eiffel Tower and visit the Left Bank in Paris.  
He also wanted to visit the cities of Cherbourg, Marseilles, and Nice.  
Mr. Smith looked forward to taking this trip to France.

Narrative 11:

Tom's birthday was on a Wednesday.  
His wife Ann invited twelve of their friends to come for dinner at 6:30 that night.  
Tom had plans to work late that night and forgot to call Ann.  
The dinner guests arrived and were ready to eat but Ann didn't know what happened to Tom.  
Tom finally arrived at 8:00.  
Ann was angry because some of his dinner was cold and the rest of it was overcooked.  
Tom was still surprised and the guests had a great time.  
In the end, Ann was glad she planned the surprise party for her husband.

Narrative 12:

Joe and Dave were good golfers.  
Both of them usually shot in the high 80's on 18 holes.  
Last Wednesday, they both had their best game ever.  
Dave was hitting long, straight shots on the fairways.  
Joe was always hitting the ball in the hole from anywhere on the green.

On the 18th hole, Dave had his best shot.  
He hit the ball 375 feet for a hole-in-one.  
Dave and Joe golfed every Wednesday.

## APPENDIX D

### ORIGINAL AND DELAYED-THEME FILLER NARRATIVES

#### Filler 1 Original

Pete was out in the front yard with his little brother, Glen.  
Their parents went shopping and Pete had to watch Glen until they returned.  
Glen always seemed to be getting into some kind of trouble.  
One of Pete's friends came by on his bicycle and stopped to talk to Pete.  
Glen headed for the street but Pete caught him in time.  
Then Glen started running up the concrete stairs to their house.  
Before Pete could get to him, Glen fell and scraped his knee.  
Glen was screaming as Pete's parents pulled in the driveway.

#### Filler 1 Delayed

Glen always seemed to be getting into some kind of trouble.  
One of Pete's friends came by on his bicycle and stopped to talk to Pete.  
Glen headed for the street but Pete caught him in time.  
Then Glen started running up the concrete stairs to their house.  
Before Pete could get to him, Glen fell and scraped his knee.  
Glen was screaming as Pete's parents pulled in the driveway.  
Pete had been watching his little brother in the front yard while his parents went shopping.

#### Filler 2 Original

Phil wanted to visit his parents for Easter vacation.  
Before leaving, he had to take care of some chores.  
His major task was working on his car.  
Phil was having some problems with the brakes.  
He thought that the car would not make it to his parents house which was five hours  
away.  
Phil also had some school work that had to be completed.  
He wanted to leave on Thursday but had additional problems with the car.  
Phil finally left on Friday and would at least be at his parents' house for Easter Sunday.

#### Filler 2 Delayed

Before leaving, he had to take care of some chores.

His major task was working on his car.

Phil was having some problems with the brakes.

He thought that the car would not make it to his parents house which was five hours away.

Phil also had some school work that had to be completed.

He wanted to leave on Thursday but had additional problems with the car.

Phil finally left on Friday and would at least be at his parents' house for Easter Sunday

Phil wanted to visit his parents for Easter vacation.

#### Filler 3 Original

Brian was invited to Robin's birthday party.

Robin was going to be 14 years old.

Brian went to a local department store and selected a gift for Robin.

He did not know what to buy but finally decided on a pair of earrings.

Brian brought the gift home and asked his mother to wrap it.

Brian went to the party that evening.

He met Robin's older sister, Nancy and had a great time.

Brian asked Nancy to go out with him for the following weekend.

#### Filler 3 Delayed

Robin was going to be 14 years old.

Brian went to a local department store and selected a gift for Robin.

He did not know what to buy but finally decided on a pair of earrings.

Brian brought the gift home and asked his mother to wrap it.

Brian went to the party that evening.

He met Robin's older sister, Nancy and had a great time.

Brian asked Nancy to go out with him for the following weekend.

Brian was invited to Robin's birthday party.

#### Filler 4 Original

Barbara decided to take her dog, Bugs for a walk.

Bugs had been scratching at the door and barking loudly.

Barbara walked the dog to the nearby park.

Bugs appeared to be happy and began running, dragging Barbara behind her.

Barbara was tired and sat down on a bench.

Bugs was whimpering and pulling on the leash.

Barbara decided to let Bugs run more and took off her leash.

She realized that this was a bad idea when Bugs chased a cat up a tree.

#### Filler 4 Delayed

Bugs had been scratching at the door and barking loudly.

Barbara walked the dog to the nearby park.

Bugs appeared to be happy and began running, dragging Barbara behind her.

Barbara was tired and sat down on a bench.

Bugs was whimpering and pulling on the leash.  
Barbara decided to let Bugs run more and took off her leash.  
She realized that this was a bad idea when Bugs chased a cat up a tree.  
Barbara decided to take her dog, Bugs for a walk.

#### Filler 5 Original

Sarah and her friends wanted to raise some money.  
They decided to have a car wash.  
They collected buckets, soap, cloths, and water hoses.  
Sarah and her friends set everything up and waited for their customers.  
A blue car pulled up and Sarah began to wash it.  
When she was finished she sat down and waited for the next car.  
Sarah's friends turned on all the hoses and started a water fight.  
Then they all sprayed Sarah until she was soaken wet.

#### Filler 5 Delayed

They decided to have a car wash.  
They collected buckets, soap, cloths, and water hoses.  
Sarah and her friends set everything up and waited for their customers.  
A blue car pulled up and Sarah began to wash it.  
When she was finished she sat down and waited for the next car.  
Sarah's friends turned on all the hoses and started a water fight.  
Then they all sprayed Sarah until she was soaken wet.  
Sarah and her friends wanted to raise some money.

#### Filler 6 Original

The Browns drove five hours to their cottage in the upper peninsula in Michigan.  
They spent three weeks there every year during the month of August.  
The four children enjoyed swimming, boating, and water skiing during this time.  
The Browns visited with old friends who also had cottages there.  
This year they had bought a new powerboat which they were looking forward to using.  
The Browns were also going to do some camping in the Porcupine Mountains.  
They brought along some sleeping bags and a tent.  
The Browns had to be back home in Toledo by September 1 because that is when school started.

#### Filler 6 Delayed

The four children enjoyed swimming, boating, and water skiing during this time.  
The Browns visited with old friends who also had cottages there.  
This year they had bought a new powerboat which they were looking forward to using.  
The Browns were also going to do some camping in the Porcupine Mountains.  
They brought along some sleeping bags and a tent.  
The Browns had to be back home in Toledo by September 1 because that is when school started.  
The Browns spend three weeks at their cottage in the upper peninsula in Michigan every year during the month of August.

## APPENDIX E

### COMPREHENSION QUESTIONS

#### E.1.1 Experimental Narratives

##### Narrative 1

Main Idea (MI): Did Mary find a stray dog? YES

Inferred Main Idea (IMI): Did Mary like the dog? YES

Detail (D): Did Mary teach the dog tricks? NO

##### Narrative 2

MI: Did Jim go to the dentist? NO

IMI: Did Jim wake up feeling healthy? NO

D: Did Jim call his office? YES

##### Narrative 3

MI: Did Dave join a basketball team? NO

IMI: Was Dave interested in softball? YES

D: Did Dave break his ankle? NO

##### Narrative 4

MI: Was John attending a new high school? YES

IMI: Did John have a lot of friends at school? NO

D: Did John go to Chemistry class? YES

##### Narrative 5

MI: Did Scott like giving his dog a bath? NO

IMI: Did Scott have a difficult time bathing his dog? YES

D: Did the kitchen become wet and messy? NO

##### Narrative 6

MI: Did Dr. Harris wake up with a hectic day ahead? YES

IMI: Did Dr. Harris have a full schedule? YES  
D: Did Dr. Harris check on a patient who had a heart attack? NO

#### Narrative 7

MI: Was Alice in Detroit for vacation? NO  
IMI: Was Alice unemployed? NO  
D: Did Alice take a nap on the plane? YES

#### Narrative 8

MI: Was Pam celebrating her birthday? YES  
IMI: Did Pam celebrate at home? NO  
D: Did Pam receive a new watch? NO

#### Narrative 9

MI: Was Susan sorry she ever doubted her fiancé? YES  
IMI: Did Susan expect her fiancé to send a gift to her office? YES  
D: Did Susan's fiancé bring candy? NO

#### Narrative 10

MI: Did Mr. Smith plan to make a call to France? NO  
IMI: Did Mr. Smith like to travel? YES  
D: Did Mr. Smith want to see the Eiffel Tower? YES

#### Narrative 11

MI: Did Ann plan a surprise party for Tom? YES  
IMI: Was Tom home when Ann expected him? NO  
D: Was Tom's birthday on a Sunday? NO

#### Narrative 12

MI: Did Joe and Dave go bowling together? NO  
IMI: Do Joe and Dave see each other once a month? NO  
D: Did Dave hit a hole-in-one? YES

### **E.1.2 Filler Narratives**

#### Filler 1

MI: Did Glen burn his knee? NO  
IMI: Did Glen get injured? YES  
D: Did Pete's uncle stop by? NO

#### Filler 2

MI: Did Phil want to visit his cousins for Easter vacation? NO



IMI: Did Phil live with his parents? NO  
D: Did Phil have problems with his car brakes? YES

Filler 3

MI: Did Brian go to Robin's party? YES  
IMI: Did Robin celebrate her birthday? YES  
D: Was Robin turning 16 years old? NO

Filler 4

MI: Did Barbara take the dog for a walk? YES  
IMI: Did Barbara dislike animals? NO  
D: Did Barbara sit on a bench in the park? YES

Filler 5

MI: Did Sarah and her friend want to raise money? YES  
IMI: Did people have to pay money to have their cars washed? YES  
D: Did Sarah start a water fight? NO

Filler 6

MI: Did the Browns live in Michigan year-round? NO  
IMI: Did the Browns like to visit new places every August? NO  
D: Did the Browns buy a new powerboat? YES

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