

# Contextual influences on comprehension of multiple-meaning words by right hemisphere brain-damaged and non-brain-damaged adults

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## Abstract

This investigation examined the influence of context on the interpretation of denotative and connotative meanings of homographs in right hemisphere brain-damaged (RHBD) and non-brain-damaged (NBD) adults. Subjects were required to choose the meaning of homographs in linguistically unbiased ambiguous sentences and in denotatively and connotatively semantically biased narrative contexts. The NBD group was significantly more accurate than the RHBD on the sentence and connotative narrative contexts. However, there was not significant difference between groups for the denotative narrative context. There were no significant differences between task contexts for the NBD group. The RHBD group was significantly more accurate on the denotative narrative than the sentence context but displayed no significant difference in performance on the connotative narrative versus sentence contexts. The findings suggest that right hemisphere brain damage may result in a reduced ability to process connotative components of word meaning, that does not appear to be aided by the presence of additional semantically supportive linguistic information.

## Introduction

A word that elicits more than one distinct meaning is referred to as a homograph (Burgess and Simpson 1988, Jastrzembski 1981, Pierce 1984, Rubenstein *et al.* 1971, Simpson 1981). Homographic word meanings have been distinguished in terms of: (1) denotative or cognitive meaning and (2) connotative or emotional meaning. Denotative meaning refers to a word's literal meaning, whereas connotative meaning addresses the various associations of a word (Brownell 1988, Brownell *et al.* 1984). Connotative associations appear to be related to an individual's experience with a particular word, as well as that person's ability to comprehend and utilize metaphoric relationships between concepts that are associated with a word (Brownell 1988, Burgess and Simpson 1988). Thus, sensitivity to non-literal aspects of a word's meaning may depend upon adequate processing of contextual

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and situational information (Joanette and Goulet 1994, Joanette *et al.* 1990, Myers 1991, 1994, Tompkins 1995). Most non-brain-damaged (NBD) individuals adequately encode both the denotative and connotative meanings of a word, ensuring reliable communication among speakers of a particular language (Brownell 1988, Burgess and Simpson 1988).

Research with adults who have suffered right hemisphere brain damage (RHBD) has revealed that some of these individuals exhibit difficulty with tasks involving judgement or association of connotative word meanings (Brownell 1988, Brownell *et al.* 1984). Frequently these patients have demonstrated a bias towards the literal interpretation of information, and specifically the literal meaning of words (Brownell 1988, Brownell *et al.* 1984, 1990, Gardner and Denes 1973, Joanette *et al.* 1990). These observations have led some researchers to conclude that RHBD individuals have a deficit in appreciating connotative or alternative word meanings. Another hypothesis is that the connotative meaning deficit may be part of a general affective impairment often associated with right hemisphere brain damage (Brownell 1988, Joanette *et al.* 1990), as it has been indicated that apprehending emotional components associated with word meanings is mediated primarily by the right hemisphere (Joanette *et al.* 1990, Tompkins 1995). It also has been suggested that RHBD adults experience generalized problems with interpreting information whenever they are confronted with linguistic ambiguity (Brownell 1988). Brownell (1988) and Brownell *et al.* (1990) refer to this more general impairment as the 'inflexibility deficit hypothesis', purporting that RHBD adults have difficulty appreciating and/or producing alternative readings for linguistic material regardless of the context.

Recent work by Tompkins and colleagues (Bloise and Tompkins 1993, Tompkins 1990, 1991a,b, Tompkins *et al.*, 1992) has been aimed at evaluating the generality of the above-mentioned results, as well as the validity of the interpretations of much of this research. These authors have utilized paradigms that explore relatively automatic activation of multiple meanings, such as priming and word monitoring. Results from their work with on-line tasks has revealed that RHBD patients perform similarly to non-brain-damaged adults when presented with ambiguous words in isolation (Tompkins 1990) and ambiguous phrases in context (Bloise and Tompkins 1993, Tompkins 1991a,b, Tompkins *et al.* 1992). These findings indicate that RHBD patients activate non-literal interpretations, including connotative meanings, and suggest that their processing problems emerge at some level subsequent to meaning activation (cf. Tompkins 1995, Tompkins *et al.* 1994).

RHBD adults have also been found to have difficulty utilizing contextual cues strategically when processing information (Beeman 1993, Foldi 1987, Joanette *et al.* 1990, Myers 1991, 1994, Wapner *et al.* 1981). This deficit has been observed in comprehending ambiguous sentences in context (Brownell *et al.* 1986), judging actions associated with indirect requests in context (Foldi 1987, Hirst *et al.* 1984, Weylman *et al.* 1989), drawing inferences (Beeman 1993, McDonald and Wales 1986), and interpreting conversational remarks (Kaplan *et al.* 1990). For some RHBD individuals, contextual and/or situational information does not aid their ability to make metalinguistic judgements about non-literal language (Joanette *et al.* 1990, Myers 1991, 1994). Thus, difficulties in processing contextual information may also contribute to RHBD adults' deficits in connotative meaning tasks. Sensitivity to alternative word meaning is highly dependent upon adequate

synthesis and integration of context. Individuals incorporate the current situation/context with the basic knowledge they have about a particular homograph. In the case of connotative word meaning, this process may require that individuals modify their initial interpretation of the word. Molloy *et al.* (1990) have suggested that RHBD adults may have difficulty with this process because they have difficulty revising their initial interpretations based on subsequent disambiguation of old and new contextual information. Beeman (1993) has specifically proposed that semantic processing deficits after right hemisphere brain damage adversely affect the ability to connect various facets of meaning.

Qualifying these observations, Tompkins and co-workers (Tompkins 1991b, Bloise and Tompkins 1993, Tompkins *et al.* 1992) found that RHBD adults' problems with utilizing context are apparent in conditions/tasks that require the most effortful or controlled processing. These patients were able to use context to infer and integrate information when resource demands for the task were limited. In a related perspective, Joannette and Goulet (1994) have suggested that RHBD adults' problems in utilizing contextual information vary with the complexity of the task. RHBD adults appear to be most impaired on tasks/processes considered to be the most difficult.

More recently, Tompkins (1995) has suggested that two mechanisms essential to the structure building framework of comprehension (Gernsbacher 1990), enhancement and suppression, may function inefficiently after right hemisphere brain damage. Deficiencies in these areas may lead to particular difficulties when comprehension requires integrating or inhibiting activation associated with various sources of information. Enhancement involves increasing activation of contextually appropriate information, whereas suppression requires decreased activation of information that becomes irrelevant to the context. Thus, inefficient functioning of one or both of these mechanisms could result in deficits in appreciating connotative word meaning.

Based on the research reviewed, it is evident that controversy exists relative to RHBD adults' decreased performance on tasks involving alternative word meanings, and their ability to utilize context to interpret ambiguous information. As implied, the paradigm used to investigate multiple word meanings may impact on the findings. However, it should also be noted that most of the RHBD studies addressing denotative and connotative meaning have focused on interpretation of information at the word or sentence level.<sup>1</sup> In the present investigation the influence of brief narrative contexts on denotative and connotative interpretations of multiple-meaning words was examined in RHBD and NBD adults.<sup>2</sup> We were specifically concerned with RHBD adults' ability to identify denotative and connotative meanings of homographs in simple but ambiguous sentence contexts, and in paragraph contexts semantically biased towards the denotative or connotative meaning of homographs. We were also interested in whether the RHBD adults showed changes in performance on either or both of the paragraph conditions relative to their performance on the sentence task.

<sup>1</sup> An exception to this statement is found in Myers and Linebaugh (1981), who examined right hemisphere brain-damaged adults' comprehension of idiomatic expressions in a two-sentence story context.

<sup>2</sup> It should be noted that, as we did not study the on-line comprehension of multiple word meanings, we cannot comment on the relatively automatic activation of such meanings.

## Method

### *Subjects*

Twenty adults participated in the study, consisting of 10 RHBD and 10 NBD adults comparable on age, education, and gender. All RHBD subjects had suffered a CVA exclusive to the right hemisphere. Lesion localization was established based on computerized tomography (CT) scans and/or magnetic resonance imaging (MRI) reports. All brain-damaged subjects were at least 2 months post-onset. All subjects: (1) were between the ages of 50 and 70; (2) had completed at least a sixth grade education; (3) were right-handed; (4) were native speakers of English; (5) had passed a bilateral pure-tone hearing screening; and (6) had passed a visual comprehension screening. The hearing screening involved appropriate responding to pure-tone stimuli presented bilaterally at 1000 Hz and 2000 Hz at 40 db HL. The visual comprehension screening consisted of accurately responding to the first four stimulus items of the Reading subtest from the Western Aphasia Battery (WAB) (Kertesz 1982). Specific subject characteristics are presented in Table 1.

Premorbid IQ was estimated for each subject utilizing the formula developed by Wilson *et al.* 1978, 1979). Three of the RHBD subjects presented with unilateral left-sided neglect (Subjects 3, 7, and 9). Neglect had been identified based on a routine test battery conducted and reported by a clinical neuropsychologist and, for one subject, a neurologist. Eight of the RHBD subjects were either previously or currently enrolled in speech-language therapy.

All subjects were administered the Test of Adolescent/Adult Word Finding (TAWF) (German 1990) to examine word-retrieval abilities. All RHBD subjects were administered the following tests: (1) Western Aphasia Battery (WAB) (Kertesz 1982) to rule out the presence of aphasia and obtain a broad measure of cognitive functioning; (2) Raven's Colored Progressive Matrices (RCPM) (as part of the WAB) to examine non-verbal abstraction and reasoning; and (3) the RIC Evaluation of Communication Problems in Right Hemisphere Dysfunction (RICE) (Burns *et al.* 1985) to examine the extent and nature of any communication deficits. Clinical test data are presented in Table 2.

### *Materials*

The experimental task homographs were 17 multiple-meaning adjectives (16 experimental, one practice) that had both denotative and connotative meanings as found in *Webster's Ninth New Collegiate Dictionary* (1985) and occurred at least once in every one million words (Carroll *et al.* 1971). All homographs are presented in Appendix A. There were three task contexts for each target word: (1) sentence task: linguistically unbiased ambiguous sentence; (2) denotative narrative: narrative semantically biased towards the denotative word meaning; and (3) connotative narrative: narrative semantically supportive of the connotative word meaning.

The length and complexity of stimulus items (sentences and narratives) were controlled. Sentences in the sentence task contained three words, and the target word appeared at the end of each sentence. Narrative paragraphs contained three sentences, with the last sentence being the same as the linguistically unbiased

Table 1. Subject characteristics

	Age (years)	Gender	Race	Education (years)	Premorbid intelligence	Months post- onset of CVA
RHBD						
1	67	M	White	21	131	4
2	67	M	White	18	123	7
3	69	F	Black	7	80	2
4	62	M	White	12	105	9
5	64	M	White	12	104	14
6	65	F	Black	8	82	17
7	50	M	White	11	100	7
8	69	M	White	8	95	9
9	63	F	White	12	104	3
10	63	M	Black	18	109	8
Range	50-69			7-21	80-131	7-17
Mean	63.9			12.7	103.3	8.0
SD	5.49			4.79	15.88	4.69
NBD						
1	57	F	White	16	113	
2	58	M	White	16	113	
3	63	F	White	12	104	
4	70	M	White	10	98	
5	64	F	Black	11	90	
6	64	M	White	12	108	
7	66	M	Black	12	95	
8	68	F	White	18	120	
9	58	M	Black	11	93	
10	66	M	White	14	114	
Range	57-70			10-18	90-120	
Mean	63.4			13.2	104.8	
SD	4.45			2.66	10.33	

ambiguous sentence for a particular target word. The first sentence contained between five and 13 words and the second sentence contained between five and 12 words. All of the sentences in the narratives consisted of simple declarative sentences, with or without conjunctions.

For each task context there were four multiple-choice answers; the same answers were presented for each of the three task contexts but order of presentation was randomly altered. The four answers consisted of: (1) the correct denotative word meaning; (2) a correct connotative word meaning; (3) a meaning opposite to the denotative meaning; and (4) a meaning opposite to the connotative meaning. For the multiple-choice foils, both the correct denotative and connotative word meanings occurred at least once in every one million words (Carroll *et al.* 1971). The opposite foils were selected based on antonym information found in *Webster's Ninth New Collegiate Dictionary*. Information on the familiarity of the correct word meanings, as well as the antonym information, was validated in exploratory

Table 2. Clinical test data

	TAWF	RCPM†	WAB	RICE
RHBD				
1	119	33	96.1	88.5
2	99	31	95.7	86.2
3	70	10	78.1	67.4
4	111	22	92.5	93.2
5	94	19	88.2	77.5
6	70	14	72.5	70.3
7	75	21	90.3	88.2
8	70	28	79.8	74.4
9	70	11	82.4	83.5
10	98	30	96.2	92.4
Range	70-119	10-33	72.5-96.2	67.4-93.2
Mean	87.6	21.9	87.2	82.2
SD	18.89	8.44	8.48	9.20
NBD				
1	81	32		
2	93	29		
3	98	32		
4	70	21		
5	83	13		
6	76	18		
7	76	18		
8	95	35		
9	74	21		
10	76	24		
Range	70-98	13-35		
Mean	82.2	24.3		
SD	9.80	7.33		

TAWF = Test of Adolescent/Adult Word Finding (standard scores);  
 RCPM = Raven's Colored Progressive Matrices (raw scores; max = 36);  
 WAB = Western Aphasia Battery (Cortical Quotient; RICE = RIC Evaluation of Communication Problems in Right Hemisphere Dysfunction (percentages).

† Raven's Colored Progressive Matrices was administered as part of the Western Aphasia Battery.

investigation with normal college students.<sup>3</sup> Sample stimuli are presented in Appendix B.

### Procedure

For each of the three task contexts one practice item was presented to each subject prior to the experimental task. For the sentence task, work on the practice item involved illustrating two different ways to consider ambiguous words. For the

<sup>3</sup> This information addresses relative frequencies of both the denotative and connotative word meanings, as well as individuals' familiarity with the meanings. However, it is possible that the two types of meanings may be relatively more or less strongly activated during the comprehension process (cf. Tompkins 1990). This type of information can be obtained only through priming evidence; thus it cannot be ascertained that the two meanings would be equally activated from the data presently available.

paragraph contexts the practice items consisted of administration of one paragraph semantically biased towards the denotative and one paragraph biased towards the connotative meaning of the homographs. With instruction, modelling, and verbal feedback, all subjects were able to perform the practice items correctly and with confidence.

For all subjects the sentence task was administered first with stimuli presented in randomized order. For each sentence there were two accurate meanings of the target word (denotative, connotative) from the four available choices. Subjects were instructed to identify both correct meanings for the target word in the sentence and were informed that there was more than one accurate response. Subjects were encouraged to identify both accurate meanings of the target word and were provided with adequate time to identify both meanings. Scoring of subject responses on this task context took into consideration whether the individual identified both meanings of the target word or just one of the meanings (denotative and/or connotative). An overall performance percentage reflecting accurate identification of both meanings was determined for each subject. In addition, accuracy percentages were calculated separately for identification of the denotative meaning and the connotative meaning of the target word in the sentences. These measures established baselines for comparison to performance on both of the paragraph conditions.

All subjects were administered all narratives (denotative, connotative) in randomized order upon completion of the sentence task. The number of accurate responses in each of the two paragraph contexts was determined for each subject, and mean performance was determined for both groups. All instructions and stimuli for the three task contexts were presented simultaneously via live voice and in large type font.

## Results

The means and standard deviations for performance accuracy percentages for both groups on the three task contexts are presented in Table 3. The percentages for the sentence context reflect a mean overall performance of accurate identification of *both* the denotative and connotative meaning of the target word in the ambiguous sentence context. Non-parametric Wilcoxon rank sums tests conducted on these data revealed significant differences between groups for the sentence context ( $F(1, 18) = 4.443$ ;  $p < 0.05$ ) and the connotative narratives ( $F(1, 18) = 4.10$ ;  $p < 0.05$ ). For both of these contexts the NBD group was significantly more accurate than the RHBD group. There was no significant difference between groups for the denotative narrative context ( $p < 0.30$ ).  $F_{\max}$  tests were also conducted on group variances. The results revealed significant differences between groups for the denotative ( $F'(9, 9) = 10.88$ ;  $p < 0.01$ ) and connotative narratives ( $F'(9, 9) = 4.90$ ;  $p < 0.05$ ). In these analyses the RHBD group had more within-group variance than the NBD group.

Means and standard deviations for accuracy of identification of the denotative and connotative word meanings in the sentence task are presented in Table 4. As can be seen, there was minimal difference between performances for the two word meanings on the sentence task for either group. Non-parametric Wilcoxon rank sum tests were conducted between these data for each of the two types of word meanings in the sentences and performance on the respective paragraph condition

**Table 3. Performance pattern accuracy percentage means and standard deviations for each task context for both groups**

	Sentences	Denotative	Connotative
Right hemisphere brain-damaged			
Mean	77.2	86.9	81.6
SD	17.11	16.98	18.90
Non-brain-damaged			
Mean	90.0	91.9	92.2
SD	8.81	5.15	9.34

**Table 4. Mean accuracy percentages for denotative and connotative word meanings in the sentence task for the RHBD and NBD groups**

	Denotative	Connotative
RHBD	77.5 (16.43)	76.8 (11.80)
NBD	93.8 (9.32)	86.3 (9.22)

Standard deviations are in parentheses.

within each group (Table 3). The results revealed no significant difference between the sentence context and either of the paragraph conditions for the NBD group ( $p > 0.15$ ). For the RHBD group there was a significant difference between the sentence and denotative task contexts ( $p < 0.01$ ); the RHBD subjects were significantly more accurate on the denotative than sentence context. However, there was no significant difference between sentence and connotative task contexts ( $p > 0.20$ ).

Individual performances of the RHBD subjects were examined in relation to the mean accuracy percentages and standard deviations of the NBD group across the three task contexts. Specifically, RHBD subject performance was examined relative to the first standard deviation below the mean performance of the NBD group. As can be observed from Figure 1, four of the RHBD subjects had accuracy percentages for all three task contexts that were within one standard deviation below the mean of the NBD group. However, it also is important to note that there were two subjects (3 and 6)<sup>4</sup> whose performance for all three task contexts was noticeably poorer than the first standard deviation below the mean of the NBD group.

Group error pattern data in percentages for the three task contexts are presented in Table 5. Statistical analyses were not conducted on these data because of the limited number of data points. As can be observed, similar error patterns were observed for both groups on the sentence task. On the denotative paragraphs the highest percentage of errors for both groups involved choosing the connotative meaning of the homographs. For the RHBD group this was followed by choosing the opposite of the denotative meaning with lowest percentage in choosing the opposite of the connotative meaning which was the most unrelated meaning for this context. However, for the NBD group the second highest percentage of errors

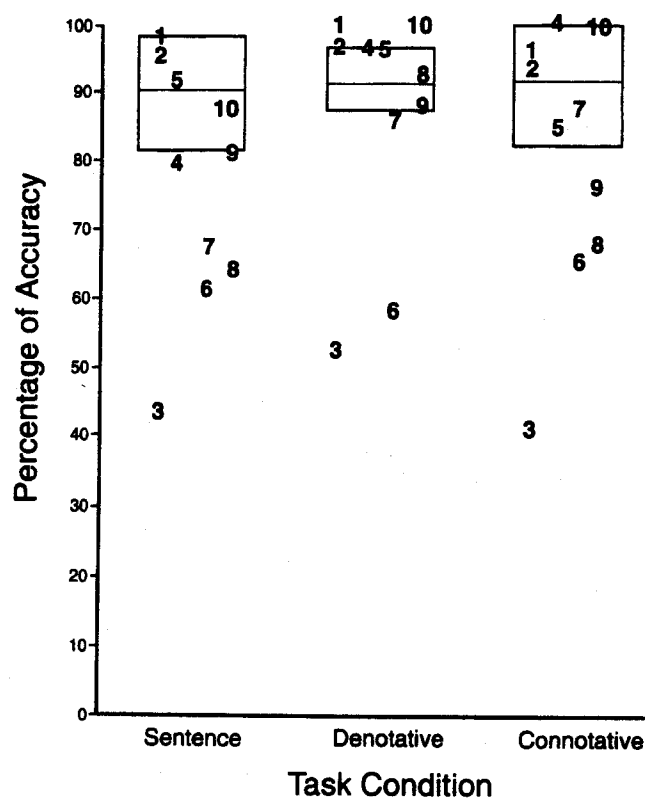
<sup>4</sup> As can be observed in Figure 1, Subject 3 appears to be an outlier in every condition. However, reanalysis of the data excluding her performance yielded similar findings.

**Table 5.** Pattern of errors in percentages for each task context for the RHBD and NBD groups

Sentence context	Error types		
	OD	OC	NR
RHBD (72)	35.2	38.0	26.8
NBD (32)	37.5	43.8	18.8
Denotative context	C	OD	OC
RHBD (36)	44.4	38.9	16.7
NBD (19)	57.9	5.3	36.9
Connotative context	D	OC	OD
RHBD (52)	42.6	31.9	25.5
NBD (24)	62.5	33.3	4.2

Numbers in parentheses are the total number of errors committed by the group.

OD: Opposite of the denotative meaning; OC: opposite of the connotative meaning; NR: no response; C: connotative meaning; D: denoting meaning.



**Figure 1.** Individual mean accuracy percentages for RHBD subjects in relation to group means and standard deviations for the NBD subjects on each task context.

was on the opposite of the connotative meaning with lowest percentage in choosing the opposite of the denotative meaning. On the connotative paragraphs, similar error patterns were observed for both groups, with the highest percentage of errors on choosing the denotative meaning of the homographs.

### Discussion

The results revealed that the RHBD subjects, as a group, appeared to take advantage of additional semantically biased information in processing denotative meaning; that is, performance improved when presented with contextual information that was semantically supportive of the denotative meaning of the target word. However, the RHBD adults had some difficulty with connotative word meaning even when additional semantically supportive context was present. That is, performance did not significantly improve on the narratives that were semantically biased towards the connotative meaning as compared to the isolated ambiguous sentence condition. Thus, the current findings are consistent with other research, indicating that some RHBD adults exhibit problems with metalinguistic judgements of connotative meaning of words and demonstrate a bias toward the denotative meaning in such tasks (Brownell 1988, Brownell *et al.* 1984; Gardner and Denes 1973, Joannette *et al.* 1990). This discrepancy in performance was apparent at the narrative level when semantically biased context was present rather than at the linguistically ambiguous sentence level, for which identification of word meaning was reduced for both the denotative and connotative interpretations of the target words.

Although RHBD adults have been found in some conditions to have difficulty utilizing contextual cues when processing linguistic information (Joannette *et al.* 1990, Myers 1991, 1994; Wapner *et al.* 1981), this was not unequivocally the case for this study. The RHBD subjects displayed a significant improvement in performance when provided with context that was semantically biased towards the denotative meaning, as compared to the ambiguous isolated sentence condition. Thus, it appears that the RHBD adults were able to utilize context to integrate and interpret information accurately. The RHBD subjects, however, did not show this significant improvement pattern with the paragraphs semantically biased towards the connotative meaning. As noted by others (Bloise and Tompkins 1993, Tompkins 1991a, b, Tompkins *et al.* 1992), it appears that they may be more successful in utilizing context to comprehend information when processing demands are limited, which may be the case in interpretation of the paragraphs semantically biased towards the denotative meaning. Connotative interpretations of homographs may be less strongly activated and/or may have weaker associations with their respective ambiguities than are denotative meanings (Tompkins 1990, personal communication). Consequently, contextually based connotative interpretations of multiple-meaning words may require greater processing resources for adequate synthesis of information, which are not as readily available for the RHBD individual as for the NBD adult (Bloise and Tompkins 1993, Tompkins 1990, 1991a, b, Tompkins *et al.* 1992, 1994). Alternatively, it has been suggested that if denotative meanings are generally more strongly activated than connotative meanings, they may be more difficult to suppress in some situations (Tompkins, personal communication). Furthermore, if RHBD individuals display a deficit in this suppression mechanism, they may have difficulty decreasing activation of information that is irrelevant to the context (Tompkins 1995). Although the current paradigm does not allow a determination on whether multiple meanings are activated, observation of the error data information indirectly supports this speculation. Specifically, when presented with paragraphs that were semantically biased towards the connotative meaning of the homographs, RHBD patients

frequently gravitated towards the denotative meaning of the multiple-meaning word. It should be mentioned that a similar error pattern was also observed for the non-brain-damaged subjects, as one would expect if the denotative meanings in this study carried some kind of activation or strength-of-association advantage (Tompkins, personal communication).

The present results could possibly be interpreted using Beeman's (1993) semantic processing deficit hypothesis. However, apparently counter to Beeman's hypothesis, connotative meanings generally were activated and available for the RHBD patients in this study, as evidenced by their largely accurate performance in the connotative context condition and their frequent selection of connotative alternatives in the other conditions. A case also could be made for interpreting the results utilizing Brownell's (1988) position of an inflexibility deficit hypothesis regarding homographs. However, as the current investigation was not designed to test or contrast hypotheses, a choice between these explanations regarding the RHBD adults' pattern of performance is not possible.

Finally, several of the RHBD adults performed similarly to the NBD adults on the experimental task; indeed, the group deficit for RHBD patients appeared to be attributable to a small subset of patients. Thus, it is important to note that a deficit in appreciating alternative interpretations of words may not be evident in all RHBD adults. An individual's processing of the multiple meanings of homographs may be influenced by specific demographic characteristics, such as education level and premorbid IQ, or clinical indicators such as general cognitive functioning and the presence of neglect. The nature of the task, particularly in regard to task complexity and whether the paradigm can document on-line activation of multiple meanings, also needs to be considered when examining RHBD adults' processing of homographs. Thus, the interaction of several factors requires further exploration in attempting to understand the communicative and cognitive deficits observed after right hemisphere brain damage.

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### Appendix A: Homographs used in each task context

warm (practice)	
straight	smooth
shallow	deep
sour	dark
rough	wide
sharp	open
bright	dull
poor	sweet
narrow	cold

### Appendix B: Stimulus items for each task context

#### *Sentence context*

She is *warm*.

In the above sentence, *warm* means:

- A. mean
- B. chilly
- C. heated
- D. kind

#### *Denotative context*

My mother feels sick. She is taking her temperature. She is *warm*.

In the above paragraph, *warm* means:

- A. mean
- B. chilly
- C. heated
- D. kind

#### *Connotative context*

My best friend always listens to me. She always gives me advice for my problems. She is *warm*.

In the above paragraph, *warm* means:

- A. mean
- B. chilly
- C. heated
- D. kind