Adults with focal damage to the right hemisphere (RHD) frequently have difficulty processing language units that support or induce multiple, alternative interpretations, such as nonliteral phrases and narratives with demanding inference revisions (e.g. Tompkins et al., 2002). However, RHD adults' difficulty with alternative meanings is evident even at the lexical level. One primary class of accounts for RHD discourse comprehension deficits focuses on impairments of lexical-semantic activation/deactivation processes for alternative word meanings.

Various investigators of intact brain function propose that RHD discourse comprehension impairments should reflect problems in maintaining activation for subordinate or context-alternative meanings and distant associates of words (e.g., Beeman, 1998; Brownell & Martino, 1998). This view reflects evidence that activation for these kinds of meanings is sustained over time in the intact right hemisphere (RH) but not in the left hemisphere (LH). A contrasting view is that RHD creates difficulty in suppressing activation of the contextually-unintended meanings and remote associates of words (e.g., Tompkins et al., 2000). General discourse comprehension performance of individuals with RHD was predicted by the extent to which they succeeded in suppressing such meanings, even after controlling for factors like vocabulary knowledge and working memory capacity for language (Tompkins et al.).

Most research on RH/RHD lexical-semantic processing has focused on ambiguous words that have two distinct and unrelated meanings (e.g., 'bat'). Atchley, Burgess, & Keeney (1999), however, report hemispheric differences in meaning activation/deactivation even for different kinds of subordinate features of *unambiguous* lexical items. Specifically, only the intact RH evidenced continuing activation for subordinate features of unambiguous words that reflect *alternatives* to our most common 'images' or representations of those words (e.g., 'rotten' for 'apple').

The current study was conducted to determine if RHD adults' previously predicted or reported deficits in processing lexical alternative meanings (i.e., maintenance or suppression deficits) would extend to semantic-feature representations of unambiguous lexical items. Based on Atchley et al., either observed RHD deficit should affect only activation/deactivation for these *alternative* subordinate features. Subordinate features that are *compatible* with the most common representations of the lexical items in question (e.g., 'crunchy' for 'apple') should be processed normally. Thus, activation for this type of subordinate feature should be inhibited over time, as the intact LH narrows activation to dominant meanings and features of the words.

Method

Participants. Fifty-nine adults participated. Twenty-one had unilateral RHD due to CVA (confirmed by CT/MRI scan reports); 38 were non-brain-damaged (NBD) controls without reported neurologic impairment. All met stringent inclusion criteria concerning hearing acuity, native language, and handedness. Table 1 provides subject information. The groups did not differ on demographic variables, but differed reliably as expected on clinical/neuropsychological tests.

Task. Maintenance of activation for subordinate features of words was assessed with a priming task. Spoken sentence stimuli were followed by spoken target words for lexical decision, at two interstimulus intervals (175 and 1000 ms). To aid perceptual segmentation, the sentences were spoken by a female and lexical decision targets were produced by a male. To encourage rapid responding, a response deadline (standard Windows bell) was presented on filler trials.

Stimuli. Sentence stimuli were built around 16 critical 1-2 syllable nouns from Atchley et al. (1999), that raters judged unambiguous (e.g., apple). These nouns were embedded in brief sentence frames, judged by raters not to bias the noun toward either its most common or an alternative mental image or representation (e.g., He has an apple). Filler stimuli were designed to minimize potential participant expectancies related to the length, content, structure, and repetition of experimental stimuli.

There were 4 types of lexical decision targets. Two types, from the stimulus set validated by Atchley et al. (1999), represented subordinate features of the sentence-final nouns: (1) Related-compatible features were compatible the unambiguous noun's most common mental representation (e.g., *crunchy*); and (2) Related-alternative features were incompatible with that common representation (e.g., *rotten*). (3) Unrelated lexical decision targets (e.g., *fluffy*) and (4) nonword targets were also used. The three types of real word targets were matched for lexical properties, including log frequency, part of speech, abstractness, and prosodic features (e.g., syllable structure, stress pattern, spoken duration). Nonword targets were phonotactically legal strings formed by changing one or two phonemes of a real word target in a way that made the 'nonword' decision impossible until the final 1/3 of each string. Each nonword target repeated 3 times, with different stimulus sentences.

Procedures. Participants were tested over 4 sessions with various tasks interspersed to maximally separate repeated presentations of stimuli/target words. Stimuli were delivered via a notebook computer, through a headphone amplifier and high quality supraoral earphones at a comfortable loudness level selected by the participant. Participants responded by pressing one of two labeled buttons (Yes/No) on a manual response box. A timing mechanism generated and stored millisecond RTs. Prior to the experimental task, participants received extensive orientation and practice until RTs stabilized.

Results

Table 2 provides accuracy and RT data for the data of primary interest from the lexical decision task, i.e., for the 'Related-alternative' subordinate feature targets (e.g., *rotten*). These outcome measures were submitted to repeated-measures two-way ANOVAs (Group by Interstimulus Interval [short, long]). Alpha was set at .05.

For the accuracy analysis, both main effects were significant. The NBD group was more accurate overall, and performance was more accurate at the longer interstimulus interval.

RTs were analyzed only for accurate trials. Analysis of raw RT data indicated only the expected Group main effect. Analysis of RT priming, calculated as a proportion (RT Related-alternative/RT Unrelated) to adjust for inter-individual differences in basic response times, indicated no significant effects.

The same analyses were performed on 'Related-compatible' trials. The only different result was a significant main effect of Interstimulus Interval, in each analysis. Both participant groups evidenced a decrease over time in activation of these subordinate features (e.g., *crunchy*).

Discussion and Implications

Against predictions, neither group evidenced a change in activation over time for the alternative subordinate features of unambiguous nouns. This may reflect an inhibition deficit for the NBD group – a finding sometimes reported for older adults. Atchley and colleagues' (1999) participants were young college students. However, Tompkins and colleagues (2000) have found older adults to inhibit contextually-unbiased meanings of words. Younger control subjects are needed to assess the existence and nature of any 'inhibition' deficit in older age.

Another possible explanation concerns the stimuli. Tompkins and colleagues' (2000) stimuli were balanced lexical ambiguities, with two relatively equiprobable meanings. Neither suppression nor maintenance deficits have yet been reported for RHD adults' processing of polarized ambiguities. The subordinate features assessed in this study were akin to the meanings of polarized ambiguities, in that one is clearly more dominant than the other. It may be that the alternative subordinate features are so semantically distant from their target nouns, that they were treated like 'unrelated' targets by our participants.

This possibility alone would not explain the difference in results between the current study and Atchley et al. (1999). Perhaps a hemispheric asymmetry reduction in older age (e.g., Dolcos, Rice, & Cabeza) changes representation of or access to these semantically-distant subordinate features.

While these results have no immediate clinical applications, research on the nature of communicative strengths and weaknesses in RHD adults eventually should inform assessment and management practices for these understudied individuals.

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Table 1. Demographic and Clinical Characteristics of Two Participant Groups

Characteristics	**RHD (n=21)**	**NBD (n=38)**
Age (years)		
Mean (SD)	64.7 (10.5)	60.4 (9.5)
Range	42-79	45-84
Gender		
Male	12	19
Female	9	19
Education (years)		
Mean (SD)	14.7 (3.2)	13.9 (2.2)
Range	9-22	12-20
Lesion site (from CT/MRI report)		Not applicable
Right cortical anterior	2	
Right cortical posterior	1	
Right cortical mixed	2	
Right subcortical	8	
Right cortical + subcortical	2	
Right MCA	6	
Lesion type (from CT/MRI report)		Not applicable
Thromboembolic	10	
Lacunar	2	
Hemorrhagic	9	
Months post-onset		Not applicable
Mean (SD)	61.7 (49.9)	
Range	4-167	
PPVT–R[a]		
Mean (SD)	157.1 (11.4)	163.0 (11.1)
Range	132-173	115-174
Auditory Working Memory for Language[b]		
Word recall error		
Mean (SD)	12.4 (6.5)	5.0 (4.6)
Range	2-24	0-16
Behavioural Inattention Test[c]		
Mean (SD)	137.6 (14.7)	144.0 (2.8)
Range	85-146	133-146

Visual Form Discrimination[d]		
Mean (SD)	28.2 (3.5)	30.3 (2.2)
Range	20-32	24-32
Judgment of Line Orientation[e]		
Mean (SD)	22.7 (4.7)	27.1 (4.2)
Range	11-30	16-33

Note. RHD = right hemisphere brain damage; NBD = non-brain-damaged;

PPVT–R = Peabody Picture Vocabulary Test—Revised.

* RHD poorer than NBD ($p < .05$).

[a]Dunn and Dunn (1981; maximum = 175).

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

[c]B. Wilson, Cockburn, and Halligan (1987; maximum = 146; neglect cutoff = 129).

[d]Benton, Hamsher, Varney, and Spreen (1983; maximum = 32).

[e]Benton et al. (1983; age and gender corrected score; maximum = 35).

Table 2. Accuracy and RT data (means, SDs) for Subordinate Feature Alternatives[a] by Group and Interstimulus Interval (ISI)

	RHD	NBD
Accuracy		
Short ISI	6.80 (0.52)	6.89 (0.31)
Long ISI	5.60 (1.27)	6.21 (1.01)
RT (ms)		
Short ISI	658 (279)	393 (124)
Long ISI	673 (309)	380 (120)
RT proportions (Related-Incompatible/Unrelated)		
Short ISI	1.14 (.23)	1.18 (.30)
Long ISI	1.25 (.22)	1.20 (.29)

[a] e.g., *rotten* (for *apple*)