The Effect of Contextual Bias on the Production of Negative Emotion Words in Patients with Right Hemisphere Brain Damage

Previous research has shown that damage to the right cerebral hemisphere (RHD) often manifests as higher-level cognitive-linguistic problems in domains such as emotion processing[1,2,3,6,10,14]. However, these studies employ metalinguistic tasks that obscure the nature of processing strengths and weaknesses because of the relatively high cognitive processing demand. Individuals with RHD often do not appear to have substantial deficits, and in fact facilitative effects have been observed[8,16,17,20], when they are assessed in a manner that reduces this demand, via methods such as priming or contextual bias.

The current study investigated the effect of contextual bias on the production of emotions conveyed via video input in individuals with RHD. Prior work reported adults with RHD deficient in producing negative emotion words in narrated descriptions of a video stimulus[6]. By inducing a negatively-toned bias prior to the video description task, we expected that negative affect words would increase in RHD subjects' descriptions, as compared to their descriptions when no bias was induced. We also expected non-brain-damaged (NBD) control participants to use more negative affect words than participants with RHD in a No-Bias Condition, with this between-group difference decreasing in the Bias Condition. No differences were expected between conditions on a control measure, the use of motion words.

Methods

Participants. (See Table 1) Twenty-one adults participated. Eleven had unilateral RHD due to a cerebrovascular accident (confirmed by CT/MRI scan reports); ten were NBD controls without neurological impairment. All met inclusion criteria for native language, handedness, and vision and hearing acuity.

Stimuli and Procedures. Participants viewed half of a video stimulus and immediately afterwards were prompted to describe what they had seen. The stimulus was a ninety-second video clip containing a stationary rectangle and a moving circle, small triangle, and large triangle[7]. Eight negative affect phrases (e.g., "Your brakes don't work on the freeway"[15]) were then read to subjects, who indicated the affect of each, given three spoken plus written choices (*fear*, *anger*, and *neither*). Following this inducement of bias, subjects viewed the second half of the video stimulus and again described what they had seen. A pilot study documented that splitting the original video stimulus[7] in half yielded equal amounts of negative affect and motion words in each segment.

The study was a partial replication of Heberlein and colleagues[6]. All tasks were completed in one or two sessions for RHD participants while NBD participants required only one session. Participants viewed the video stimulus on an HP G60 laptop computer with a 15.6-inch screen placed at a comfortable distance and location. Narrated descriptions were recorded via microphone and Audacity audio recording software. Participants' responses were orthographically transcribed by the primary author, including fillers, errors, re-phrased, and additional extraneous utterances. Transcriptions were analyzed for negative affect words and motion words with the Linguistic Inquiry and Word Count software[13]. Additional descriptive parameters were evaluated as well (i.e., comparisons, personified actions, emotions, and states of being, See Appendix for definitions and examples of parameters).

Results

Controls achieved 91.3% accuracy for evaluating the affect of the bias-inducing sentences ($\underline{M}$ = 7.3; SD = 0.67). Subjects with RHD achieved 85.0% accuracy ($\underline{M}$ = 6.8; SD = 0.98).

For the narrated descriptions, the within-group nonparametric analysis was conducted using the Related-Samples Wilcoxon Signed Rank Test and between-group nonparametric analysis was conducted using the Mann-Whitney U for Independent Samples. Results are illustrated in Tables 2 and 3 and Figures 1 and 2. As predicted, the proportion of negative affect words in narrated descriptions varied significantly between conditions, with negative affect word use increasing in the Bias Condition. Against expectation, though, the groups did not differ in the proportion of negative affect words in either the No-Bias or Bias Condition.

As expected, the proportion of motion words in subjects' narrated descriptions did not vary significantly between the No-Bias and Bias Conditions. That is, the inducement of a negative affect bias did not influence motion word use. This result further validates the division of the video in half.

As for the additional descriptive parameters, no difference was observed between NBD and RHD groups in regards to labels and references of the objects in the video. Subjects in each group used the same type and consistency of types of labels, i.e. pronouns and nouns, to talk about the shapes. Participant groups did differ, though, in how they described the shapes in the video (See Appendix).

Discussion and Implications

Following focal RHD, the production of negatively-toned material has been reported to be impaired. However, as predicted, inducement of a contextual bias prior to presentation of a stimulus facilitated processing and description of negative emotions by a group with RHD. This is consistent with many other findings that adults with RHD perform cognitive-linguistic tasks better when primed, and suggests that their "deficit" in processing negative emotion is task- and task-demand-specific[8,16,17,20]. In addition, the use of strategies to reduce cognitive demands can highlight not only problem areas but also processing strengths. These are important concepts for both clinical assessment and management of cognitive-linguistic deficits in adults with RHD.

The results of this study do not accord with the conclusions of the original study, in that the current study found no significant difference between RHD and NBD participants in proportion of negative affect words. Possible explanations for the differences include varying data collection and data analysis methods. In addition, participants with RHD in the previous study had damaged confined to the right somatosensory area, whereas lesion location was variable amongst individuals with RHD in the current study.

In the direction of our predictions, though, the control participants did use a higher proportion of negative affect words than participants with RHD across conditions, and following the bias inducement, the gap between subject groups did decrease. Motion word use did not differ across conditions, supporting the contention that the bias inducement influenced the intended factor, negative affect word use.

Descriptive analysis of subjects' narrations revealed distinct qualitative differences between groups. NBD participants used a greater variety of outlined descriptive parameters compared to participants with RHD. Controls used adjectives more often to reference and label shapes during narrated descriptions, whereas which shapes the RHD group was referencing was apparent only from contextual information and previous knowledge of the stimulus. These

differences are patterns commonly observed in adults with RHD[4,11,12,21], suggesting that we investigated a representative sample.

Few diagnostic and treatment measures are available for individuals with cognitive-communicative disorders, yet it is estimated that well more than half of individuals with RHD admitted to rehabilitation facilities have some kind of cognitive-communicative deficit[5,9]. Findings from the current study add to the corpus of data on emotional processing in RHD. In addition, these results further document the supportive effect of contextual bias, which may be exploited in treatments for individuals living with RHD[18,19].

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Table 1: Enrolled subjects' demographic information and clinical characteristics

Characteristics	RHD, n=11	Control, n=10
Sex	5 Females, 6 Males	4 Females, 6 Males
Age		
Mean (Std. Dev.)	67.8 (12.3)	63.3 (10.6)
Range	51-85	49-78
Education		
Mean (Std. Dev.)	14.6 (2.7)	15.3 (2.6)
Range	10-20	12.0-18.9
Months post-onset		
Mean (Std. Dev.)	93.7 (39.7)	N/A
Range	20-155	N/A
Peabody Picture Vocabulary Test-Revised[a], Peabody Picture Vocabulary Test-III[b]		
Mean (Std. Dev.)	158.8 (15.1), 173.3 (24.5)	164.0 (5.3)
Range	122-168, 145-188	154-172
Behavioral Inattention Test[c]		
Mean (Std. Dev.)	131.5 (20.7)	143.7 (4.99)
Range	77-146	130-146
Judgment of Line Orientation[d]		
Mean (Std. Dev.)	22.9 (5.6)	27.8 (3.1)
Range	12-32	23-32
Visual Form Discrimination[e]		
Mean (Std. Dev.)	24.9 (4.7)	31.0 (1.4)
Range	15-32	28-32
Discourse Comprehension Test[f], Total % Correct		
Mean (Std. Dev.)	80.9 (11.6)	88.9 (4.7)
Range	65.00-97.50	80.00-95.00
Discourse Comprehension Test[f], Implied % Correct		
Mean (Std. Dev.)	75.9 (14.5)	85.9 (4.9)
Range	60.00-95.00	80.00-93.75
Auditory Working Memory[g]		
Word recall errors		
Mean (Std. Dev.)	10.8 (5.1)	6.1 (4.0)
Range	4-21	1-12
True/False Errors		
Mean (Std. Dev.)	1.18 (1.16)	0.7 (1.25)
Range	0-3	0-4

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Table 2: Means (standard deviations) for negative affect use for between- and within-subject analyses

Between-Subject Findings (Mann-Whitney U for Independent Samples)	Within-Subject Findings (Related-Samples Wilcoxon Signed Rank Test)
No-Bias Condition: (U = 49; p = 0.76) RHD: 0.20 (0.67) NBD: 0.68 (1.08) Bias Condition: (U = 47; p = 1.00) RHD: 2.02 (1.82) NBD: 2.30 (2.40)	RHD (p = 0.038) No-Bias Condition: 0.41 (0.60) Bias Condition: 2.01 (1.82) NBD (p = 0.012) No-Bias Condition: 0.68 (1.08) Bias Condition: 2.30 (2.40)

Note: $\alpha = 0.05$

Table 3: Means (standard deviations) for motion word in within-subject analysis*

RHD	NBD
No-Bias Condition: 2.42 (3.59) Bias Condition: 2.32 (2.75) p = 0.735	No-Bias Condition: 4.0 (2.96) Bias Condition: 3.08 (2.26) p = 0.333

*Related-Samples Wilcoxon Signed Rank Test, $\alpha = 0.05$

Figure 1: Percent negative affect words in subjects' narrated descriptions

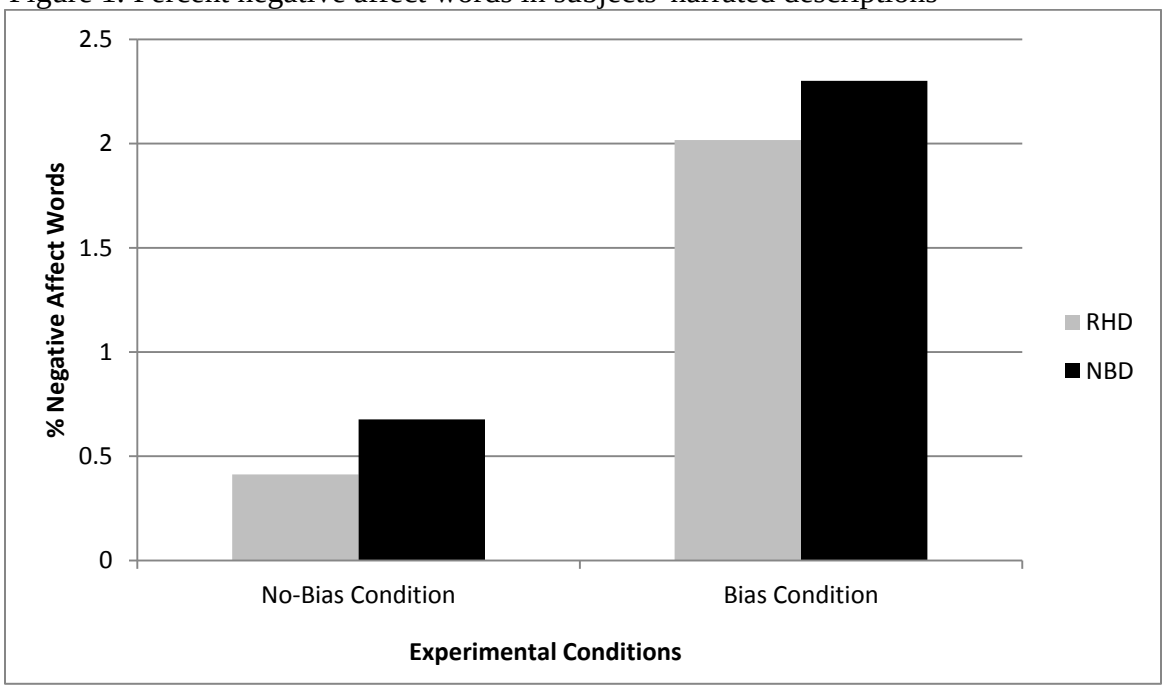
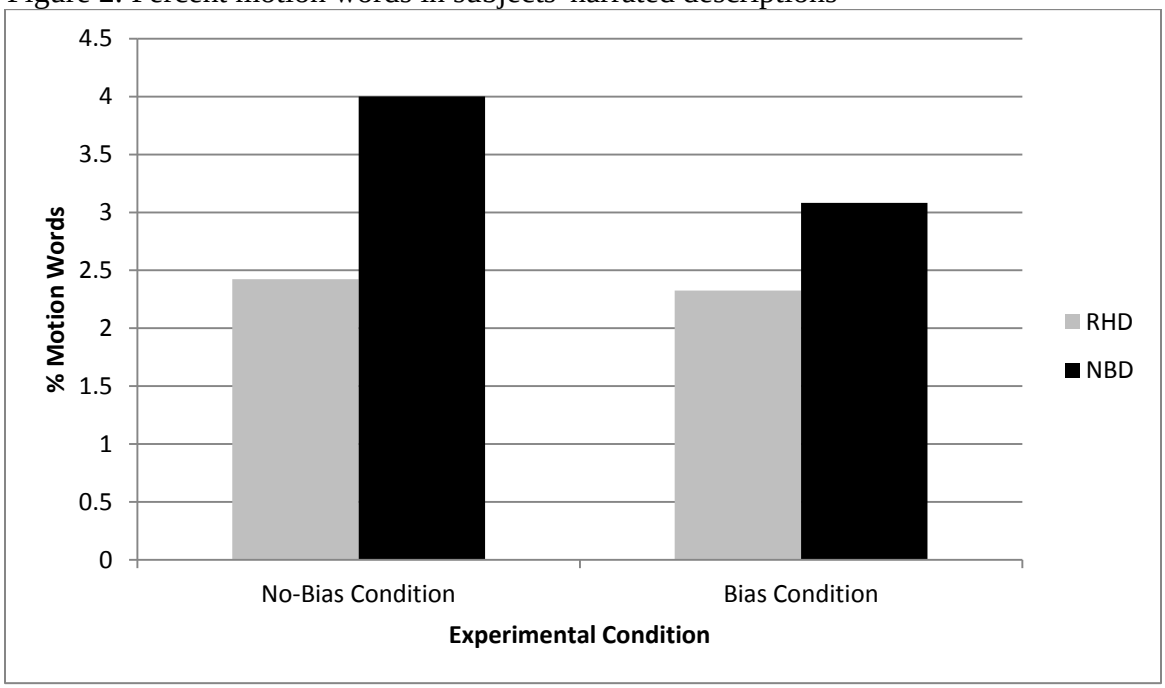


Figure 2: Percent motion words in subjects' narrated descriptions



Appendix

Comparisons were defined as when characters and events were described in terms of another thing or event.

Comparisons used by subjects in narrated descriptions

RHD	NBD
"…the larger triangle went after a smaller one that was outside of the rectangle and it was almost like two little birds one bigger bird running after the smaller one…"	*"It* [the video] *reminds me of a domestic altercation…"*
	"[the video] *Looks like a little game of cat and mouse and the two little one were running from the big triangle and it looked like a game"*
	"In a rectangle that resembles a room…"
	"... [little triangle] *seemed to use one of his points to open the flap at the top like a door…"*

Personified actions were defined as when the origin and execution of the action (verb) originated from an object (i.e., a shape in the video).

Personified actions used by subjects in narrated descriptions*

RHD	NBD
break (3), *chase* (5), *bully, leave, destroy, go in/out* (6), *escape* (3), *open* (2), *sneak out, try, go after, move, tear, come out, play, bounce* (3), *play, locked in, release, duke it out, skitter, swallow, hit, compete, pull, stop, bend down, fight, win, get away*	*break* (4), *chase* (3), *bully, leave* (2), *destroy* (2), *go in/ out* (6), *escape* (5), *open* (3), *sneak out (2), try* (6), *go after* (2), *move, tear (up), come out* (2), *play, attempt, hide, meet, follow, burst through, get in a fight, confront, challenge, run* (2), *smash, not let in, come up, allow, close* (3), *decide* (2), *kiss, poke, approach, attack* (2), *push* (2), *look out, drive, distract, run away* (2), *dance* (2), *maneuver (with other triangle), enter* (2), *exit, team up against, pursue, lend aid, scare, retreat, interact, see, migrate, join, proceed, take advantage, work*

*****For words used by multiple participants, the number who used the term is in parenthesis. For instance, *break* (4) was found in four NBD participants' narrated descriptions.

Emotion words were defined as words or phrases that render or describe an emotional state of objects (i.e., a shape in the video).

States of being were defined as words or phrases that may not describe an emotional condition but instead depict a mental state or condition.

Emotion words and states of being descriptions used by subjects in narrated descriptions*

RHD	NBD
angry (2), *upset, not too happy, free, having trouble*	*angry* (5), *distraught, rage, mean, preferred, not like, stay away, unsuccessful, no rhyme or reason, want, aggressive, curious, interested, stuck, happy, alone, not understanding*

*****For words used by multiple participants, the number who used the term is in parenthesis. For instance, *angry* (5) was found in five NBD participants' narrated descriptions.