

The Effect of Emotion on Verbal Recall in Traumatic Brain Injury

INTRODUCTION

Individuals with traumatic brain injury (TBI) have impairments in identifying emotion in social and pragmatic communication (Ben-David, van Lieshout, & Leszcz, 2011). These deficits include difficulty with correctly matching emotion in facial expressions (Watts & Douglas, 2006), interpreting prosody of speech (Dimoska, McDonald, Pell, Tate, & James, 2010), retrieving words (Hough, 2008) and determining the perspectives of other individuals using theory of mind (McDonald & Flanagan, 2004). However, little research has focused on the processing of emotional content in verbal recall.

The purpose of this study is to determine the effects of stimulus emotional content on the ability of individuals with TBI to recall words from lists and content units from paragraphs. Results from the study have clinical significance because the tasks may serve as appraisal instruments for determining the level of emotional processing impairment associated with traumatic brain injury and document the importance of emotional content in selecting stimuli for treatment intervention.

METHOD

Participants

Twelve individuals (11 male, 1 female) with TBI confirmed from medical history and 32 speakers (12 male, 20 female) without history of brain injury participated in the study (see Table 1). Participants were monolingual, native speakers of English with normal hearing acuity. The participants with TBI were administered the Scales of Cognitive Ability (SCATBI) to provide additional information on memory, orientation and other aspects of cognitive processing (Adamovich & Henderson, 1992).

Stimuli

Word and paragraph stimuli were developed for the experiment (see Table 2). Sixty undergraduate students without history of cognitive and/or communication disorders were recruited from the University of Texas to rate the emotionality of 10 paragraphs and 100 words on 100 millimeter visual analog scales. The words were selected based on high emotional content or lack of (emotionally neutral) content. The paragraphs were five to six sentences in length and were developed to reflect high emotional content or neutral content. They were equated on the basis of the number of content units. The rating anchors were 0 mm for neutral emotional content and 100 mm. for highly emotional content. The words and paragraphs were presented in written form to each rater who was instructed to bisect a 100 mm line below each word and paragraph to reflect the emotional content of the word or paragraph. The paragraphs were rated for emotionality as a whole; words were rated individually. Paragraphs were matched for content unit length but not word length or phonotactic probability because these factors do not have a significant impact on recall (Glanzer, 1982; Murphy & Puff, 1982).

Each paragraph and word was assigned a rating based on the average of the 60 individual ratings determined by measurement of the bisected lines. The three most emotional (highest numeric ratings: mean = 88.44) and three least emotional (lowest numeric ratings: mean = 16.62) paragraphs and the 30 most emotional (highest numeric ratings: mean = 77.68) and 30 least emotional, or most neutral, (lowest numeric ratings: mean = 15.89) words were selected for the study. Five emotional and five neutral words are randomly assigned to each of six word lists.

Procedures

The word lists and paragraphs were presented to each participant under Sennheiser headphones in counterbalanced order using a Lenovo Y560p computer. For the lists, the participant was instructed to listen carefully and then asked to recall the words. For the paragraphs, the participants were presented the paragraphs and then were asked to retell as much as possible.

Analysis

Responses to the words and paragraphs were recorded on response forms. The number of emotional and neutral words from the lists and the number of content units from the emotional and neutral paragraphs were calculated for the participants with TBI and the non-brain injured participants. Scoring reliability exceeded .90 for words and paragraphs.

RESULTS

The number of words recalled based on emotional content and the number of content units recalled for emotional and neutral paragraphs for the traumatic brain injured (TBI) and non-brain injured (NBI) participants is shown in Table 1. The NBI participants recalled more content units from emotional (mean = 33.97) and neutral paragraphs (mean = 27.97) than the participants with TBI (emotional mean = 23.83; neutral mean = 22.50). A two way analysis of variance revealed significant effects for groups ($F = 17.499, p < .001$) and condition ($F = 14.955, p < .001$) and a significant group by condition interaction ($F = 6.147, p < .05$). Pair wise post-hoc comparisons revealed a significant difference between the recall of content units for the emotional compared to neutral paragraphs for NBI ($p < .05$) but not for the TBI ($p < .05$) group. The significant group by condition interaction resulted from the increased number of content units recalled for emotional paragraphs for the NBI but not the TBI participants. The number of emotional and neutral words was greater for both the TBI (emotional mean = 14.17; neutral mean = 10.75) and NBI participants (emotional mean = 16.78; neutral mean = 13.72). A two-way analysis of variance revealed significant effects for groups ($F = 10.486, p < .01$) and condition ($F = 41.030, p < .001$). The interaction of groups and condition was not significant. Post-hoc comparisons revealed significant differences ($p < .05$) between the number of emotional and neutral words recalled by both the TBI and NBI groups.

In summary, the participants without brain injury recalled more content units from emotional paragraphs but emotional content did not increase the number of units recalled by the participants with TBI. For lists, NBI participants recalled more words, and the emotional content of the words increased the number recalled by both groups.

Discussion

The study found that individuals with TBI do not have increased recall in paragraphs with increased emotional saliency, while NBI individuals have increased recall with increased emotional saliency. Both individuals with TBI and NBI had increased recall with increased emotional salience of words. These results suggest that individuals with TBI are more successful at processing and perceiving emotion encoded semantically at the word level than at the paragraph level where emotion can be encoded without using specifically emotive words, where more inference may be required. Results suggest that individuals with TBI may benefit from

therapy aimed at increasing ability to infer emotional salience at the paragraph level by using less impaired processes of semantically encoded emotion.

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Table 1. Age, gender and SCATBI and experimental task scores for traumatic brain injury (N = 12) participants. Mean and standard deviation data are shown for a comparison group of non-brain injured participants (N = 32).

TBI	Age (Years)	Time Post Injury (months)	Gender	Scales of Cognitive Ability for Traumatic Brain Injury (SCATBI)							Experimental Task Data			
				Perc*	Orie*	Org*	Reca*	Reas*	Total	Severity	ParE*	ParN*	ListE*	ListN*
1	60	432	M	92	119	129	101	114	112	Mild	16	18	14	9
2	34	84	M	108	97	115	90	94	98	Mild	17	19	12	7
3	49	57	M	108	119	129	105	122	124	Borderline Normal	29	25	14	16
4	44	68	M	108	119	129	119	112	125	Borderline Normal	26	16	18	8
5	38	8	M	98	119	107	110	125	113	Borderline Normal	18	24	15	7
6	36	240	M	108	101	91	110	122	106	Mild	26	24	19	14
7	59	204	M	113	101	129	125	125	128	Average-Normal	32	29	15	13
8	26	44	F	98	101	119	100	97	101	Mild	20	15	11	12
9	29	144	M	93	91	95	100	100	92	Moderate	25	26	13	7
10	43	113	M	119	119	129	135	121	135	Average-Normal	30	30	12	9
11	45	47	M	101	119	129	101	107	112	Mild	16	19	10	13
12	24	6	M	119	101	119	107	112	113	Borderline Normal	31	25	17	14
Mean	40.58	120.58 months		105.42	108.83	118.33	108.58	112.58	113.25	Mean	23.83	22.50	14.17	10.75
				9.13	10.97	13.87	12.44	11.02	12.91	sd	6.12	4.96	2.79	3.25
										NBI (mean)	33.97	27.97	16.78	13.72
										NBI (sd)	6.74	5.65	2.80	2.99

*Perc = Perception and Discrimination su *Orie = Orientation; *Org = Organization; *Reca = Recall; *Reas = Reasoning; *ParE = Emotional Paragraphs; *ParN = Neutral Paragraphs; *ListE = Emotional words; *ListN = Neutral words

Table 2. Stimulus examples of neutral and emotional paragraphs and words with emotion ratings.

Neutral Paragraph Examples	Mean rating	Emotional Paragraphs Examples	Mean rating
Justin went to the video game store but didn't find anything he liked. He decided to rent a game rather than spend his money on a game he wasn't sure he would enjoy. After renting the game, Justin decided he made the right choice in renting the game. The game was boring, and had he bought it he would have wasted \$40.	11.78	The doctor told Michelle that a mass growing on her brain would require invasive brain surgery. Michelle asked if she would dance again. The doctor said that she wouldn't. Three months after her brain surgery, Michelle put away her walker and started dancing. She refused to take "no" for an answer.	84.42
When Maria's parents came home from work they brought home a new pencil for Maria, which she needed. That night Maria dropped her pencil, and it rolled away. She looked for her pencil everywhere, only to find the one she had lost the week before. She finished her work and continued to look for a short while. Maria found her new pencil, and played until bedtime.	13.98	A sister was traumatized when her parents picked her up from school with bad news. Her brother was murdered. The sister sobbed as her parents explained that he was killed while saving a woman being assaulted by a masked man. His heroic actions saved the woman, but cost him his life. The sister smiled at his memory.	93.89

Neutral Word Examples	Mean rating	Emotional Word Examples	Mean rating
Straw	4.10	Affair	80.83
Pen	4.83	Abused	81.27
Stick	6.75	War	81.52
Capsule	7.37	Wedding	82.00
Cleaners	7.70	Family	83.35
Hibernate	8.75	Suicide	87.18
Here	9.20	Rape	87.53
Baker	11.33	Death	88.10
Switched	11.70	Abortion	88.98
Medium	12.37	Love	89.22