Clinical Aphasiology, Vol. 23, 1995, pp. 217–225

Drawing Inferences from Emotional Situations: Left Versus Right Hemisphere Deficit

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A person's ability to draw inferences about another person's emotional state is a higher cognitive function that requires both linguistic and extralinguistic interpretations. In addition to what and how something was said in the heat of the moment, the judgment about what someone else is feeling is influenced by nonverbal variables. These include such things as the facial expressions and the physical distance between persons involved in the interaction, body posture, and the physical setting in which the behavior occurred. A certain amount of mental flexibility is required to synthesize information as it unfolds sequentially over time. The ability to draw inferences from emotional situations is a subjective process that requires a person to integrate both world knowledge and personal experience.

It has been postulated that the right hemisphere is dominant for mediating emotional prosody (Heilman, Bowers, Speedie, & Coslett, 1984). Persons with right hemisphere damage (RHD) have been reported to have difficulty detecting the emotional mood of a speaker even though they were able to identify the content of the spoken message (Heilman, Scholes, & Watson, 1975). Additionally, persons with RHD may exhibit impaired processing of gesture and facial expression, both of which convey emotional tone and influence discourse comprehension. Persons with left hemisphere damage (LHD) have been described as being socially aware and socially appropriate, which assumes an ability to appreciate what another person is feeling.

Numerous studies have examined the ability of persons with RHD or LHD to draw inferences. Studies have employed both linguistic and nonverbal inference tasks. The results of these studies have been inconclusive regarding the ability of RHD subjects to draw inferences.

Myers, Linebaugh, and Mackisack-Morin (1985) asked subjects to sort black-and-white emotive photographs into themes such as love/affection, mistrust, and suffering/comforting. Based upon the results of their study, the authors suggested that subjects with RHD had more difficulty drawing inferences from nonverbal material than did subjects with LHD.

Purdy, Belanger, and Liles (1993) asked subjects with RHD to watch an animated film and to answer two types of inference questions. These authors found that the subjects performed significantly better on inference questions involving general world knowledge, called outside-text information, than they performed on questions assessing within-text information. However, these authors noted that the RHD subjects performed significantly more poorly on both explicit and implicit type questions than did the matched control group of normal adults.

In the present study, we investigated the ability of individuals with LHD or RHD to draw inferences from the feeling or sense of affect conveyed in videotaped vignettes. We hypothesized that both RHD subjects and LHD, aphasic adults with low comprehension would have difficulty drawing inferences from emotions conveyed in situational contexts presented on videotape.

METHOD

Subjects

The subjects in this study belonged to one of four groups. The first group consisted of 7 LHD, aphasic adults with high auditory comprehension (LHD-H). High auditory comprehension was designated as having scored 9 or greater (out of 12 points) on the Complex Ideational Material subtest of the *Boston Diagnostic Aphasia Examination* (BDAE) (Goodglass & Kaplan, 1983). Six of the 7 LHD-H subjects had a unilateral, focal left hemisphere lesion secondary to a single cerebrovascular accident; the seventh subject had aphasia of gradual onset. The second group of subjects consisted of 6 aphasic adults with low auditory comprehension (LHD-L) as determined by a score of 8 or less on the Complex Ideational Material subtest of the BDAE. All subjects with aphasia were also given the Sentence Comprehension subtest of the *Reading Comprehension Battery for Aphasia* (RCBA) (LaPointe & Horner, 1979). Twelve of the 13 subjects with aphasia scored 10 of 10 on this subtest; the remaining subject scored 5 of 10. The demographic and clinical characteristics of the LHD, aphasic subjects are presented in Table 1.

Table 1. Demographic and Clinical Characteristics of Left Hemisphere–Damaged Aphasic Subjects

Subject	*Age*	*Sex*	*Education (years)*	*Etiology*	*TPO*	*Hemi*	*Fl/Non*	*Com Idea*	*RCBA*
			Left Hemisphere—High Comprehension						
CC	51	F	17	CVA	120	+	Non	12	10
JP	44	F	16	CVA	60	+	Fl	12	10
AH	72	M	12	CVA	4	–	Fl	10	10
AM	80	F	16	CVA	16	+	Non	10	10
LJ	57	F	12	CVA	48	–	Non	10	10
SR	80	M	12	CVA	11	–	Fl	9	10
GA	80	F	12	grad	16	–	Fl	9	10
Mean	**66.3**		**13.9**		**39.3**			**10.3**	**10**
			Left Hemisphere—Low Comprehension						
JH	40	M	16	CVA	39	+	Non	8	10
MN	76	M	12	CVA	96	+	Non	8	10
JG	72	M	17	R CVA	59	left	Non	8	10
EO	68	F	12	CVA	74	+	Non	7	10
EG	69	F	12	CVA	5	–	Non	7	10
ER	72	F	12	CVA	24	+	Non	3	5
Mean	**66.2**		**13.5**		**49.5**			**6.8**	**9.2**

Note: TPO = time postonset in months; Hemi = presence (+) or absence (–) of right hemiparesis; FL/Non = fluent or nonfluent speech characteristics; Com Idea = complex ideational material (*Boston Diagnostic Aphasia Examination;* Goodglass & Kaplan, 1983); RCBA = *Reading Comprehension Battery for Aphasia* (sentence comprehension subtest) (LaPointe & Horner, 1979); CVA = cerebrovascular accident; grad = gradual onset; R CVA = right hemisphere CVA; left = presence of left hemiparesis.

The third group of subjects consisted of 9 adults with right hemisphere damage (RHD). These subjects were given the *Mini-Mental State Exam* (Folstein, Folstein, & McHugh, 1975). In addition, RHD subjects were given screening tests for constructional impairment (drawing a circle) and visual inattention (crossing out boxes). Only one RHD subject had visual inattention, and none of the RHD subjects had constructional impairment. The identifying characteristics of the RHD subjects are shown in Table 2. The fourth group consisted of 13 control subjects matched with the LHD subjects for age and educational level (see Table 3).

Stimuli

The stimuli for this study consisted of 20 vignettes presented on videotape that showed one or more persons conveying either a positive or a negative emotion. Video segments were presented without sound so that subjects were drawing inferences from emotional content solely on the basis of nonverbal information. The video vignettes were recorded from television programs or movies and ranged from 8 to 18 seconds in length.

Procedure

Subjects were tested either in small groups or individually depending upon how much assistance they required. The response choices were read aloud to 3 of the LHD-L subjects in addition to having them simultaneously read the question. Each video vignette was presented twice to each subject; the second presentation was preceded by the examiner stating, "Here it is again." This served to alert subjects to look up at the video screen for the second presentation. Subjects made two judgments for each vignette. First, the subjects selected one of four words that best described how the person in the video segment was probably feeling in that situation. Second, the subjects determined whether the feeling conveyed in the video was positive or negative. Subjects were asked to mark a box that read "positive" or "negative." On top of each positive box was a smiling face; on top of each negative box was a frowning face. Figure 1 contains a sample of the multiple-choice response and positive or negative judgment required for one video vignette. Three practice items were presented before testing began. An explanation was given by the examiner as to what was meant by a positive or negative emotion. Questions were addressed during the presentation of the practice items.

Table 2. Demographic and Clinical Characteristics of Right Hemisphere–Damaged Subjects

Subject	*Age*	*Sex*	*Education (years)*	*Etiology*	*TPO*	*Hemi*	*MMS*	*Const Imp*	*Vis Inatt*
AS	*64*	*F*	*16*	*CVA*	*96*	+	*28*	–	+
CB	85	F	18	CVA	120	+	20	–	–
PL	73	F	16	CVA	69	+	27	–	–
JB	71	F	18	CVA	62	+	30	–	–
GM	84	F	16	CVA	24	+	27	–	–
LK	42	F	13	tumor	42	+	30	–	–
MD	55	F	12	CVA	77	+	29	–	–
WS	50	M	12	CVA	36	+	30	–	–
GM	42	M	16	CVA	62	–	30	–	–
Mean	**62.9**		**15.2**		**65.3**		**27.9**		

Note: TPO = time postonset in months; Hemi = presence (+) or absence (–) of left hemiparesis; MMS = *Mini-Mental State* exam score (Folstein, Folstein, & McHugh, 1975); Const Imp = presence (+) or absence (–) of constructional impairment (drawing a clock); Vis Inatt = visual inattention for crossing-out task; CVA = cerebrovascular accident.

Table 3. Demographics of Control Subjects

Subject	*Age*	*Sex*	*Education*
LD	58	M	12
LF	61	F	12
MP	79	M	12
GO	70	M	12
HC	76	M	12
DC	69	F	12
JC	45	M	17
FN	53	M	12
JN	44	F	12
HH	60	F	12
JH	61	M	12
FN	60	F	12
BN	61	M	12
Mean	**61.3**		**12.4**

1. These men are probably feeling
   a. disappointed
   b. embarrassed
   c. hurt
   d. miserable

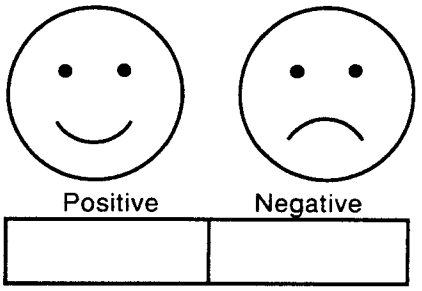

Figure 1. Sample multiple-choice question, and the positive/negative option provided for each video segment.

RESULTS

Only the responses for which there was high agreement among 25 college students for the word that best described the emotion conveyed in each video sample were analyzed. This resulted in an analysis of 18 responses per subject. There was 100% agreement on 17 of the items; 96% on the other. Half of the correct responses were positive and half were negative.

There was no significant difference between the four subject groups for the task requiring a positive or negative judgment of feeling conveyed in the video segments. However, an analysis of variance on the

mean number of errors for the four subject groups revealed a significant difference [$F(3, 31) = 5.17$, $p = .005$] between the subjects on the task requiring the selection of the word that best described each situation.

Table 4 shows the mean number of errors on word choice for the four subject groups. Post-hoc analysis using Scheffé's test revealed a significant difference between LHD-L and LHD-H subjects and between LHD-L and control subjects ($p < .05$). There were no significant differences among the RHD subjects and the other three groups on the word choice task.

DISCUSSION

There was no difference between the four groups in their ability to determine whether a situation presented on videotape conveyed a positive or negative emotion. These judgments were based solely on visual information. Earlier studies suggested that individuals with RHD have more difficulty interpreting the mood conveyed in pictures than do individuals with LHD. That was not the case in this study. The results of the current investigation were consistent with those of Bloise and Tompkins (1993), who were unable to replicate earlier findings suggesting that subjects with RHD had difficulty on inference tasks. Their study suggested that RHD subjects, as a group, did not differ from the normal control subjects on questions pertaining to revised linguistic material called bridging inferences, or attitudinal inferences. As in the Bloise and Tompkins (1993) study, the responses of the RHD subjects in this investigation were not homogeneous. Two of the 9 subjects with RHD made relatively more errors than did their cohorts. This appeared to be due to what Myers (1991) identified as the impulsive behavior exhibited by some subjects with RHD. Two subjects in our study tended to mark their responses almost immediately after a

Table 4. Mean Number of Errors (of 18 Possible) on Word Choice for the Four Subject Groups

Group	*Count*	*Mean*	*Standard Deviation*	*Standard Error*
LHD-H	7	1.143	1.464	.553
LHD-L	6	4.667	2.582	1.054
RHD	9	2.889	2.571	.857
Control	13	1.462	.967	.268

Note: LHD-H = left hemisphere–damaged, high comprehension; LHD-L = left hemisphere–damaged, low comprehension; RHD = right hemisphere–damaged.

vignette began rather than carefully watching the situation develop and perhaps change in emotional tone. These subjects seemed to be in a hurry to mark a response, and they seemed disinterested in watching the video as it was being shown a second time. (These two subjects were asked to watch the entire vignette before marking their response.)

In accounting for nonsignificant results on the positive/negative judgment task, it should be noted that the RHD subjects in this study had relatively mild impairments as a group. None of the subjects had constructional impairment, and only one subject had visual inattention. In addition, all subjects were at least 2 years postonset of RHD. Time postonset, as well as the absence of clinical markers associated with RHD, may influence RHD subjects' performance on an inference task.

Differences were found on the more difficult task of selecting one of four words that best described the emotion conveyed in the video segment. LHD-L subjects made significantly more errors on this task than did the LHD-H or normal control subjects. Aphasic subjects from both groups showed evidence of concrete thinking. For example, when shown a group of soldiers struggling through mud up to their thighs, carrying their guns and ammunition, but not under fire, four persons with aphasia chose the word *hurt* rather than the best answer *miserable* to describe how the soldiers were probably feeling.

LHD-L subjects tended to choose high-frequency words over less frequently used words to describe the feeling conveyed. For example, in one vignette, they chose *happy* rather than *ecstatic*. The word choice was given for the video segment that showed the last out of the final inning of the World Series. One can imagine the winning team members running toward the pitcher, jumping, hugging, and tumbling onto the field. Clearly the word *ecstatic* rather than *happy* was the better word choice. Preliminary investigations from a follow-up study suggest that LHD-L subjects recognize low-frequency words, but they may not appreciate the emotional strength or the continuum of emotional power associated with word meaning. The question remains as to whether this reflects a linguistic deficit or a higher level cognitive deficit in not appreciating the emotional nuance or emotional power conveyed by two words similar in meaning.

Subjects in the control group also made errors on the word selection task. For example, one video segment showed an adolescent boy blowing out birthday candles while family members joined in the celebration. Three of the 13 control subjects chose the word *curious* rather than *happy* to describe this vignette. It was interesting to note that the adolescent had suffered traumatic brain injury and these control subjects were clearly distracted by his spastic facial expressions and movements. This

suggested that the normal control subjects were employing overpersonalization when responding to this vignette. Overpersonalization has been defined as "integration of self into story structure or description of events" (Tompkins et al., 1993). This type of inappropriate association has been attributed to subjects with RHD. However, in a recent study of connected speech characteristics, Tompkins et al. (1993) noted that overpersonalization did not distinguish right hemisphere–damaged subjects from left hemisphere–damaged or normally aging control subjects. (It was interesting to note that all of the RHD and LHD subjects inferred that the young man celebrating his birthday was probably feeling *happy*.)

In summary, our hypothesis that RHD and LHD-L subjects would have difficulty drawing inferences from emotional situations was not borne out. Even though some subjects had difficulty with the word choice task, all subjects were able to process situational cues and to interpret whether videotaped situations conveyed positive or negative emotions.

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