

Plausibility Judgments of Subjects with Right or Left Hemisphere Brain Damage

Christine R. Baron and Katherine M. Byers

Difficulty making inferences has frequently been observed in the behavior of right hemisphere-damaged (RHD) adults (Myers, 1994). Many studies have shown that RHD adults perform poorly on tasks requiring comprehension or expression of inferential information (Wapner, Hamby, and Gardner, 1981; Goodenough-Trepanier, Powelson, and Zurif, 1982; Brownell, Michel, Powelson, and Gardner, 1983; Myers, Linebaugh, and Mackisack-Morin, 1985; Brownell, Potter, Bihrlé, and Gardner, 1986; McDonald and Wales, 1986).

Other studies have shown that RHD adults are generally able to express or comprehend inferential information under certain conditions. For example, when describing a sequence of pictures RHD subjects, as a group, included appropriate inferences (Byers and Yeni-Komshian, 1989). Both Brownell et al. (1986) and McDonald and Wales (1986) found that RHD subjects accurately judged true inferences, although they had difficulty judging false inferences. RHD subjects have also demonstrated implicit knowledge of familiar idioms when response variables were controlled (Tompkins, Boada, and McGarry, 1992).

Despite evidence that RHD adults generally are able to express or comprehend inferential linguistic material, they appear to have difficulty judging the plausibility of inferential information. This includes difficulty adjusting an initial inference when additional information renders it implausible (Brownell et al., 1986), difficulty rejecting false or implausible inferences (McDonald and Wales, 1986), and difficulty choosing a plausible reason why a speaker used an off-topic statement to signal a topic shift (Rehak, Kaplan, and Gardner, 1992).

Additional support for this apparent difficulty in judging plausibility comes from the frequently observed tendency of RHD adults to provide implausible explanations for incongruous information or events. Wapner,

Hamby, and Gardner (1981) found RHD subjects more likely than left hemisphere-damaged (LHD) or non-brain-damaged (NBD) subjects to include incongruous information when retelling a story. While LHD and NBD subjects omitted or regularized this information, RHD subjects frequently included it and went on to justify the bizarre incongruity with an additional explanation of how these events could have occurred. Byers and Yeni-Komshian (1989) found that when RHD subjects made errors completing a picture sequencing task, they produced implausible inferences in an apparent effort to convince the examiner that their choice was correct. In contrast, LHD and NBD subjects readily admitted when their choice was not a likely scenario, and usually changed their answers accordingly.

RHD subjects' ability to judge plausibility has not been specifically investigated. This study was designed to address two questions: (1) Do RHD subjects differ from LHD and NBD subjects in their ability to make plausibility judgements? and (2) Do RHD, LHD and NBD subjects differ in their ability to make plausibility judgements across different kinds of statements (always, sometimes, and never)?

METHOD

Subjects

Subjects were 10 adults with unilateral right hemisphere damage (RHD), 10 with unilateral left hemisphere damage (LHD), and 10 non-brain-damaged (NBD) adults. All subjects were right-handed, spoke English as a primary language, and had no history of alcohol or other substance abuse, psychiatric disease, or declining cognitive function by subject report or medical record review. Each group consisted of three males and seven females. The RHD and LHD groups were matched for age, education, and time post onset (TPO) (Table 1). Based on administration of a battery of language and/or cognitive tests by a certified speech-language pathologist, seven RHD and seven LHD subjects were described as having mild or no deficits. The remaining six brain-damaged subjects were described as having aphasia or cognitive-communication disorder of moderate severity. Brain-damaged subjects were at least 4 weeks post onset of thromboembolic or hemorrhagic cerebrovascular accident (CVA). For most subjects, a CT or MRI report was used to determine that the CVA was confined to a single hemisphere. In three cases a neurologist verified the acute CVA by clinical examination following negative CT/MRI results. Subjects were excluded from this study if there was evidence of mass effect. Subjects matching all criteria for inclusion in this study were selected from consecutive admissions to a 160-bed rehabilitation hospital over the course of 10 months.

Table 1. Descriptive Data for Three Subject Groups

<i>Characteristics</i>		<i>RHD</i> (<i>N</i> = 10)	<i>LHD</i> (<i>N</i> = 10)	<i>NBD</i> (<i>N</i> = 10)
Age (years)	Mean (SD)	64.3(8.8)	65.0(11.3)	64.4(9.6)
	Range	49–79	45–78	44–73
Education (years)	Mean (SD)	14.5(3.2)	14.2(3.2)	14.3(2.4)
	Range	12–21	10–21	12–18
Gender	Female:Male	7:3	7:3	7:3
TPO (months)	Mean (SD)	1.2(.4)	1.3(.5)	N/A
	Range	1–2	1–2	
Etiology of CVA	% Thromboembolic	90	100	N/A
BDAE ¹	Mean (SD)	11.5(.70)	10.2(1.2)	N/A
	Range	10–12	9–12	
Aphasia ²	WNL/MILD:MOD	0	5:3	N/A
Cognitive/ Linguistic Disorder ³	WNL/MILD:MOD	7:3	2:0	N/A

Note: RHD = Right hemisphere brain-damaged, LHD = Left hemisphere brain-damaged, NBD = Non-brain-damaged, TPO = time post onset.

¹Score on *Boston Diagnostic Aphasia Examination* complex ideational material subtest.

²Documentation of Aphasia in patient's medical record by a speech-language pathologist.

³Documentation of Cognitive/Linguistic Disorder in patient's medical record by a speech-language pathologist.

Stimulus Materials

Statements containing the words always, sometimes, or never, were solicited from approximately 50 people of various age and educational levels. A subset of these statements was chosen ($N = 180$), and a corresponding foil created for each statement. Foils were created so that each statement type (always, sometimes, never) was represented equally across the 180 trials. All statements ranged from three to six words in length. Ten certified clinical speech-language pathologists were asked to write a true or false response to these 360 printed statements, which were presented in random order. Only statements with 90% or better agreement for each statement in the pair were included as stimuli in the study, resulting in 56

statements: 8 *always* pairs, 10 *sometimes* pairs and 10 *never* pairs (see Appendix A). Statement type was determined by the form of the statement that produced a true response.

Procedures

Subjects were required to achieve at least 90% on a screening test designed to confirm adequate attention, auditory acuity, and auditory comprehension via a series of 10 yes/no questions. The results of a pilot for this study suggested that the screening test was not a sufficiently sensitive measure of adequate auditory comprehension/attention for the experimental task. Therefore, brain-damaged subjects were also required to score at least 9 out of 12 on the Complex Ideational Material subtest from the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan, 1983).

After passing the screening tests, subjects were trained to perform the plausibility judgement task as follows. A brief description of the concepts of always, sometimes, and never was provided. Then, three example statements were presented auditorily for each of the three conditions: always, sometimes, never. Subjects needed to respond true or false correctly to at least two of the three statements in each condition in order to pass the training session. Printed response cards were provided in the event that subjects were unable to speak. Three LHD subjects and no NBD or RHD subjects were excluded from the study based on the inability to achieve criteria.

The experimental task followed the training task and consisted of the presentation of the 56 experimental statements in one of two randomized orders to each subject. Statements were presented by live voice. Subjects were instructed to respond true or false to each statement. Stimulus repetition was permitted a maximum of two times upon patient request. Correct responses following stimulus repetition or inaccurate responses that were immediately self-corrected were scored as correct.

RESULTS

The percent of correct responses for the three statement types was calculated for each subject and the results are presented in Figures 1–3. Group means and standard deviations across statement types are presented in Table 2. NBD and RHD groups made more correct plausibility judgements than the LHD group. All groups performed more accurately on *always* and *never* statements than *sometimes* statements.

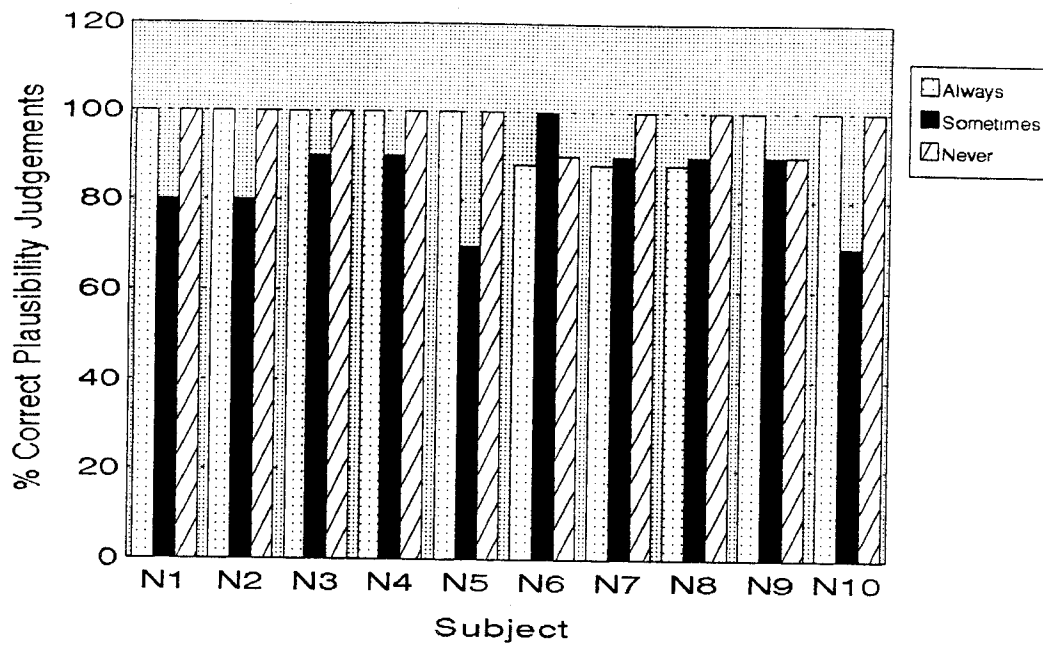


Figure 1. Percent correct plausibility judgements for always (A), sometimes (S), and never (N) statements by the non-brain-damaged group.

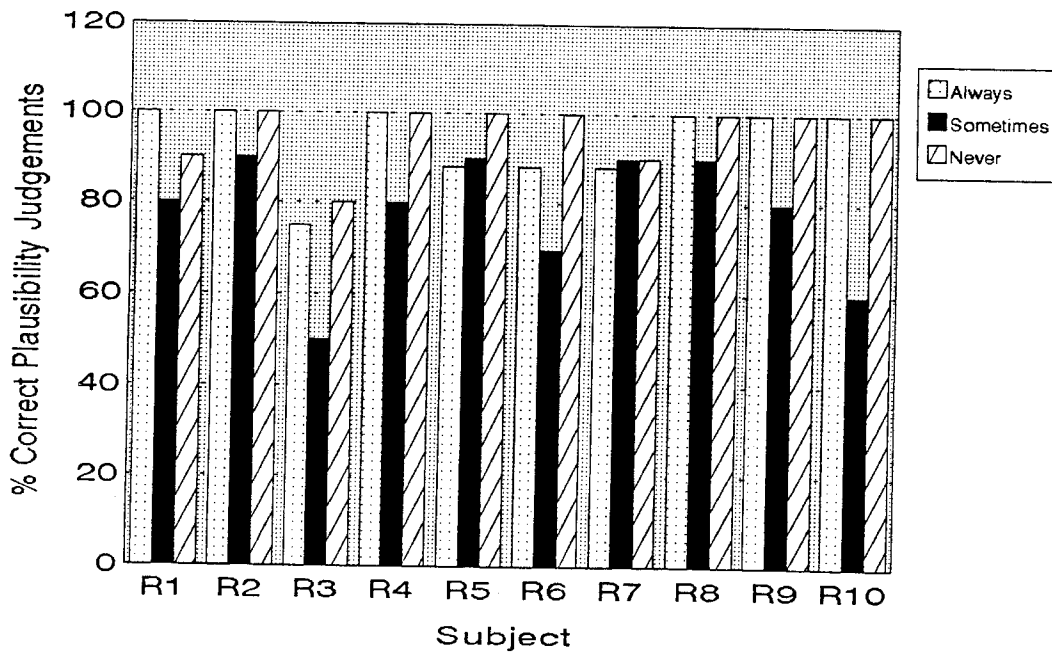


Figure 2. Percent correct plausibility judgements for always (A), sometimes (S), and never (N) statements by the right hemisphere brain-damaged group.

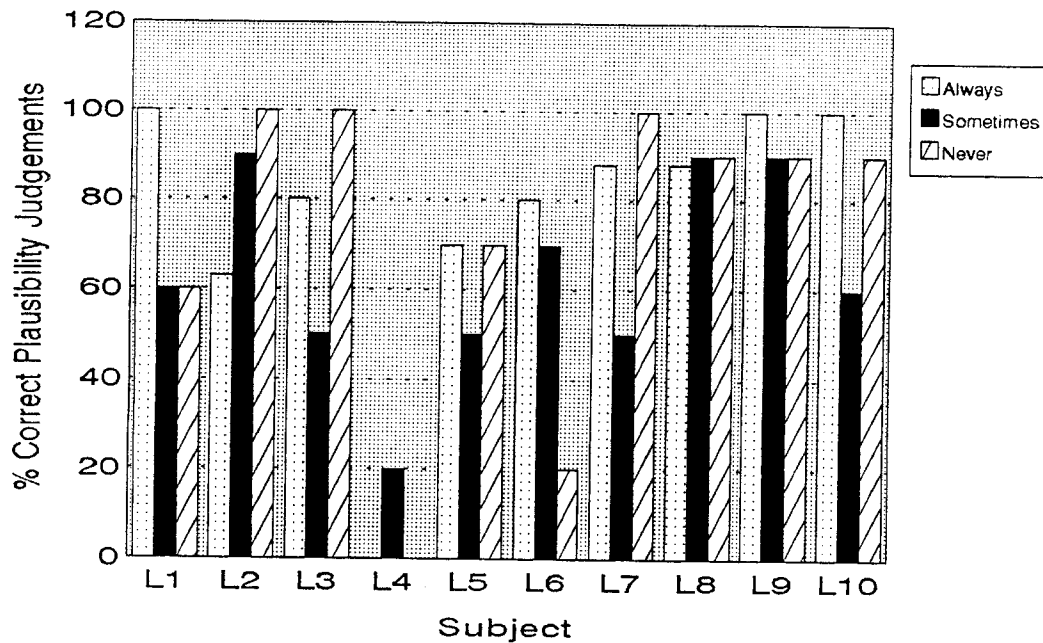


Figure 3. Percent correct plausibility judgements for always (A), sometimes (S), and never (N) statements by the left hemisphere brain-damaged group.

To determine which relationships were significant (group, statement type), a two factor repeated measures analysis of variance (1 between, 1 within) was performed on the data summarized in Table 2. There was a significant main effect for groups ($F(2,27) = 5.21; p < .01$) and statement type ($F(2,54) = 10.99; p < .01$), but no significant interaction ($F(4,54) = 0.78; p > .50$) suggesting that analysis of the two main effects was appropriate.

To evaluate the main effect for groups, Tukey's HSD tests were calculated on the differences among group means. The results indicated that NBD and RHD groups scored significantly higher than the LHD group and that NBD and RHD groups did not significantly differ from each other ($p < .05$).

To evaluate the main effect for statement type, dependent-measure t tests were calculated on the differences among statement type for the combined group. The Type I error level was adjusted to $p < .017$ ($.05/3$) to compensate for multiple comparisons (the Bonferroni inequality). The results indicated that subjects responded to *always* statements significantly more accurately than they responded to *sometimes* statements ($t(29) = 4.47; p < .001$); that they responded to *never* statements significantly more accurately than they responded to *sometimes* statements ($t(29) = 3.64; p < .001$); and they did not significantly differ in their response to *always* and *never* statements ($t(29) = 0.62; p > .50$).

context affects the ability to make inferences. Some studies have found that RHD adults do not appear to incorporate contextual variables when making inferences (Weylman, Brownell, Roman, and Gardner, 1989; Kaplan, Brownell, Jacobs, and Gardner, 1990). Other studies have shown that RHD adults do utilize contextual information to aid them in processing (Tompkins, 1991a, 1991b; Tompkins, Spencer, and Boada, 1994). Further research is needed to more thoroughly evaluate the effects of context on judging plausibility.

Although this study demonstrated that mildly impaired RHD subjects' ability to make plausibility judgements did not significantly differ from that of NBD subjects, it is possible that more severely impaired RHD subjects would have had greater difficulty judging plausibility. Furthermore, LHD subjects demonstrated significantly greater difficulty with this plausibility judgement task than did either the RHD or NBD subjects, as a group. Finally, all subject groups exhibited greater difficulty determining the plausibility of *sometimes* statements than *always* or *never* statements. Factors that need to be investigated further are the interaction between severity and task performance—especially for more severely impaired RHD subjects—and the disproportionate difficulty that LHD subjects experienced when compared with NBD or RHD subjects.

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APPENDIX A:

<i>Always statements:</i>	<i>Sometimes statements:</i>	<i>Never statements:</i>
A square always/ never has 4 sides.	Buses sometimes/ never run on time.	Books never/some- times walk.
The sun is always/ never hot.	Glass sometimes/ always breaks when dropped.	Three shoes never/ sometimes make a pair.
The sun always/never rises in the morning.	Cars sometimes/never start in the winter.	There are never/ always 25 hours each day.
A giraffe always/ never has a long neck.	Cars sometimes/ always start.	New York is never/ always a southern state.
Baseballs are always/ never round.	Cats sometimes/ always have claws.	Carrots never/always grow on trees.
Fire is always/never hot.	Lakes sometimes/ never freeze in the winter.	Mothers never/ always are male.
Ice is always/never cold.	Trees sometimes/ always have leaves.	Cats never/always bark.
A year always/never has 12 months.	Children sometimes/ always go to school.	Glasses are never/sometimes worn on your feet.
	Telephones some- times/never ring.	Balls are never/some- times square.
	Soup is sometimes/ never served cold.	Christmas is never/sometimes in November.