

Case Relations in Broca's Aphasia:  
Some Considerations Regarding Treatment

John D. Tonkovich  
The University of Kansas, Lawrence, Kansas

Investigators have noted that adults with Broca's aphasia are able to code grammatical (syntactic) constituents correctly in some contexts, but not others. A strictly syntactic interpretation using Chomsky's (1957, 1965) transformational grammar model has not been adequate to describe these inconsistencies. It has been suggested that semantic variables might, in part, play an important role in the encoding of grammatical constituents by adults with Broca's aphasia (Schnitzer, 1974).

Fillmore (1968, 1971) proposed an alternative model of generative grammar based on case relations. Case relations are semantic concepts of syntactic significance. According to case grammar theory, the basic structure of a sentence is presumed to be a verb and one or more noun phrases, with each element related to the other in terms of case relations. Perhaps one of the major advantages of this approach is that it avoids the difficulties inherent in deriving a semantic interpretation from syntactic structures. The notion that syntactic structures might be derived from a semantic base would appear to be useful in accounting for the grammatical encoding difficulties in Broca's aphasia.

A number of inherent weaknesses in the case grammar model have been noted. Brown (1973) suggested that the case grammar model had insufficient linguistic mechanisms to deal with some of the more complex structures of the normal adult language system. Bowerman (1973) and Leonard, Bolders, and Miller (1976) claimed that some case relations were too broad for categories presumed to be semantic in nature. Fillmore (1971, p. 264) himself suggested that he was "counting on [the] services [of magicians and witches]" to help him explain how a case grammar could operate. Despite some limitations, the case grammar model has been used effectively to describe children's early utterances (Bowerman, 1973; Brown, 1973) and those of language disordered children (Leonard *et al.*, 1976; Cupples and Koenigsknecht, 1977). Given the telegraphic nature of verbal output associated with Broca's aphasia, it would appear that the model could provide useful information as to the relationships between semantic and syntactic components in the verbal output of individuals with Broca's aphasia.

The purpose of this investigation was to examine the influence of case relation complexity on the language performance of normal English speaking adults and adults with Broca's aphasia. The experimental task was a sentence construction task, which required subjects to consolidate information from two or more sentences into a single sentential response. Specifically the study was designed to investigate the facility with which subjects utilized case relations in their responses to the experimental task; to attempt to describe the contexts in which semantic and syntactic formulations were likely to be produced correctly; to compare and contrast the responses of nonaphasic and aphasic subjects to the experimental stimuli; and to describe the case relation error patterns (e.g., case substitutions, omissions, and additions) of the aphasic subjects.

## Methods

Subjects. Ten adults with a history of left hemisphere brain damage and speech and language characteristics consistent with a diagnosis of Broca's aphasia according to the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan, 1972) served as the aphasic subjects. Additional selection criteria included: 1) brain injury occurring at least six months prior to participation in the study; 2) hearing sensitivity within normal limits at 500, 1000, and 2000 Hz (ANSI, 1969) in the better ear; 3) no reported pre-morbid communication impairment; 4) no significant speech mechanism anomalies; and 5) no significant auditory comprehension difficulties as measured by ten selected test items from the Revised Token Test (McNeil, 1973). Ten normal adult speakers with no history of brain damage served as control subjects. They were matched to the aphasic subjects on the basis of age (within two years), educational level completed (within two years), race and sex. In addition, control subjects were required to meet the following selection criteria: 1) normal hearing sensitivity; 2) no history of communication impairment; 3) no speech mechanism anomalies; and 4) accurate completion of ten selected screening items from the Revised Token Test (McNeil, 1973).

Procedures. The format for the experimental task was a sentence construction task, based on information presented in the context of short stories. The task was similar to story completion tests previously employed by Goodglass and Berko (1960) and Goodglass et al. (1972). Subjects were required to listen to 57 tape recorded stimulus items, and to verbally produce one sentential response per stimulus, which included all of the pertinent information contained in the story. Stimuli were constructed to elicit eight case relations. These were:

- AGENTIVE: The animate perceived as instigator of the action identified by the verb (e.g., "dog" in "The dog dug the hole").
- ESSIVE: The noun or noun phrase in a sentence which assumes the role of nominalizing or naming another case in the sentence (e.g., "boy" in "Ralph is the boy on the bus").
- GOAL: The object or endpoint of the action or event (e.g., "at Idlewild" in "The plane arrived at Idlewild").
- INSTRUMENTAL: The inanimate force or object causally involved in the action or state named by the verb (e.g., "hammer" in "He broke it with a hammer").
- LOCATIVE: The location or spatial orientation of the state or action identified by the verb (e.g., "on the radiator" in "The socks are on the radiator").
- OBJECTIVE: Anything represented by a noun whose role in the state or action identified by the verb depends on the meaning of the verb itself (e.g., "ball" in "Reggie caught the ball").
- SOURCE: The origin or starting point of the action or event (e.g., "his native country" in "He fled his native country").

TIME: The temporal orientation of the action or event (e.g., "yesterday" in "Laurie was here yesterday").

Target responses were intended to require two-, three-, or four-case combinations. For example, to elicit a three-case (Agentive + Objective + Instrumental) response, one of the stimulus items was:

Someone is stirring the juice. It is Betty.  
 She is stirring it with a spoon. We could say  
 that: (Betty is stirring the juice with a spoon).

All responses were tape recorded and analyzed by a panel of three judges, who determined the accuracy of the responses and types of errors (i.e., case substitutions, omissions, and additions).

### Results and Discussion

The experimental data were analyzed with respect to several different variables. First, the responses of the aphasic and control subjects were analyzed to determine whether the two groups responded differentially to two-, three-, and four-case stimuli. Utilizing the mean percentages of correct responses, two treatments x subjects analyses of variance were performed—one for each group (Table 1). In the first analysis, the effect

Table 1. Summary of Treatments x Subjects Analyses of Variance.

Source	SS	df	MS	F	p
<u>Aphasic Ss.</u>					
Subjects (S)	0.70	9	0.08	-----	----
Cases (C)	0.45	2	0.23	14.63*	.001
C x S	0.28	18	0.02	-----	----
<u>Control Ss.</u>					
Subjects (S)	0.46	9	0.05	-----	----
Cases (C)	0.33	2	0.17	7.96*	.005
C x S	0.38	18	0.02	-----	----

of number of cases was observed to be significant ( $F=14.63$ ;  $df=2/18$ ;  $p<.001$ ), indicating that as a group, aphasic subjects were not equally facile in responding correctly to stimulus items as a function of the number of case relations in those items. The effect of number of cases for the control subjects also was observed to be significant ( $F=7.96$ ;  $df=2/18$ ;  $p<.005$ ). This indicated that increasing the number of case relations in a sentence generated differing levels of difficulty for the control subjects as well. Post hoc comparisons using the Newman-Keuls test ( $p<.01$ ) were performed on

the data from the aphasic and control subjects. For both groups, all pair-wise mean comparisons were significant. This indicated that, in general, for both aphasic and control subjects, it was easier to produce a correct response to a stimulus item containing two case relations than one containing three or four, and easier when the stimulus contained three rather than four case relations.

In order to verify a difference between aphasic and control subjects on the experimental task, three pair-wise comparisons of mean scores for the three levels of case relation stimulus complexity were performed, using a t-test for independent means (Table 2). All pair-wise comparisons were significantly different beyond the .001 level, indicating that control subjects performed significantly better than aphasic subjects at each of the case relation complexity levels of the experimental task.

Table 2. Summary of Pair-Wise Comparisons\* Between Aphasic and Control Subjects' Mean Scores for Two-, Three-, and Four-Case Stimulus Items.

NUMBER OF CASES IN STIMULUS	MEAN CORRECT		t	p
	APHASIC	CONTROL		
Two	.375	.950	6.978	.001
Three	.205	.790	8.170	.001
Four	.077	.694	6.810	.001

\*t-test for independent means

A subsequent analysis of the data was performed on the subjects' case substitutions, case omissions, and case additions, to determine whether any of these error patterns were more typical of some cases more than others. Many of the case relation error patterns of the aphasic group were similar to those of the control group, except that there were a greater variety and frequency of errors in the aphasic group (Table 3).

Finally, another analysis was performed, utilizing the responses of the aphasic subjects to determine their facility in coding grammatical (syntactic) constituents (i.e., subject, verb, and object) in the context of various case (semantic) relations.

The following trends were noted in the aphasic group's error analyses:

1) Both the Agentive and Objective cases were remarkably well retained in the aphasic group's responses. These two cases were more likely to be produced correctly and less likely to be omitted (relative to other cases) in the responses of the aphasic subjects. These two cases were also more likely to be added to the aphasic group's responses than were other cases. Further, the aphasic subjects, as a group, were more likely to add an Agentive case in the context of stimuli which had no intended Agentive than in those which did. It is interesting to note that Bowerman (1973) in a case grammar analysis of early syntactic development in children across several languages, reported that all children used the Agentive and Objective cases in their early utterances. It is presumed that these two cases are linguistically robust because of their high informational content in sentences.

Table 3. Summary of Subjects' Correct, Substituted, and Omitted Case Relations in Their Responses.

Group	Case	% Correct	% Substituted	% Omitted	Total Occurrences
<u>Aphasic*</u>					
	Objective	61.8	22.2	16.0	562
	Agentive	61.2	23.8	15.0	227
	Essive	45.0	32.5	22.5	40
	Locative	47.0	12.1	40.9	257
	Source	29.1	29.1	41.8	110
	Goal	45.4	25.0	29.6	108
	Instrumental	35.2	21.6	43.2	185
	Time	53.7	10.2	36.1	166
<u>Control</u>					
	Objective	93.6	1.9	4.5	570
	Agentive	99.6	0.4	0.0	230
	Essive	50.0	50.0	0.0	40
	Locative	92.7	2.3	5.0	260
	Source	90.0	1.8	8.2	110
	Goal	93.7	3.6	2.7	110
	Instrumental	88.4	4.2	7.4	190
	Time	91.8	2.9	5.3	170

\*This summary table excludes 1.4% of the aphasic subjects' responses which were scored as "incorrect, but not specified."

2) The aphasic individuals appeared likely to substitute cases which were semantically similar (e.g., Source/Goal) rather than those which were semantically dissimilar (e.g., Agentive/Goal, Objective/Source). Particularly with respect to the Source and Goal cases, this finding might be explained by the difficulty Broca's aphasic individuals have with functors such as "from" and "to" which signalled Source and Goal cases in the experimental stimuli.

3) The aphasic subjects appeared to omit case relations in their responses, largely as a function of the stimulus contexts in which they occurred, and inherent constraints (e.g., semantic, syntactic, and informational variables) in the stimuli. For example, two stimulus items which contained the Instrumental case were designed to elicit the responses "John is cutting bread with a knife" and "The lady hit the singer with her shoes tonight." Subjects more frequently omitted "knife" than "shoes." This finding might be explained in terms of redundancy and predictability. That is, in the former item, the Instrumental "knife" is highly predictable from the other information in the sentence and therefore, is redundant. Conversely, in the latter example, "shoes" is fairly non-predictable and highly informational. It may be that the agrammatic Broca's aphasic individual tends toward using only those content words with inherent informational value in his/her verbal output, a strategy that is linguistically economical and efficient.

4) The Essive case, which occurred in stimulus items as the predicate nominative (e.g., Mary is the girl on the phone) appeared to be a redundant

feature with little informational value, and was not used efficiently by the aphasic individuals. The Essive case also was not efficiently used by the control subjects. A typical strategy for both aphasic and control subjects was to omit the Essive feature altogether in items requiring an Essive form. For example, when the intended response was "Mary is the girl on the phone," subjects were likely to produce the item as "Mary is on the phone."

5) There appeared to be a hierarchy of cases in the context of the grammatical subject of a sentence, which dictated facility in the production of subject-verb and subject-verb-object constructions by the aphasic group. The Agentive case as grammatical subject was better preserved in the aphasic group's responses than was the Instrumental case as grammatical subject. Further, the Instrumental case as grammatical subject appeared to be better preserved than the Objective case as grammatical subject in the aphasic group's responses. These findings lend empirical support for Fillmore's (1968) original notion about how case relations could function as grammatical subjects for English sentences.

6) When syntactic rather than semantic (case) constituents were analyzed, there appeared to be a hierarchy with respect to facility of production of grammatical constructions by the aphasic group. The aphasic individuals produced verb-object responses correctly more often than subject-verb constructions. They produced subject-verb responses correctly more often than subject-verb-object constructions, and subject-verb-object constructions correctly more often than object-verb constructions. These findings are consistent with those of Goodglass et al. (1972) and Gleason et al. (1975) for adults with Broca's aphasia.

Several problems arose in the analysis of the subjects' responses. One of these had to do with case ambiguity. Nilsen (1973) suggested that certain cases were likely to be confused when the preposition marking those cases was the same. Although the experimental stimuli were constructed without duplication of prepositional forms to signal different cases, several responses evidenced duplicated prepositional forms. For instance, one aphasic subject responded "woman sent by Georgia on Tuesday" to the stimulus which attempted to evoke "A lady will be sent to Georgia on Tuesday." One wonders whether by Georgia in this instance is Agentive (i.e., An animate Georgia will send the woman.), Instrumental (i.e., An inanimate Georgia will send the woman.) or Locative (i.e., The woman will be sent in close proximity to Georgia.). Despite the contextual information in these types of responses, the case relation intended by the speaker is not clearly identifiable at a surface structure level.

Other problems were encountered when action verbs were deleted in the response, since case relations are defined largely with respect to the verb. Case ambiguities and verbal deletions accounted for 1.4% of the aphasic group's responses. Certain experimental limitations also resulted from the nature of the experimental task, with constraints imposed by the stimulus items. It should be noted that the encoding process used to formulate the reconstructed sentences of the experimental task may not be identical with the encoding processes used by adults with Broca's aphasia in spontaneous conversational discourse. Despite these and other limitations, the present findings may have some important implications for speech and language therapy for the individual with Broca's aphasia.

A number of therapy programs and materials for the agrammatic Broca's aphasic adult have focused disproportionately on naming, with little regard

for other aspects of expressive language production. The underlying assumption of this approach to aphasia therapy is that if the client's word repertoire (particularly content word repertoire) is enhanced, he/she will be more facile at producing meaningful, comprehensible utterances, even if they are telegraphic. The findings of the present investigation however, suggest that the Essive case (the case relation which occurs with naming), in and of itself, may be highly redundant, and its use in language rehabilitation for the individual with Broca's aphasia is therefore questioned. A more productive alternative to extensive naming drill in therapy might be to increase the number of contexts in which a particular lexical choice might be used to convey different case relations. For example, for the lexical item "table," the client might verbally use this item for each of the following stimulus contexts"

- 1) The table broke the lamp. (Instrumental)
- 2) The table fell. (Objective)
- 3) The vase fell from the table. (Source)
- 4) She put flowers on the table. (Locative)
- 5) The mosquito flew to the table. (Goal)

By using such an approach, instead of increasing the lexical repertoire of the individual with Broca's aphasia, the semantic-syntactic repertoire would be enhanced with the lexical repertoire available residually. While it is not the intent of this paper to purport that Broca's aphasia reflects a regression to the early stages of language acquisition, it should be noted that this strategy is not unlike what normal young children do in their acquisition of expressive syntax.

There appears to be a complex interaction between semantic and syntactic relations operative in Broca's aphasia. For instance, the apparent hierarchy of grammatical relations (i.e., verb-object constructions better preserved than subject-verb constructions), coupled with the apparent hierarchy of case relations associated with the grammatical subject (i.e., Agentive subjects better preserved than Instrumental subjects) might also be useful in developing a hierarchy for treatment strategies. For instance, initial attempts at expanding verbal output might begin with the stabilization of verb + object constructions prior to proceeding to Agentive subject + verb combinations, and so forth.

Finally, manipulating the information content in stimulus items might also be worthwhile in facilitating the expansion of verbal output in individuals with Broca's aphasia. Creating stimulus items that intend to evoke non-predictable and therefore highly informational case relations might promote syntactic expansion. For instance, stimulus items might be constructed to evoke non-predictable Instrumental cases. Items such as "John cut bread with a hatchet" or "John cut bread with a razor blade" might facilitate the Broca's aphasic speaker's inclusion of the Instrumental case more readily than items such as "John cut bread with a knife," and serve to establish expanded syntactic output as well.

These clinical implications are highly speculative, and are subject to further research and clinical investigation. The characteristically telegraphic verbal output of the Broca's aphasic patient lends itself easily to test the case grammar model. The model might indeed prove to be useful to the speech-language pathologist in remediating agrammatic aspects of Broca's aphasia, without assistance from magicians and witches.

## References

- Bowerman, M. Early Syntactic Development: A Cross-Linguistic Study with Special Reference to Finnish. London: Cambridge University Press (1973).
- Brown, R. A First Language: The Early Stages. Cambridge, Massachusetts: Harvard University Press (1973).
- Chomsky, N. Aspects of the Theory of Syntax. Cambridge, Massachusetts: MIT Press (1965).
- Chomsky, N. Syntactic Structures. The Hague: Mouton and Company (1957).
- Cupples, W.P. and Koenigskecht, R.A. Case grammar analysis of the language of preschool children. Paper presented to the American Speech and Hearing Association, Chicago, Illinois (1977).
- Fillmore, C.J. Some problems for case grammar. In R.J. O'Brien (Ed.), Report of the Twenty-Second Annual Round Table Meeting on Linguistics and Language Studies. Washington, D.C.: Georgetown University Press (1971).
- Fillmore, C.J. The case for case. In E. Bach and T. Harms (Eds.), Universals in Linguistic Theory. New York: Holt, Rinehart and Winston (1968).
- Gleason, J.B., Goodglass, H., Green, E., Ackerman, N., and Hyde, M.R. The retrieval of syntax in Broca's aphasia. Brain and Language, 2, 451-471 (1975).
- Goodglass, H. and Berko, J., Agrammatism and inflectional morphology in English. J. Speech Hearing Res., 3, 257-267 (1960).
- Goodglass, H., Gleason, J.B., Bernholtz, N.A., and Hyde, M.R. Some linguistic structures in the speech of a Broca's aphasia. Cortex, 8, 191-212 (1972).
- Goodglass, H. and Kaplan, E. The Assessment of Aphasia and Related Disorders. Philadelphia: Lea and Febiger (1972).
- Leonard, L.B., Bolders, J.G., and Miller, J.A. An examination of the semantic relations reflected in the language usage of normal and language-disordered children. J. Speech Hearing Res., 19, 371-392 (1976).
- McNeil, M.R. A psychometric revision of the Token Test: The Revised Token Test. Paper presented to the American Speech and Hearing Association, Detroit, Michigan (1973).
- Nilsen, D.L.F. The Instrumental Case in English: Syntactic and Semantic Considerations. The Hague: Mouton (1973).
- Schnitzer, M.L. Aphasiological evidence for five linguistic hypotheses. Language, 50, 300-315 (1974).

## Discussion

- Q: Were the Essive cases in your stimuli predictable or non-predictable?
- A: Half were predictable ones, such as "Mary is the girl on the phone"; half were non-predictable, such as "The animal in the house is a rat." There did not seem to be any differences between predictable and non-predictable Essive forms however, as both aphasic subjects and control subjects tended to omit the Essive case from these responses.
- Q: What is the advantage of a case grammar as opposed to a transformational grammar?
- A: In the transformational grammar model, one must infer semantic meaning



from surface structures. That is, meaning is represented in the more abstract deep structure. A case grammar avoids this inference by bringing semantic meanings to the surface. Of course, sometimes the surface cases are ambiguous, and one still must infer the meaning of the utterance, however the case grammar model minimizes the occurrence of this.