Verbal inflection deficit in Kurdish-speaking aphasia patients

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Abstract

Introduction: Aphasia is a language disorder which can affect different aspects of language production and comprehension. Broca's aphasia is a non-fluent type of aphasia in which patients suffer from a deficit in the use of function words and inflectional categories of the verb.
Materials and methods: Two Kurdish- Speaking patients diagnosed with Broca's Aphasia were selected to be investigated for their linguistic performance in the main inflectional categories of verbs including grammatical agreement, tense and aspect. To collect the data, natural conversations of the patients were recorded to be analyzed. Sentence Completion Task (SCT) was, also, employed to find the less frequent inflectional categories. SPSS version 23 was utilized to analyze the collected corpora.
Results: Both patients had a relatively intact agreement system, while both committed a higher number of errors as far as grammatical tense is concerned. Finally, the worst linguistic performance for the two patients was reported to be in the appropriate use of markers to represent grammatical aspect.
Conclusion: Grammatical aspect was found to be the most problematic inflectional category, while grammatical agreement was the least severely damage category for Kurdish-speaking aphasic patients.

Keywords: Broca' aphasia, Inflectional category, Agreement, Tense, Aspect

Introduction

Aphasia is most often the result of a damage to the left hemisphere. It can be characterized as a deficit in processing symbolic materials appearing in different modalities of language function such as speaking, writing and reading (1). For 95.97 percent of right-handed and 70 percent of left-handed people, it is proved that language faculty is located in the left hemisphere (2). In addition to stroke as the main cause of language aphasia, traumatic brain injury, a tumor, or an infection are among the other possible causes of aphasia. The middle cerebral artery (MCA) is the main supplier for the language areas of the brain. A stroke, which can appear in the form of thrombotic or embolic occlusion of blood vessels, causes cerebral infractions that result in the stopping of blood supply to the infected areas (3). A cerebral hemorrhage ruptures blood vessels through bleeding into cerebral tissues. Moreover, bacterial or viral organisms contribute to aphasia. Based on the lesion site and the severity of the lesion, different types of aphasia are identified and described.

Boston Diagnostic Aphasia Examination (BDAE) developed by Goodglass set out a classification to differentiate different language disorders (4, 5). According to this framework, pre-Rolandic lesions may lead to non-fluent speech output and temporal and temporo-pariental lesions can lead to fluent speech output. Accordingly, Broca's aphasia, global aphasia and transcortical motor aphasia are categorized as being non-fluent aphasia. As the main type of non-fluent aphasia, Broca's aphasia is characterized as a telegraphic speech in which function words including pronouns and prepositions are often dropped or substituted. Grammatical morphemes used to represent important inflectional categories are also omitted or substituted (6). Patients have no difficulty in language comprehension, although complex sentences may be poorly understood. Transcortical motor aphasia as a second type of non-fluent aphasia is characterized by a relatively intact comprehension and repetition, and few spontaneous utterances. Finally, global aphasia is the most serious type of non-fluent aphasia where the patient basically has no or limited language production, often with apraxia of speech and impaired language comprehension.

Patients suffering from Wenicke's aphasia, as the main type of fluent aphasia, produce verbal paraphasias and neologism or jargons in their speech. Sentence comprehension, repetition and naming are impaired. Another type of non-fluent aphasia is anomia aphasia in which patients have word finding problem and unable to name people and entities (2). Finally, conduction aphasia is characterized with many phonemic paraphasias especially during repetition. The patients have repetitive attempts to correct their own verbal output. However, different types of fluent aphasia are excluded in the present study. Instead, this study deals with the agrammatic patients' performance of main inflectional categories of verbs including grammatical agreement, tense and aspect .

Inflectional errors are among the most prominent features of non-fluent aphasic patients (7, 8). Grammatical features expressed by inflectional morphemes include tense, agreement, mood, aspect, voice, negation, etc. A damage to the brain may not equally disturb these features. Some studies present evidence that grammatical agreement is less affected comparing with tense or aspect (9, 10). Others argue that in many patients it is not possible to distinguish clear patterns of impaired grammatical features such as agreement or tense. Function words and inflectional categories are notorious for the problems that they raise for agrammatic aphasic individuals. The present study set out to investigate the linguistic representation of the main inflectional categories including grammatical agreement, tense and aspect in two Kurdish-speaking patients.

Materials and methods

Two Kurdish-speaking aphasic subjects were chosen to be interviewed. They were close relatives of the researchers, so they were selected for the ease of access. Both developed aphasia as a result of stroke in the temporal part of their left hemisphere. The first patient (NG) was 77 years old who had a lesion in the left hemisphere. She is right-handed and uneducated. She has no problem in comprehension, but her language production is severely affected. Most of the function words are deleted. In addition, she is not able to use the appropriate inflected form of the verbs. The second patient (FG) is 65 years old. He is a native a speaker of Kurdish language with a little familiarity with Persian language. He is uneducated and left handed. The lesion site for this patient is reported to be fronto-temporal part of the left hemisphere. His language comprehension is relatively intact, while his language production is laborious and effortful, accompanied with short sentences, simple syntax and frequent pauses. Function words and verbal inflectional markers of tense, agreement

and aspect are frequently deleted or substituted. The relevant statistics of these two subjects will be presented in the next section. Based on the symptoms and the lesion type, both patients were clinically diagnosed as suffering from Broca's aphasia. In this study, it is intended to investigate these two patients' performance in the main inflectional categories of verbs including grammatical agreement, tense and aspect.

Two tasks were employed to collect data: interview and sentence completion task. Since, the patients were close relatives, the researchers had no problem to approach them. They were even aware of the goals of the study, so they were totally cooperative in the process of data collection. It was intended to elicit spontaneous speech by asking them some questions about their daily activities. It was predicted that some grammatical features may be missing in the collected data, so a targeted questionnaire was constructed to help the patients to produce the target feature. As stated earlier, in this study, it is intended to assess the patients' ability to use the linguistic markers to represent grammatical agreement, grammatical tense and grammatical aspect. For each category, two subcategories are identified. As for agreement, a distinction is made between subject and object agreement. Kurdish language has two separate set of affixes to represent each subcategory. Another distinction was made between past and non-past tense to be assessed for the patients. Finally, perfect aspect was distinguished from imperfect aspect on the ground that for each subcategory, Kurdish language has its own linguistic tools. In the employed questionnaire, 15 items for each subcategory (totally 90 items) are included. For each item, a grammatical Kurdish sentence is produced (cue sentence), the patient is expected to utter the same pattern with a different person/ number, tense or aspect. To help the patients to produce the target feature, sometimes the second sentence is started (by the researcher) and the patient is, then, allowed to complete it. The collected data were analyzed using SPSS software version 23. Descriptive statistics including frequency and percentage were calculated for the normal and abnormal responses of the subjects. Chi-square was employed to assess the relation between different variables.

Results

As explained in the previous section, this study is intended to investigate grammatical agreement, grammatical tense and grammatical aspect of two aphasic patients. It is, also, intended to find which one of these categories is more severely impaired in the two patients. Since each category is subdivided into two subcategories, the patients' linguistic performance will be, also, analyzed to find any language disturbance in terms of these subcategories. It is possible to compare both the three language categories (and their related subcategories) of each patient with each other and with that of the next patient. The following table (Table 1) presents the frequency of normal and abnormal responses of each patient in the three investigated categories. This table displays that that the proportion of abnormal responses (errors) in patient 1 is 14%, 30.8% and 45.5% for grammatical agreement, grammatical tense and grammatical aspect respectively.

Table 1. The frequency distribution of normal and abnormal responses of the patients based on 'Grammatical agreement', 'Grammatical tense', and 'Grammatical aspect'

Patients		Grammatical agreement		Grammatical tense		Grammatical aspect	
		Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Patient1	Frequency	209	34	153	68	122	102
	Percent	86	14	69.2	30.8	54.5	45.5
Patient 2	Frequency	238	19	195	33	176	58
	Percent	92.6	7.4	85.5	14.5	75.2	24.8

In other words, this proportion is highest for grammatical aspect and lowest for grammatical agreement, while grammatical tense falls in between. As for the second patient, almost the same pattern is observed. The same table reveals that out of the total number of 343 collected instances for grammatical agreement, only 7.4% of instances were found to be abnormal. The proportion of errors (abnormal responses) in Patient Two for grammatical tense and grammatical aspect is 14.5% and 24.8%, respectively. Figure 1 illustrates the proportion of abnormal responses of the two patients in the three investigated language categories.

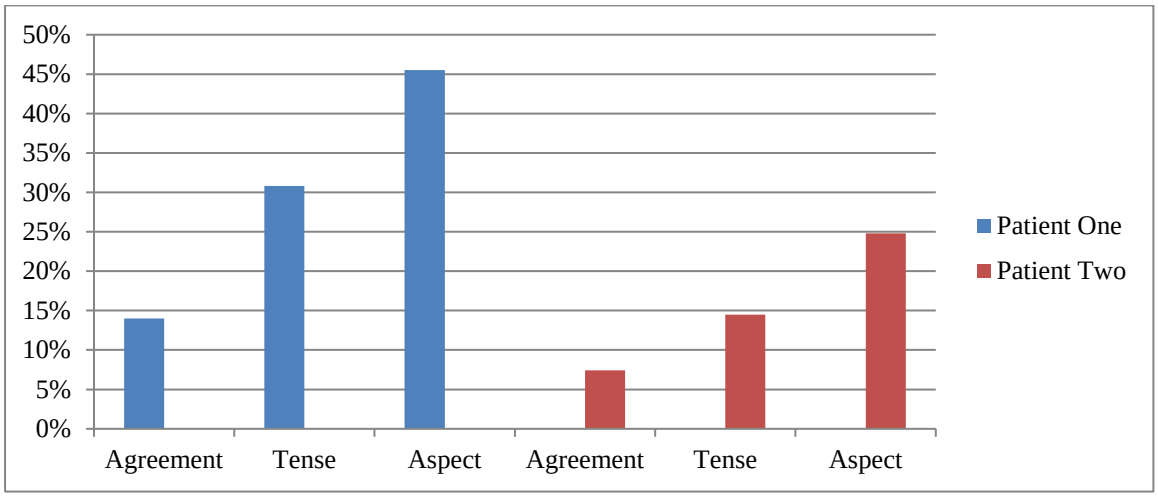

Figure 1. The proportion of abnormal responses of the patients in grammatical "Agreement", "Tense", and "Aspect".

Comparing the two patients, it can be observed that Patient One has committed a higher degree of abnormal responses in the three grammatical categories. This figure, also, illustrates that although a great variability is observed in the two patients' performance in the three investigated categories, however, both follow a systematic pattern. In both, 'grammatical agreement' is found to be the least impaired and 'grammatical aspect' is found to be the most impaired, while 'grammatical tense' fall somewhere in between. To find whether the above differences both between (and within) the patients are meaningful or not, X^2 was run.

As the Table 2 reveals the employed chi-square shows that the attested difference between (the proportion of errors of) 'agreement' and 'aspect' is found to be statistically significant as far as the first patient is concerned, the same comparison for the second patient is found, also, to be statistically significant for the second patient. In the same vein, the attested difference between 'tense' and 'aspect' for both patients is proved to be significant (since P value is < 0.05). Finally, the comparison between agreement and tense is neither significant for the first patient nor for the second one.

Table 2. Chi-square test to compare the categories.

Comparison of categories	Agreement-Tense		Agreement-Aspect		Tense-Aspect	
Test	X^2	P	X^2	P	X^2	P
Patient 1	1.53	.215	4.10	**.043**	.895	**.044**
Patient 2	.512	.474	.881	**.048**	4.26	**.039**

As referred to earlier, agreement as a grammatical construct is subdivided to subject agreement and object agreement. This study is intended to compare each patient's performance regarding subject and object agreement. The two patients can

be, also, compared. Table 3 presents the frequency distribution of normal and abnormal responses of the two patients in terms of subject and object agreement.

Table 3. The frequency distribution of normal and abnormal responses of the patients based on "subject" and "object" agreement.

Patients		Subject agreement		Total	Object agreement		Total
		Normal	Abnormal		Normal	Abnormal	
Patient 1	Frequency	196	25	221	13	9	22
	Percent	88.7	11.3	100	59.1	40.9	100
Patient 2	Frequency	216	13	229	22	6	20
	Percent	94.3	5.7	100	78.6	21.4	100

This table shows that out of the total number of 221 instances of collected subject agreement, 11.3% of the instances are judged to be abnormal for the first patient by the present researchers. The relevant figure for the second patient is 5.7%. As for object agreement, the proportion of abnormal errors for the first and second patients is 40.9% and 21.4%, respectively.

In the same vein, "grammatical tense" is subdivided into "past" and non-past". In other words, we meant to find any difference in the performance of the two aphasiac patients regarding this sub-division. Table 4 presents the findings of the study as far as "past and non-past" is concerned.

Table 4. The frequency distribution of normal and abnormal responses of the patients based on "past" and "non-past" tense

Patients		Past tense		Total	Non-Past tense		Total
		Normal	Abnormal		Normal	Abnormal	
Patient 1	Frequency	67	35	102	86	33	119
	Percent	65.7	34.3	100	72.3	27.7	100
Patient 2	Frequency	79	16	95	116	17	133
	Percent	83.2	16.8	100	87.2	12.8	100

As the table indicates, out of the total number of 102 collected sentences with past tense verbs, 34.3% of the instances are recognized as being abnormal for the first patient. As for sentences with non-past verbs, the figure is a little lower (27.7%) for the same patient. The proportion of the errors for the second patient is 16.8% and 12.8% for past and non-past verbs respectively. Comparing the committed errors by the two patients makes it clear that the first patient is at least twice worse than the second patient.

Finally, the aphasic patients' performance in terms of aspect was analyzed in terms of two separate subcategories: perfect and imperfect aspect. Table 5 presents the relevant statistics of the two aphasiac patients as far as perfect-imperfect is concerned.

Table 5. The frequency distribution of normal and abnormal responses of the patients based on "perfect" and "imperfect" aspect.

Patients		Perfect aspect		Total	Imperfect aspect		Total
		Normal	Abnormal		Normal	Abnormal	
Patient 1	Frequency	106	70	176	16	32	48
	Percent	60.2	39.8	100	33.3	66.3	100
Patient 2	Frequency	142	41	183	34	17	51
	Percent	77.6	22.4	100	66.7	33.3	100

For the first patient, a total number of 48 and 176 sentences with imperfect and perfect aspect were collected. The proportion of errors for imperfect aspect is

66.7% which is a relatively high amount. The statistics for perfect aspect for the same patient is 39.8%. Comparing the obtained results for the second patient with the first patient reveals that second patient is less severely damaged, although he has a relatively high degree of errors (33.3%). Figure 2 clarifies the attested differences between (and within) the patients.

This figure illustrates that in all the subcategories, the proportion of the errors for the first patient is higher than the second patient. This implies that these subcategories are more severely impaired in the first patient. Furthermore, this figure clarifies that subject agreement is the least impaired subcategory and imperfect aspect is the most difficult subcategory to produce for aphasiac patients. In addition, correct use of object agreement markers is a more challenging task for the patients than subject agreement markers. The same is true with aspect. To form a sentence with imperfective aspect is a more formidable task for the patients than forming a sentence with perfective aspect. The statistics for past and non-past tense are, somehow, close to each other.

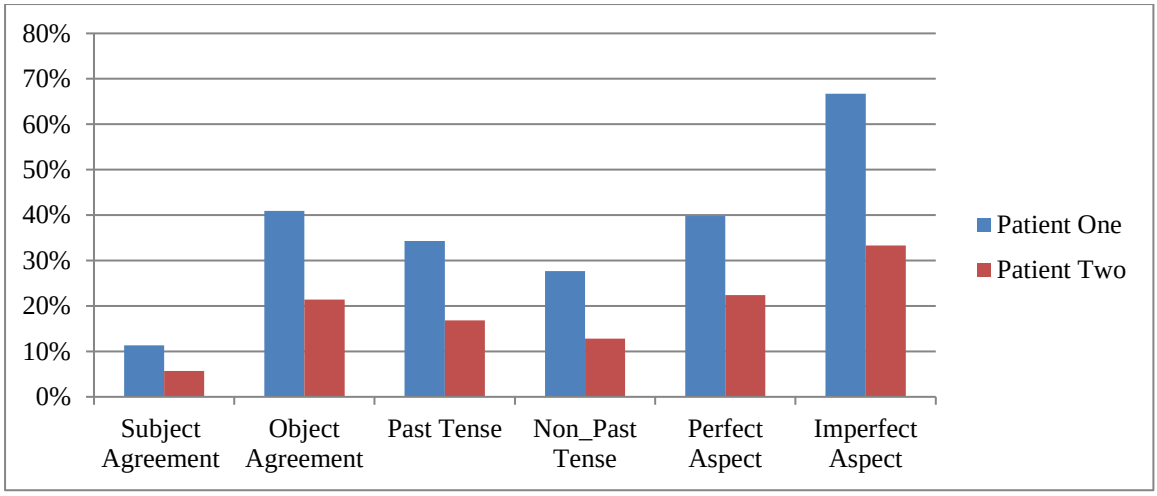

Figure 2. The proportion of abnormal responses of the patients in six investigated subcategories.

Table 6. Chi-square to compare the sub-categories.

	Subject agreement-Object agreement		Past tense-Non-past tense		Perfect aspect-Imperfect aspect	
	X^2	P	X^2	P	X^2	P
Patient 1	.082	**.033**	1.987	.159	17.143	**.000**
Patient 2	14.725	**.000**	.062	.803	2.342	**.000**

To find whether these attested differences are statistically significant or not, X^2 is run. The employed chi-square indicates that the comparison between subject agreement and object agreement for both patients is statistically significant. This implies that the attested difference (in the proportion of errors) in the use of subject markers and object markers is found to be meaningful (Table 6). Figure 2 indicated that the patients had a relatively intact subject agreement system, while in object agreement, both patient showed a high degree of abnormal responses. As for the comparison of past and non-past tenses, no significant relation was found. Finally, the difference in the use of perfect and imperfect aspect was statistically significant for both patients. As indicated in Figure 2, both patients had a worse performance in the use of linguistic markers to represent imperfect aspect.

Discussion

The results of the present study showed that in the two patients grammatical subject

agreement was relatively intact, while the patients had a relatively poor performance as far as object agreement is concerned. Although, agreement has been subject of many studies (10, 11), but the distinction between subject and object agreement was not noticed in the previous literature. This can be regarded as the innovation of the present study. As for grammatical tense, the patients committed more errors than agreement. Finally, the two patients' performance in grammatical aspect was worse than the first two categories, although in imperfect aspect a higher number of errors were reported.

Since Kurdish is a relatively synthetic language, several functional categories can be realized in the verb. The tense markers are closer to the verb than agreement markers. Object agreement markers are more peripheral than subject agreement markers. In contrast, aspect markers which are sometimes fused with tense markers are attached the stem, provided that they are expressed synthetically (12). According to the sequence of the inflectional categories in Kurdish language verbs, the following structure is proposed:

CP > MoodP > NegP > AgrP > VoiceP > AspectP > VP.

The results obtained in the present study do not violate this hierarchy which is called by Freidman & Grodzinsky as tree-pruning hypothesis (TPH). Friedman & Grodzinsky (9) and Grodzinsky (11, 13) attribute verbal inflectional errors to a breakdown of functional categories and their projections. They argue that impairment in agrammatic production can be related to a deficit in the syntactic tree. They propose that any node in the syntactic trees of aphasic individuals can be impaired. If a given node is impaired at a given level of projection, no higher projections can be constructed, but lower level projections will be intact. Other studies confirm TPH. Plakouda investigated agreement, tense and aspect in a Greek-speaking non-fluent aphasic patient (11). Plakouda reported that in this patient the most problematic category was grammatical aspect to express. This finding confirms the obtained results of the present study in the same as Stavrakaki & Kouvava does (14). They reported that agreement was the least problematic issue for the two aphasic subjects, while both patients encountered some difficulties in the production of past tense forms. However, they showed that perfective aspect was the worst category.

Conclusion

Based on the findings, it is concluded that grammatical agreement was the least damaged category, although the patients had a relatively poor performance as far as object agreement is concerned. Regarding grammatical tense, it was found that the patients committed more errors than grammatical agreement. Another conclusion which can be made based on the results was that grammatical aspect (both perfect and imperfect) was reported to be more severely damaged in the two patients. Theoretically, the obtained results of the study do not violate Freidman & Grodzinsky hierarchy called tree-pruning hypothesis (TPH), although it can be challenging for this hypothesis as far as grammatical object agreement is concerned.

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