COMPREHENSION AND PRODUCTION OF PREPOSITIONS BY PALESTINIAN-SPEAKING BROCA'S APHASICS

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Abstract

The aims of the present study were (a) to investigate the behavior of Broca's aphasics in using prepositions in Palestinian Arabic; (b) to examine whether the patterns of errors are comparable to those found in other languages and (c) to see what the findings tell us about the underlying source of preposition deficit. Spontaneous speech samples of three participants with Broca's apahasia was recorded. The results indicate that prepositions were predominantly omitted, indicating a significant dissociation between the temporal and spatial prepositions. The findings are consistent with findings from other languages. The results may contribute to neurolinguistic research across different languages, especially given that Palestinian Arabic is studied significantly less than other Arabic dialects and languages.

Keywords: *Aphasia, Agrammatism, Prepositions by Palestinians with Broca's aphasia*

Aphasia is defined as a disturbance in the ability to interpret and formulate language as a result of damage to certain subsystems of the brain, mainly the temporal lobe or higher up in the frontal lobe (Hickok, 2010). Expressive speech of individuals with Broca's aphasia is typically characterized as agrammatic, due to the fact that omission and substitution of functional words dominate their output (Caramazza & Zurif, 1976; Howard, 1985). Free grammatical morphemes such as determiners, conjunctions, prepositions, pronouns, and auxiliary verbs are omitted, and bound grammatical morphemes such as noun and verb inflections are substituted (Grodzinsky, Swinney, & Zurif, 1985; Grodzinsky, 1990; Gentner, 2001).

Prepositions are reported to be frequently omitted in agrammatic aphasia. Nevertheless, only relatively few studies have focused on prepositions, with the aim of identifying the underlying reasons for their deficit (Friederici, 1981; Druks & Froud, 2002; Kemmerer, 2005). The neglect of prepositions in aphasia research is surprising because prepositions are a paticularly interesting grammatical class to study. Furthermore, they share properties of both lexical and functional categories (Herskovits, 1986). This is reflected in the ongoing debate among linguists as to how to characterize them (Lindstromberg, 1998; Grimshaw, 2005). In general, review of research on prepositions in aphasia indicate that high frequency prepositions are better preserved than low frequency ones and meaningful prepositions are better preserved than meaningless prepositions (Friederic, 1981; Leikin, 2002). In fact, many definitions have been established for agrammatism. Some of these restrict it only to production. For example, Howard (1985) described agrammatism as impairment in structural words, considering it a misuse of rules of words. However, other studies revealed comprehension disorders among agrammatic patients (Caramazza, Capasso, Capitani, & Miceli, 2005).

In their comprehensive data about the main features of agrammatism in 14 languages, Menn and Obler (1990) made it possible to explore how the closed classes are omitted or replaced by other items and how this differs from one language to another. They revealed that while free grammatical morphemes are generally susceptible to omissions, bound grammatical morphemes are mainly substituted for other items. On the other hand, bound grammatical morphemes are omitted rarely by the examined aphasics, but are usually replaced by more frequent and less marked forms. Results obtained from several studies indicate that in highly inflected languages like the Semitic languages, substitutions predominated over deletion errors (Grodzinsky, 1986).

A number of theories that aimed to explain the language deficits of agrammatic patients have been proposed. In this account, one early proposal was made by Caramazza and Zurif (1976) who indicated that agrammatic subjects display a complete breakdown in syntax. However, in their investigation of the omission of free grammatical morphemes, Menn and Obler (1990) found differences in the extent of the morphologic deficit based on the structure of the language. Similarly, individual differences pertaining to severity of the deficit, site of lesion and psychological factors, come into play.

A preposition may be defined as a connecting word showing the relation of a noun or a noun substitute to some other word in the sentence

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(Grimshaw, 2005). Basically, prepositions are special words that link nouns, pronouns, or words, acting as nouns to other parts of the sentence. For example, the preposition "on" in the sentence (the bird is on the tree) shows the relationship between the bird and the tree. Thus, prepositions reveal the relationship of time, space or other relationships between ideas. The noun or pronoun to which a preposition connects is referred to as an object of the preposition. Taken together, the preposition and the object of the preposition are called a prepositional phrase.

Prepositional phrases in Arabic are similar to those in English. For example, they indicate position [ʕala tˤtˤa:wlih] [on the table], direction [ʔila: ʔal madrasa] [to school], time [fis- sa: ʕa al xa:misa] [at five clock], means [bis sajja:rra] [by car] or agent by referring to the one doing an action with a passive voice verb [kusira alz zudʒa:dʒu min qibali aħad attˤulla:b] [The glass was broken by one of the students].

On the whole, prepositions are used to express a number of relationships including time, location, manner, means, quantity, purpose and state or condition (Lindstromberg, 1998). It is important to note, however, that the meanings of prepositions are extremely complex and multidimensional. Many studies have focused on the meanings of the spatial/locative prepositions that are in general considered to be a class of grammatical morphemes used to express static spatial relationships between objects (Bolinger, 1997; Lindstromberg, 1998). The structure of prepositions involves the thing to be located which is called the "figure," and the object which operates as a point of reference called the "ground" or "landmark." For instance, in the sentence, "the glass is on the table," the noun-phrase (the glass) serves as the figure; the noun-phrase (the table) determines the landmark and the preposition *on* specifies the nature of the spatial relationship between them as much literatures indicates (Sandra & Rice, 1995; Lindstromberg, 1998).

However, establishing a comprehensive meaning for the locative prepositions is difficult because of their high adjustment to different geometric circumstances in a spatially complex word. Many prepositions, however, bear not only spatial relationships, but also multiplicity of semantic functions. For example, in Arabic the preposition [fi:] [in] can refer not only to spatial reference like [al kita:bu fil durdʒ] [the book is in the drawer], but also to a moment in time [sajasilu fi:lqita:r assa:ʕaal Tha: mina] [I will arrive by train at eight o'clock].

The significance of the present study

Much research has been conducted to characterize the aspects of language and speech abnormalities of aphasics in English compared to those in Arabic. In this respect, results of studies on English are not necessarily applicable to Arabic. To the researcher's knowledge, little research has been done in this field in the Arab world and in Palestine in particular. The current study is a step towards filling this gap, particularly by studying the production and comprehension of prepositions by Palestinian speakers diagnosed with Broca's aphasia. The results of the study might have its implications for training persons with Broca's aphasia and developing assessment tests for measuring the agrammatic performance on prepositions in Arabic.

Objectives of the present study

Language in perosns with agrammatism can be characterized with impaired production of grammatical morphemes, including prepositions. In this respect, the aim of the present study is to investigate the extent of the deficit in the production and comprehension of prepositions in a group of Palestinian speakers with Broca's aphasia, and to examine whether they exhibit patterns of errors are comparable to those found in other languages. The study also aims to see what the findings tell us about the underlying source of the preposition deficit.

Method

Subjects

This study tested three male Palestinian speakers with Broca's aphasia. Palestinian Arabic was their native langauge and they were from the same region. They were all right handed with no significant history of educational problems. Subjects were diagnosed with Broca's aphasia based on both the Boston Diagnostic Aphasia Examination (Goodglass & Kaplan, 1983) and the Bilingual Aphasia Test (Jordanian Arabic version) (Paradis, 1987). All were diagnosed with mild to moderate Broca's aphasia. Hearing was within normal limits with no evidence of dysarthria or visual impairments. The subjects were suffering from a single left hemisphere lesion for at least six months prior to testing. Clinical reports indicated that some of them displayed an earlier history of heart trouble, hypertension and high cholesterol levels.

Data Collection and Analysis

Samples of spontaneous speech were collected from all three subjects. Subjects were tested individually in a quiet room. The experimenter maintained informal conversation and gave the subjects under study an opportunity to talk freely. The questions in the semi-conducted

interview were equivalent to the questions of the Aachen Aphasia Test (AAT) (Huber, Poeck, Weniger, & Willmes, 1983). The samples were directed around the description of a situational picture –the 'Cookie Theft' picture from the Boston Diagnostic Aphasia Examination Test (BDAE) (Goodglass & Kaplan, 1983).

For the description of the *Cookie theft* picture no time limit was imposed and each subejct was seated at a table with the experimenter seated by him. As the pictures were presented, the participants were told to "Tell me everything you see happening in this (these) pictures". For example, they were instrcuted to describe the picture, saying where it takes place, who is shown in the picture and what they are doing. However, if a participant was not able to describe the picture in enough detail, assistance was often provided by giving it out in a certain way. Thus, the experimenters would ask *we:n el walad u shu ibjʕmal?* "Where is the boy and what is he doing?", but without given any direct indication of a place or the manner of an action, such as *we:n elwald waqif u shu ibjʕmal?* "What is the boy standing on, and what is he doing?".

Data were obtained in two sessions (one hour sessions). The speech samples were tape recorded and then transcribed by the investigator in a quiet room. Another trained speech-language pathologist transcribed the data separately, and the results of the two examiners were compared for interjudge reliability.

Uninterruptable neologisms, consistently used stereotypes, yes/no answer, repetitions, filler words, filler pauses and interjections were excluded from the analysis. The total number of prepositions omitted or substituted was counted. An Omission error is considered as the absence of the preposition that must appear in a well-formed sentence, while substitution error is that one included substituting one preposition for another (Tahaineh, 2010).

Results and Discussion

Table 1 presents the proportion of preposition errors made by the subjects with Broca's aphasia.

The results indicated that there were two types of preposition errors: omissions and substitutions. Approximately (61%) of the preposition errors were omissions, as shown in the following examples:

1-[zalameh ……..ʔibnu …….sajjara]
"man his son car"

For [zalameh a:ʕid maʕ ʔibnu fis sajjarra]

"a man (masculine) is sitting with his son in the car"

The man is sitting with his son in the car.

2-[ʔana dʒibit ilʔakel binti]
"I brought the food my daughter"

For [ʔana dʒibit ʔakel labinti]
"I brought the food to my daughter"
I brought the food to my daughter.

Table 1. *Percentage of Preposition Errors by Type. (O) refers to omissions, and (S) for substitution errors. (A) refers to the subjects with* Broca's *aphasia* .

Subject	% S	% O
A1	50	61
A2	24	42
A3	38	79

Despite the predominance of preposition deletion, there are occurrences of preposition substitution such as:

[ka:seh tiħt tittˁa:wleh] "glass under the table"

For [ka:seh fo: ʔitˁa:wleh]
"Glass on the table"
The glass is on the table

However, apart from these omissions, the participants in some situations were randomly able to use the prepositions correctly, suggesting a deficit in but not a loss of this ability. The following examples present the correct use of prepositions:

1- [binit …… zalameh ….biftaħ…..ba:b *bi*lmufta:ħ] "boy….man….open…door…with the key"

For/ the boy (masculine) open the door with the key

The boy opens the door with the key.

Another finding is the poor performance of the participants on the abstract concepts of prepositions. For example, their performance on a sentence like [ana anðˁuru ʔila: mustaqbalin afdˁal] [I am looking for a better future] shows that they were unable to use the preposition correctly, since it has an abstract concept, whereas their performance on a sentence like [al walad janðˁuru ʔilassajj:a:rra] [the boy is looking at the car] was relatively better than the former since this preposition refers to something concrete. Those findings are in accordance with those reported by Friederici (1981) in her investigation on the cognitive processing of prepositions in persons with Broca's aphasia. She found it is easy to access the preposition in such a sentence, "Peter is located on chair," in contrast to the sentence "Peter hopes for the summer", in which only syntax is of importance. However, controversial results have also been reported

from other investigations (Breedin, Saffran, & Coslett, 1994). These results would suggest a possible dissociation between abstract and concrete concepts, supporting the concreteness effect which has been addressed by many scholars (Martin, 1996; Friedman & Gvion, 2003).

In fact, the patterns found among the participants indicated a significant dissociation between the temporal and the spatial prepositions, suggesting a different mental representation and processing of prepositional meanings. In this regard, sentences like [dˤaʕ al kita:b ʕaltˤa:wila] [put the book on the table], were easier to comprehend than those requiring temporal correlations. In the previously mentioned sentence, the preposition [ʕala] provides information about the nature of the spatial relationships found in the entities of the sentence.

Significantly, it would be assumed that the space domain possibly provides a conceptual foundation for the temporal domain, since temporal meanings usually emerge from spatial prepositions that are gradually established through a process of semantic expansion. Further evidence for this difficulty is shown by preschool children who exhibited overlapping between "Where" questions and "When" questions by misinterpreting "When" questions as "Where" questions, e.g. answering questions like "When did your father leave?" with the answer "To the market" and after/before sequences acquisition (Clark, 1971).

In addition, this study has found evidence that there is a correlation between the agrammatic subject's impairment in processing the meanings of locative prepositions and retrieving verbs to name actions such as [tasħab ʕarab:jeh assajja:rra] [carriage is pulling car] for [tusħabu assajja:rra bilʕaraba:jeh] [the carriage is pulled by the car]. These results agree with those reported from Cappa, Sandrini, Rossini, Sosta, & Miniussi (2002) and Hillis, Wityk, Barker, & Caramazza (2003). In fact, this view implies a considerable overlap between the neural systems involved in retrieving words for actions and those that are essential for processing spatial prepositions, suggesting an important association in the neural systems required for operating and accessing both verbs and locative prepositions. Tranel, Adolphs, Damasio, & Damasio (2001) concluded that processing of the locative prepositions activates the left inferior prefrontal region. In the meantime, this region is involved in various kinds of linguistic information.

Thompson-Schill, D'Esposito, Aguirre, & Farah (1997) also present evidence for the contribution of the left inferior prefrontal region in semantic processing by facilitating and accelerating the retrieval of prepositional meanings and coordinating and monitoring the comparison of different meanings in order to retrieve and to select the appropriate one.

In addition, neurophysiological studies have emphasized that the spatial meanings of prepositions are processed in the left posterior frontal operculum and the left supramarginal gyrus which are found to be involved in the brain damaged subjects. In this account, Kemmerer and Tranel (2003) investigated the effects of the site of lesion on the spatial meanings of prepositions for aphasiac subjects. They concluded that the impaired knowledge of the spatial meanings of prepositions was mainly associated with damage in the left posterior frontal operculum, the left supramarginal gyrus and in the white matter subjacent to these areas. This is in line with neuroimaging studies which have provided valuable evidence for an interaction and correlation between site of lesion and the impaired knowledge of the spatial meanings for prepositions (Damasio, 2001).

Conclusions

The present study is the first study on the comprehension and production of prepositions by Palestinians with Broca's aphasia. Results indicate that the subjects understudy have problems with prepositions in production and comprehension. The patterns indicate a significant dissociation between the temporal and spatial prepositions, suggesting a different mental representation and processing of prepositional meanings. In addition, this study found evidence that there is a correlation between the subject's impairment in processing the meanings of locative prepositions and retrieving verbs to name actions. The results are consistent with those reported from other studies, in which prepositions having temporal domain are found to be difficult to be accessed and comprehended.

In general, the findings obtained from the present study should only be regarded as preliminary results in an area where further investigations and research are required by using larger number of subjects and stimuli in order to get a comprehensive idea about the nature of this deficit among Palestinian- speaking Brocas aphasics.

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