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Comprehension of if-conditionals at the morphosyntax-semantics interface in Turkish Broca’s aphasia

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Introduction

Broca’s aphasia is diagnosed in individuals who have significant deficits in expressive and/or receptive language skills, due to brain injury (Goodglass, 1980). Hallmark features of the disorder include profound impairments in their morphosyntactic abilities, and specifically in their abilities to use correct tense / time-reference marking morphology (e.g. Stavrakaki & Kouvava, 2003; Yarbay Duman & Bastiaanse, 2009). However, specificity of language impairment is subject to debate. Recent studies suggest that non-linguistic deficits often co-occur with linguistic deficits in Broca’s aphasia, implying that individuals with Broca's aphasia do not only have impaired language but also suffer from cognitive deficits, particularly in specific executive functions (e.g. inhibition: Peristeri, Tsimpli, & Tsapkini, 2011). From this point of view, the morphosyntax-semantics interface is a highly interesting area to look into because it allows detecting relationships between morphosyntactic abilities and cognitive abilities of individuals with Broca’s aphasia. However, although there is extensive work on morphosyntactic impairments in Broca’s aphasia (e.g. Bastiaanse & Thompson, 2003 for Dutch and English; Yarbay Duman et al., 2011 for Turkish), hardly anything is known about the morphosyntax-semantics interface in this group.

For this investigation, we examined the ability of Turkish-speaking individuals with Broca’s aphasia to comprehend counterfactuals and compared the results with those of a control group consisting of individuals with no speech and language impairment history. Counterfactuals are thoughts about ‘what might have been’, that is, imagining what might have happened, but did not. For example, when a person misses an important interview, he might think ‘if I had taken the bus!’ . In this scenario, the person generated a different event and an outcome than what has happened in reality, by inhibiting the current state of affairs. That is, the counterfactual is the scenario in which the person took the bus and made his interview as opposed to the factual where the person missed the interview.

According to Beck, Riggs, & Gorniak (2009) three executive functions are required for counterfactual thinking: (1) inhibition – to ignore what has happened; (2) working memory – to hold two different representations simultaneously in mind;
(3) cognitive switching – shifting between those representations. Hence, using, but also understanding, counterfactuals involve complex cognitive processes. We also tested the comprehension of nonconditional clauses and factual conditionals, in which no such cognitive processes are involved, to manipulate morphosyntactic (the presence/absence of an if-conditional) and semantic (counterfactuality) variables separately.

**Table 1**: Summary of the clause types with respect to their relevant characteristics to the present study

<table>
<thead>
<tr>
<th>Clause Type</th>
<th>If-embedding</th>
<th>Verb morphology</th>
<th>Factual</th>
<th>Specific EF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NonConditional</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gömleğ-i ütüle-di ve dolab-a as-ti</td>
<td>no</td>
<td>past tense</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>The shirt-acc iron-past/3sg-conditional the closet-dat hang-aorist</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>He ironed the shirt and hung it up in the closet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpretation: the shirt was ironed and hung up in the closet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Factual</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gömleğ-i ütüle-diy-se dolab-a as-ar</td>
<td>yes</td>
<td>past tense + -sa</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>The shirt-acc iron-past/3sg -conditional the closet-dat hang-anrist</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If he has ironed the shirt, he will hang it up in the closet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpretation: when the shirt is ironed, it is in the closet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Counterfactual</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gömleğ-i ütüle-sey-di dolab-a asar-di</td>
<td>yes</td>
<td>-sa + past tense</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>The shirt-acc iron-conditional-past/3sg the closet-dat hang-past/3 sg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If he had ironed the shirt, he would have hung it up in the closet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpretation: The shirt is certainly not ironed and not hung up in the closet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Individuals with Broca’s aphasia have morphosyntactic deficits. Thus, it was expected that conditional clauses would be more difficult to comprehend than nonconditional clauses since the former are morphosyntactically more complex. Furthermore, in Turkish, counterfactual and factual conditionals are morphosyntactically equivalent, which allows observing whether counterfactuality itself adds to difficulties that individuals with Broca’s aphasia experience in sentence comprehension. Considering the assumption that individuals with Broca’s aphasia are impaired in executive functions such as inhibitory control, it was predicted that counterfactual conditionals would be more difficult to comprehend than factual conditionals. That is, it was expected that individuals with Broca’s aphasia, unlike the control group, would have more difficulties with counterfactuals not only because of morphosyntactic complexity but also due to semantic complexity and the cognitive processes involved in counterfactuals. Table 1 presents examples of test sentences and their relevant characteristics of the present study. Note that conditionals in Turkish are marked by a conditional suffix on the main verb (-(y)sa) ‘if’, which occurs to the right of the past tense marker – di in factuals (temporally past) and to its left in counterfactuals. Note that Turkish, unlike English, has a specialized conditional morpheme used for both counterfactuals and factuals. Besides, Turkish does not make use of if – complementerizor, modals, auxiliaries, and participle verbs in its formulation of these structures, which make them grammatically easier and semantically more transparent than in English.
Methods

Subjects
12 individuals with Broca’s aphasia were tested (7 male / 5 female; MA: 54.2). The diagnoses were based on the standardized Afazi Dil Değerlendirme Testi (ADD)-The Test of Language Assessment in Aphasia (Maviş & Toğran, 2009) and the clinical judgments of a speech therapist. All the patients were at least 3 months post onset of left CVA (lesion data are available for each patient). Ten non-brain-damaged Turkish speakers participated (and performed at ceiling) on the test.

Materials
A spoken–sentence–to–picture–matching task was developed with three conditions (nonconditional, factual conditional, counterfactual conditional), with 15 items each in the test. A sentence was read aloud by the experimenter and the participants were asked to point to the picture that matched the spoken sentence (see Figure 1). In the factual condition, the subjects were always shown pictures in which the action of the main clause was realized (e.g. ironing was done), as a consequence of which the action of the other clause had to be realized as well e.g. the shirt is in the closet.

Results
Factual conditionals were significantly more difficult to comprehend than nonconditionals (t=2.311; df=1; p=.041) and counterfactual conditionals (t=2.692; df=11, p=.021). However, there was no difference between factual and counterfactual conditionals (t =1.351, df =11; p=.204). In this analysis, lexical errors were ignored (these were cases in which the patients interpreted the target sentence as a factual or a counterfactual correctly-but, by choosing a semantically related item e.g. shirt vs. dress) to see the effect of counterfactuality more clearly. This was the most conservative way to analyze the data since the subjects made twice as many lexical errors as in factuals than in counterfactuals. Exactly the opposite pattern was observed for Action Unfulfilled errors (these were the cases in which the patients interpreted a counterfactual as a factual or vice versa). Although there was no significant group difference between factuals and counterfactuals at the group level, 4 patients (out of 12) were significantly impaired in counterfactuals compared to factuals (chi-square).

Discussion
There are two major findings. First, comprehending factual and counterfactual conditionals was more difficult than comprehending nonconditionals for Turkish individuals with Broca’s aphasia. Second, although comprehending factuals and counterfactuals were equally difficult for them at the group level, some of the patients were selectively impaired in counterfactual thinking. Apparently, sentence
comprehension in Broca’s aphasia is influenced by morphosyntactic properties of sentence structure: conditionals that were morphosyntactically more complex than nonconditionals were more difficult to comprehend for them, supporting earlier data for Turkish (Yarbay Duman et al., 2011). Furthermore, comprehending counterfactuals at the morphosyntax-semantics interface is particularly difficult for some individuals with Broca’s aphasia. Thus, executive functions such as inhibition required for counterfactual thinking can also be a factor hampering their sentence comprehension ability.
References


