

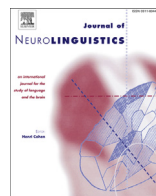


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Sentence comprehension and morphological cues in aphasia: What eye-tracking reveals about integration and prediction



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ABSTRACT

Comprehension of non-canonical sentences can be difficult for individuals with aphasia (IWA). It is still unclear to which extent morphological cues like case marking or verb inflection may influence IWA's performance or even help to override deficits in sentence comprehension. Until now, studies have mainly used offline methods to draw inferences about syntactic deficits and, so far, only a few studies have looked at online syntactic processing in aphasia. We investigated sentence processing in German-speaking IWA by combining an offline (sentence-picture matching) and an online (eye-tracking in the visual-world paradigm) method. Our goal was to determine whether IWA are capable of using inflectional morphology (number-agreement markers on verbs and case markers in noun phrases) as a cue to sentence interpretation. We report results of two visual-world experiments using German reversible SVO and OVS sentences. In each study, there were eight IWA and 20 age-matched controls. Experiment 1 targeted the role of unambiguous case morphology, while Experiment 2 looked at processing of number-agreement cues at the verb in case-ambiguous sentences. IWA showed deficits in using both types of morphological markers as a cue to non-canonical sentence interpretation and the results indicate that in aphasia, processing of case-marking cues is more vulnerable as compared to verb-agreement morphology. We ascribe this finding to the higher cue reliability of agreement cues, which renders them more resistant against impairments in aphasia. However, the online data revealed

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that IWA are in principle capable of successfully computing morphological cues, but the integration of morphological information is delayed as compared to age-matched controls. Furthermore, we found striking differences between controls and IWA regarding subject-before-object parsing predictions. While in case-unambiguous sentences IWA showed evidence for early subject-before-object parsing commitments, they exhibited no straightforward subject-first prediction in case-ambiguous sentences, although controls did so for ambiguous structures. IWA delayed their parsing decisions in case-ambiguous sentences until unambiguous morphological information, such as a subject-verb-number-agreement cue, was available. We attribute the results for IWA to deficits in predictive processes based on morpho-syntactic cues during sentence comprehension. The results indicate that IWA adopt a wait-and-see strategy and initiate prediction of upcoming syntactic structure only when unambiguous case or agreement cues are available.

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1. Introduction

Many individuals with aphasia (IWA) show impairments in auditory sentence comprehension whenever reliance on syntactic structure is necessary in order to derive the correct sentence interpretation (Caramazza & Zurif, 1976; for an overview see Caplan, 2006). Often, severe comprehension deficits can be observed for semantically reversible non-canonical sentences such as object-verb-subject sentences (OVS), passives, object clefts and object relative clauses, which are derived by movement operations. In contrast, IWA perform better with canonical structures like subject-verb-object sentences (SVO), subject clefts and subject relative clauses (e.g., Cho-Reyes & Thompson, 2012; Grodzinsky, 2000; Mitchum & Berndt, 2008). However, different syntactic structures may be affected to varying degrees across individual IWA and intra-individual patterns do not always yield significant canonicity effects (Berndt, Mitchum, & Haendiges, 1996; Caplan, Waters, DeDe, Michaud, & Reddy, 2007; Caramazza, Capitani, Rey, & Berndt, 2001; Luzzatti et al., 2011). Nevertheless, IWA's sentence comprehension abilities are significantly worse than controls' and this effect is frequently more pronounced for non-canonical structures.

Although traditionally sentence comprehension deficits have been associated with Broca's aphasia, there is overwhelming evidence that impairments in sentence comprehension, particularly deficits in assigning thematic roles correctly, can occur across all aphasic syndromes (Caplan, Baker, & Dehaut, 1985; Caramazza & Miceli, 1991; Dronkers, Wilkins, Van Valin, Redfern, & Jaeger, 2004; Luzzatti et al., 2011).

The answer to one important question remains unclear: to what extent do different morphological cues (for example, case marking or verb inflection) influence IWA's performance in non-canonical structures? Such cues might equally well hinder or help override sentence processing deficits (Burchert, De Bleser, & Sonntag, 2003).

As languages differ in the extent to which morphological cues are overtly realized and, thus, may constitute cues to sentence meaning, it is important to study the interplay of grammatical morphology and syntactic processing with reference to language-specific properties. In the case of studies involving English-speaking IWA, only limited conclusions can be drawn about the interplay of morphology and syntax from IWA's performance, because in English many morphological markers are not realized overtly. Therefore, morphological cues like case markers on nouns and person or number-agreement morphemes on verbs provide only limited information towards the meaning of a sentence. For most sentence structures, English heavily relies on a strict subject-verb-object word order principle.

In contrast, languages with rich grammatical morphology are less restricted in their word order and they provide overt morphological cues to sentence meaning. In German, for example, word order is less

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