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Automatic processing of wh- and NP-movement in agrammatic aphasia: Evidence from eyetracking

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ABSTRACT

Individuals with agrammatic Broca's aphasia show deficits in comprehension of non-canonical wh-movement and NP-movement sentences. Previous work using eyetracking has found that agrammatic and unimpaired listeners show very similar patterns of automatic processing for wh-movement sentences. The current study attempts to replicate this finding for sentences with wh-movement (in object relatives in the current study) and to extend it to sentences with NP-movement (passives). For wh-movement sentences, aphasic and control participants' eye-movements differed most dramatically in late regions of the sentence and post-offset, with aphasic participants exhibiting lingering attention to a salient but grammatically impermissible competitor. The eye-movement differences between correct and incorrect trials for wh-movement sentences were similar, with incorrect trials also exhibiting competition from an impermissible interpretation late in the sentence. Furthermore, the two groups exhibited similar eye-movement patterns in response to passive NP-movement sentences, but showed little evidence of gap-filling for passives. The results suggest that aphasic and unimpaired individuals may generate similar representations during comprehension, but that aphasics are highly vulnerable to interference from alternative interpretations (Ferreira, F. (2003). The misinterpretation of non-canonical sentences. *Cognitive Psychology, 47*(2), 164–203).

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1. Introduction

Sentences with non-canonical movement are difficult for agrammatic (Broca's) aphasic individuals to comprehend (Caramazza & Zurif, 1976; Drai & Grodzinsky, 2006; Grodzinsky, 1990, 2000; Mauner, Fromkin, & Cornell, 1993; among others). This difficulty appears in a wide variety of tasks, including sentence–picture matching (Caramazza & Zurif, 1976; Schwartz, Saffran, & Marin, 1980), makes-sense judgment tasks (Dickey & Thompson, 2004; Saffran, Schwartz, & Linebarger, 1998), and even grammaticality judgment (Grodzinsky & Finkel, 1998; though see Linebarger, Schwartz, & Saffran, 1983). For example, non-canonical NP-movement sentences like passives (1) and non-canonical wh-movement sentences like object relatives (2) often elicit chance performance in sentence–picture matching tasks:

(1) *The boy* was kissed *t* by the girl.
(2) I saw the boy *who* the girl kissed *t*.

The italicized constituents in (1 and 2) (*who*, *the boy*) represent the element which has been moved or displaced in these sentences, while the traces (*t*) represent the positions from which those elements have been moved. It is the task of the comprehender to associate the moved elements (or fillers) with the trace position (or gap) during comprehension, in order to arrive at a correct interpretation of the sentence (Frazier & Flores D'Arcais, 1989). While there are important linguistic differences between wh- and NP-movement (Chomsky, 1986, 1995; Nevins & Anand, 2003), and the two types of movement may be independently impaired and recovered in agrammatic aphasia (Friedmann, 2006; Thompson & Shapiro, 2005), they impose similar comprehension demands on readers or listeners. In both cases, a reader/hearer must associate a displaced element with a trace/gap in order to assign the element a semantic role in the sentence, while ignoring potentially competing information such as agent-first heuristics (Bever, 1970; Ferreira, 2003; Grodzinsky, 1990; Townsend & Bever, 2001) or lexical–semantic entailments (Piñango, 2000). Some part of this process appears to be impaired for many agrammatic aphasic individuals crosslinguistically (see Drai & Grodzinsky, 2006 for a survey and meta-analysis of crosslinguistic evidence).

Recently, evidence of this comprehension impairment has been provided using a novel experimental paradigm, eyetracking while listening (Dickey, Choy, & Thompson, 2007). Dickey et al. (2007) studied a group of aphasic and unimpaired listener's eye-movement patterns while processing wh-movement structures. Stories as in (3) were auditorily presented while subjects looked at images of characters and locations from the stories on a computer screen. The stories were followed by critical comprehension probes, and the participants' eye-movements were monitored as they processed these probes.

(3) This is a story about a boy and a girl.
One day, they were at school together.
The girl was pretty, so the boy kissed the girl.
They were both embarrassed after the kiss.
  a *Who* did the boy kiss *t* that day at school?
  b It was the girl *who* the boy kissed *t* that day at school.
  c Did the boy kiss the girl that day at school?

The comprehension probes appeared in three forms: critical wh-movement structures, object wh-questions (3a) or object clefts (3b) and control yes/no questions (3c). Participants responded by answering the wh-question or by saying "yes" or "no" in response to the cleft structures, and yes/no questions.

Dickey et al. (2007) reported three main findings. First, the aphasic participants were reliably less accurate in their responses to both wh-questions and object clefts than they were to control yes–no questions without wh-movement. This finding replicated many previous studies, which have found comprehension impairments for these structures. Second, the eye-movement patterns were quite similar for the aphasic and control participants for both clefts and wh-questions. For example, for wh-questions, both groups exhibited a significant theme preference: upon hearing the verb "kiss," which signaled the trace/gap, both groups shifted their visual attention to the girl (the theme of the kissing) even though the girl was not overtly mentioned at that point in the sentence. Dickey et al. interpreted this pattern as visual