



Feature dissimilarities in the processing of German relative clauses in aphasia



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ARTICLE INFO

Article history:

Received 28 May 2016

Received in revised form 3 December 2016

Accepted 22 January 2017

Keywords:

Aphasia

Relative clauses

Relativized Minimality

Sentence processing

Morpho-syntactic features

Eye tracking

ABSTRACT

The cross-linguistic finding of greater demands in processing object relatives as compared to subject relatives in individuals with aphasia and non-brain-damaged speakers has been explained within the Relativized Minimality approach. Based on this account, the asymmetry is attributed to an element intervening between the moved element and its extraction site in object relatives, but not in subject relatives. Moreover, it has been proposed that processing of object relatives is facilitated if the intervening and the moved elements differ in their internal feature structure. The present study investigates these predictions in German-speaking individuals with aphasia and a group of control participants by combining the visual world eye-tracking methodology with an auditory referent-identification task. Our results provide support for the Relativized Minimality approach. Particularly, the degree of featural distinctness was shown to modulate the occurrence of the effects in aphasia. We claim that, due to reduced processing capacities, individuals with aphasia need a higher degree of featural dissimilarity to distinguish the moved from the intervening element in object relatives to overcome their syntactic deficit.

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1. Introduction

It is a well-attested finding that subject-extracted relative clauses (SRCs) in head-initial languages are easier to process than object-extracted relative clauses (ORCs) for individuals with aphasia and non-brain-damaged healthy adults (e.g., Bader & Meng, 1999; Burchert, De Bleser, & Sonntag, 2003; Caplan, Waters, Dede, Michaud, & Reddy, 2007; Caramazza & Zurif, 1976; Garraffa & Grillo, 2008; Traxler, Morris, & Seely, 2002).¹ Relative clauses are characterized by the displacement of the head noun from its argument position in the embedded clause, resulting in a long-distance dependency between the moved argument (*the boy*) and its extraction site, which is marked by underscores in the following examples (e.g., Chomsky, 1995; Haegeman, 1994). In SRCs, the head noun is linked to the subject position (1), while it is linked to the object position in ORCs (2).

(1) (I see) the boy who ___ is kissing the girl (SRC)

(2) (I see) the boy who the girl is kissing ___ (ORC)

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¹ In head-final languages (e.g., Basque, Japanese, and Chinese), there is evidence of a processing advantage of ORCs over SRCs (e.g., Carreiras, Duñabeitia, Vergara, de la Cruz-Pavía, & Laka, 2010; Hsiao & Gibson, 2003; Ishizuka, Nakatani, & Gibson, 2006).

Over the past decades, several approaches have been proposed to account for the so-called subject-object asymmetry. For example, Grillo (2005, 2008, 2009) adopted the linguistically based approach of Relativized Minimality (RM; Rizzi, 1990, 2013) and attributed the asymmetry to the occurrence of a Minimality effect (adopting the term from Grillo, 2005, 2009; Varlokosta, Nerantzini, Papadopoulou, Bastiaanse, & Beretta, 2014). In Grillo's adaptation of RM, it is claimed that greater demands in processing ORCs are caused by the presence of the embedded subject (*the girl* in example (2)), which has to be crossed when establishing the syntactic relation between the moved object and its extraction site. Friedmann, Belletti, and Rizzi (2009) extended the RM approach to explain patterns of sentence comprehension in language acquisition. They suggested that the Minimality effect is reduced when the intervening subject in ORCs is a pronoun, which was shown to enhance comprehension of ORCs in typically developing children and healthy adult speakers (Brandt, Kidd, Lieven, & Tomasello, 2009; Gordon, Hendrick, & Johnson, 2001, 2004; Haendler, Kliegl, & Adani, 2015; Reali & Christiansen, 2007; Warren & Gibson, 2002). This facilitative effect of pronouns was attributed to feature dissimilarity between the moved and the intervening element in terms of [+NP]. Thus, the question arises as to whether individuals with aphasia (IWA) also exhibit such a pronoun facilitation effect in spoken sentence processing. There is some evidence suggesting that ORC comprehension in IWA does not benefit from dissimilar [+NP] features (Varlokosta et al., 2014). However, so far, only one type of disambiguating morpho-syntactic feature, namely case marking, has been used to investigate the effect of pronoun facilitation. The present study investigates RC processing in German, a language where both case and number marking are involved in disambiguating between SRCs and ORCs. Hence, the study extends previous work targeting the impact of pronouns on RC processing in aphasia.

In the following, we first detail the results from studies investigating the subject-object asymmetry in healthy adults and IWA and the theoretical approach of RM. Then, we introduce our notion of feature dissimilarity and describe what previous studies on the pronoun facilitation effect revealed about the impact of feature dissimilarity.

1.1. Subject-object asymmetry in the processing of relative clauses

In IWA, the subject-object asymmetry in terms of higher accuracy on SRCs as compared to ORCs has been observed cross-linguistically using different offline methods such as spoken sentence-picture matching (Friedmann, 2008; Friedmann, Reznick, Dolinski-Nuger, & Soboleva, 2010; Garraffa & Grillo, 2008; Grodzinsky, 1989; Lukatela, Shankweiler, & Crait, 1995; Martin, 1987; Varlokosta et al., 2014) and spoken sentence-picture verification (Burchert et al., 2003). Within online measures, a processing disadvantage for ORCs as compared to SRCs has been observed in terms of slower self-paced listening times (Caplan et al., 2007). Initially, this selective comprehension difficulty for sentences with a non-canonical word order (object-before-subject) such as ORCs was primarily associated with non-fluent Broca's aphasia (e.g., Caramazza & Zurif, 1976; Schwartz, Saffran, & Marin, 1980). Later studies, though, revealed that impaired sentence comprehension is also present in other fluent aphasia types (e.g., Caramazza & Miceli, 1991; Goodglass et al., 1979; Martin & Blossom-Stach, 1986).

In non-brain-damaged adult speakers, the presence of a subject-object asymmetry is usually restricted to online tasks such as speeded grammaticality judgment (Bader & Meng, 1999), self-paced listening and reading (Caplan et al., 2007; Gordon et al., 2001, 2004; Mak, Vonk, & Schriefers, 2002; Mak, Vonk, & Schriefers, 2006), eye-tracking while listening and reading (Dickey & Thompson, 2009; Traxler et al., 2002), and event-related brain potentials studies (Friederici, Steinhauer, Mecklinger, & Meyer, 1998; Mecklinger, Schriefers, Steinhauer, & Friederici, 1995). In contrast to IWA, healthy speakers show no processing disadvantage for ORCs in terms of lower accuracy in offline tasks such as spoken sentence-picture matching (Friedmann et al., 2010) or verification (Burchert et al., 2003).

Since the subject-object asymmetry is present both in IWA and healthy speakers, it appears that a unitary explanatory approach could have the potential to elucidate the underlying processes responsible for the asymmetry. So far, only separate explanatory approaches have been proposed to account for the asymmetry in unimpaired and impaired sentence processing (for healthy adults: Active Filler strategy, e.g., Frazier, 1987; expectation-based approach, Levy, 2008; Locality Theory and working memory, e.g., Gibson, 1998; for IWA: Trace Deletion Hypothesis, e.g., Grodzinsky, 1995, 2000; Derived Word Order Hypothesis, e.g., Bastiaanse & van Zonnefeld, 2006; reduced processing capacities devoted to sentence processing, e.g., Caplan et al., 2007). Given the fact that Grillo (2005, 2008, 2009) proposed an extension of the linguistically based approach of RM (Rizzi, 1990, 2013) to explain this pattern, it seems that this approach has the potential for becoming such a unitary theoretical framework for the understanding of RC comprehension in different populations.

1.2. Relativized Minimality (RM)

In formal terms, RM is defined as follows (Rizzi, 1990, 2004): Given the configuration X ... Z ... Y, a local relation between X and Y can only hold, if there is no Z that:

- (i) intervenes between X and Y, and
- (ii) is of the same structural type as X.

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