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Cataphoric pronoun resolution in native and non-native sentence comprehension

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ABSTRACT

Encountering a cataphoric pronoun triggers a search for a suitable referent. Previous research indicates that this search is constrained by binding Condition C, which prohibits coreference between a cataphoric pronoun and a referential expression within its c-command domain. We report the results from a series of eye-movement monitoring and questionnaire experiments investigating cataphoric pronoun resolution in German. Given earlier findings suggesting that the application of structure-sensitive constraints on reference resolution may be delayed in non-native language processing, we tested both native and proficient non-native speakers of German. Our results show that cataphoric pronouns trigger an active search in both native and non-native comprehenders. Whilst both participant groups demonstrated awareness of Condition C in an offline task, we found Condition C effects to be restricted to later processing measures during online reading. This indicates that during natural reading, Condition C applies as a relatively late filter on potential coreference assignments.

Introduction

Establishing referential dependencies quickly and accurately during language comprehension is one of the parser's crucial tasks. Whilst the formation of anaphoric dependencies involves memory search and retrieval procedures triggered by encountering a referentially dependent element, resolving cataphoric dependencies involves a forwards-looking search for a dependent element's licenser. Both anaphoric and cataphoric dependency formation is subject to structure-sensitive constraints, and a growing body of sentence processing research has investigated how these constraints are applied during real-time reference resolution (e.g., Badecker & Straub, 2002; Chow, Lewis, & Phillips, 2014; Cunnings & Felser, 2013; Cunnings, Patterson, & Felser, 2015; Dillon, Mishler, Sloggett, & Phillips, 2013; Kazanina, Lau, Lieberman, Yoshida, & Philips, 2007; Kazanina & Phillips, 2010; Kennison, 2003; Kush, 2013; Nicol & Swinney, 1989; Pablos, Doetjes, Ruijgrok, & Cheng, 2015; Patil, Vasishth, & Lewis, 2016; Sturt, 2003; Xiang, Dillon, & Phillips, 2009).

One key issue in this line of research has been whether structure-sensitive constraints act as filters preventing illicit referential dependencies from being formed in the first place, or whether these constraints can be violated at any stage during processing. The question of when during processing structure-sensitive constraints become relevant has been discussed from the perspective of two-stage models of reference resolution, such as the 'bonding and resolution' model originally proposed by Sanford and Garrod (1989). According to two-stage models, an initial link is formed between a referentially dependent element and one or more candidate antecedents based on lexical and morphosyntactic information. At a later resolution stage, the appropriateness of these links is evaluated using discourse-level information, with inappropriate links being discarded. While the results from several studies suggest that bonding is also sensitive to structure-sensitive constraints, such that these constraints act as filters precluding structurally inaccessible antecedents from being considered (e.g., Kazanina et al., 2007; Nicol & Swinney, 1989; Sturt, 2003), findings from other studies have called the immediacy or privileged role of structural constraints into question (e.g., Badecker & Straub, 2002; Kennison, 2003; Patil et al., 2016).

Although examining cataphoric dependency formation can be informative about what kind of information guides active search processes during sentence or discourse comprehension, and about possible processing stages involved in reference resolution, cataphoric dependencies have thus far received less attention than anaphoric ones. Regarding the real-time status of structure-sensitive constraints on cataphoric reference resolution, we also currently know little about their universality in parsing, that is, whether their role and timing is the same not only across different languages but also across different populations.

Building on and extending previous research on the processing of cataphoric dependencies, the current study investigates and compares

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the time course of cataphoric pronoun resolution in native and non-native speakers of German. Resolving cataphoric dependencies might be particularly challenging for non-native (henceforth, L2) speakers because they may have more difficulty anticipating upcoming referents compared to native (L1) speakers (Grüter, Rohde, & Schafer, 2016). Studies using highly time-course sensitive measures have revealed delayed sensitivity to structure-sensitive constraints on anaphoric reference resolution in L2 comprehension (e.g., Felser & Cunnings, 2012; Kim, Montrul, & Yoon, 2015), but whether these findings extend to cataphoric reference resolution is currently unclear. Real-time processing data from L2 comprehenders (and other non-standard populations) allows us to test claims about the universality of search mechanisms and the nature and timing of the information sources that feed them, including structure-sensitive constraints.

Previous studies have provided evidence of the parser's active search by demonstrating that native comprehenders try to link a cataphoric pronoun to the first potential referent (Cowart & Cairns, 1987; Filik & Sanford, 2008; Van Gompel & Liversedge, 2003). In a series of online reading experiments using stimulus sentences such as (1a,b) below, Van Gompel and Liversedge (2003), for example, found that encountering a main clause subject whose categorical gender mismatched the preceding pronoun's gender (such as *the duchess* in 1b) gave rise to longer reading times at the word following it compared to when it matched (such as *the lord* in 1a).

(1) a. When he was depressed, the lord invited the duchess for a drink.
b. When he was depressed, the duchess invited the lord for a drink.

The active search mechanism is thought to be constrained by a supposedly universal principle known as *Condition C*, however (e.g., Clackson & Clahsen, 2011; Kazanina & Phillips, 2010; Kazanina et al., 2007; Pablos et al., 2015; Yoshida, Kazanina, Pablos, & Sturt, 2014). Condition C has traditionally been defined as a syntactically mediated constraint on reference resolution (Chomsky, 1981; Reinhart, 1976; Sportiche, 2013). It prohibits referential expressions from being bound, that is, from being interpreted as coreferential with an element that c-commands it.[1] Consider the examples in (2a,b):

(2) a. He got depressed when the lord married the duchess.
b. His butler got depressed when the lord married the duchess.

Sentence (1a) is perfectly acceptable provided that the pronoun *he* is interpreted as referring to someone other than *the lord*. Coreference is ruled out by Condition C because *he*, which functions as the main clause subject, and the embedded subject *the lord* are in a potential binding configuration. To prevent a Condition C violation, the two must be assigned distinct referential indices. In (2b), on the other hand, the cataphoric pronoun *his* functions as a possessive modifier of the noun *butler* and hence does not c-command the remainder of the sentence. Assuming that binding and coreference assignment are subject to different kinds of constraints (Reinhart, 1983), in the absence of a potential binding configuration, a coreferential reading should be permitted in (2b).

Unlike binding Conditions A and B, which restrict the interpretation of reflexive and non-reflexive anaphors, Condition C is a constraint on referential expressions (e.g, *the lord*) and not specifically a constraint on pronouns. Referential expressions cannot normally be interpreted as coreferential with a c-commanding noun phrase or pronoun, although exceptions are well attested (compare e.g., Davis, 2009; Grodzinsky & Reinhart, 1993; Schlenker, 2005). Rather than being considered a syntactic primitive, Condition C is widely assumed to reflect more general semantic or pragmatic constraints on reference resolution (e.g., Büring, 2005; Huang, 1994; Huang, 2000; Levinson, 1991; Reinhart, 1983; Reinhart & Reuland, 1993; Schlenker, 2005). The unavailability of a coreferential reading in (2a), for example, might follow from a semantic constraint prohibiting coreference where replacing a referential noun phrase (such as *the lord*) by an anaphor (such as a personal pronoun) would yield an indistinguishable interpretation (Reinhart, 1983). Coreference would also violate a general pragmatic principle which states that referentially dependent expressions should preferentially be encoded by pronominals rather than full noun phrases (e.g., Huang, 2000). In a similar vein, Schlenker (2005) argues that Condition C effects reflect a pragmatic economy principle (linked to the Gricean maxim of minimization) which applies during incremental interpretation and according to which full noun phrases are deviant if they could be dropped or replaced by a pronoun without any effects on a sentence's meaning. Regardless of what the ultimate source of Condition C effects might be, there is evidence that this condition constrains the antecedent search in adult monolingual processing.[2]

The present study's goals are threefold: (i) to examine whether both native and non-native speakers of German engage in an active search following the encounter of a cataphoric pronoun; (ii) to test whether Condition C acts as an early or late filter on referential dependency formation using a more time-course sensitive experimental technique than most previous studies, and (iii) to assess whether the timing of Condition C is invariant across different populations.

The real-time application of Condition C

Referential dependency formation is guided by different kinds of information sources, including morphosyntactic features, structural knowledge, linear proximity, and discourse-level cues. An ongoing debate concerns the relative timing of these information sources, and in particular, the timing of structure-sensitive constraints. Whilst the question of whether structural constraints act as 'early' or 'late' filters on anaphoric reference resolution remains controversial (see Sturt (2013), for a review), findings from previous studies examining the real-time application of Condition C appear to provide a comparatively uniform picture.

Kazanina et al. (2007) report the results from a series of offline rating and online self-paced reading experiments examining the application of Condition C in young adult native speakers of English. Taken together, their findings provide convincing evidence for the application of Condition C during cataphoric pronoun resolution. Most relevant to the current study is their experiment 3, whose design served as a model for one of our own experiments reported below. Kazanina et al. used stimulus sentences such as (3a,b) in a gender-mismatch paradigm (Van Gompel & Liversedge, 2003).

(3) a. Constraint (match/mismatch)
He/She chatted amicably with some fans while the talented, young
quarterback signed autographs for the kids …
b. No constraint (match/mismatch)
His/Her managers chatted amicably with some fans while the talented, young
quarterback signed autographs for the kids …

In Kazanina et al.'s (2007) *constraint* conditions (3a), a cataphoric pronoun appeared in matrix subject position and thus c-commanded the entire remainder of the sentence, including the (stereotypically male) potential antecedent *quarterback*. Coreference between the two should therefore be ruled out by Condition C. In the *no constraint* conditions (3b), the sentence-initial pronoun was a possessive modifier whose c-

[1] The term "c-command" refers to a relationship between syntactic constituents that is defined in terms of hierarchical dominance. A constituent c-commands its sister constituents and all other constituents that these dominate (Reinhart, 1983).

[2] We use the term "antecedent" irrespective of a noun phrase's linear relationship to the pronoun here.