

Information structure effects on anaphora resolution in German and French: A crosslinguistic study of pronoun resolution

Saveria Colonna, Sarah Schimke, Barbara Hemforth

▶ **To cite this version:**

Saveria Colonna, Sarah Schimke, Barbara Hemforth. Information structure effects on anaphora resolution in German and French: A crosslinguistic study of pronoun resolution. Linguistics, 2012, 50 (5), pp.901-1073. hal-00799557

HAL Id: hal-00799557
https://hal.science/hal-00799557

Submitted on 13 Mar 2013

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Information structure effects on anaphora resolution in German and French: A crosslinguistic study of pronoun resolution*

SAVERIA COLONNA, SARAH SCHIMKE, AND BARBARA HEMFORTH

Abstract

This paper presents an off-line study consisting of five questionnaires in which we observed interpretational preferences for ambiguous intra-sentential pronouns in parallel structures in German and French. We tested the influence of information structural factors, in particular, we compared the effects of topicalizing versus focusing potential antecedents of the ambiguous pronoun. Results replicated a baseline difference between the two languages: a subject preference in German and an object preference in French (Hemforth et al. 2010). We argue that the object preference in French is due to the fact that speakers take into account an alternative nonambiguous construction. In addition, we found that in both languages, topicalization enhances, but focusing reduces the accessibility of antecedents for pronouns in the same sentence. This stands in contrast with previous results showing an equal accessibility of focused and topicalized referents for pronouns in subsequent sentences (Cowles et al. 2007). We explain this difference with the different function of focus within and across sentences.

1. Introduction

During language comprehension, we are continuously occupied with the task of reference resolution. But referential forms such as pronouns (e.g., “they”, “s/he”) do not, on their own, provide enough information to identify the intended referent. Nevertheless, successful language comprehension requires rapid interpretation of co-reference. This raises the question of what factors determine which referent is chosen as the antecedent of a pronoun.

It has been shown that pronoun resolution is influenced by a range of factors on the sentence as well as on the discourse level. On the discourse level, the accessibility of an antecedent seems to be influenced by its discourse status, with discourse topics being more accessible than other possible antecedents (e.g., Crawley 1986), by implicit causal relations and by coherence relations in general (see e.g., Kehler 2002; Sanders and Noordman 2000). On the sentence level, referents that are mentioned first in the sentence seem to be more accessible (Gernsbacher and Hargreaves 1988; Gernsbacher et al. 1989; Gernsbacher 1990). Subjecthood seems to play a central role as well (Crawley et al. 1990; Frederiksen 1981; Järvikivi et al. 2005; Kaiser 2006; Kaiser and Trueswell 2008), as does parallelism of syntactic roles between a potential antecedent and the critical pronoun (Stevenson et al. 1994). It has been proposed for some of these factors that they are of influence because they enhance the salience (or prominence) of the potential antecedents. More precisely, linguistic theories concerned with the choice of referring expressions have claimed that the use of a certain anaphoric form is directly linked to the salience level of the antecedents: a more reduced form, such as a pronoun, would therefore be likely to be interpreted as referring to a salient antecedent; contrary to more informative forms such as full NPs (Ariel 1990; Givón 1983; Gundel et al. 1993). Use of an inappropriate (e.g., too informative) anaphor generally leads to

increased processing effort, such as the so-called repeated name penalty (Gordon et al. 1993). In consequence, an antecedent should be particularly accessible for a pronoun when it is salient.

The preference for a salient antecedent for a pronoun is assumed to be valid across languages so that for sentences like (1) a preference for the first noun phrase would generally be predicted, given that it is mentioned first, the topic and the subject at the same time. However, crosslinguistic comparisons suggest that these factors may not have the same effect in every language. Hemforth et al. (2010) conducted questionnaire studies and visual world experiments in which they studied interpretation preferences in German and French in sentences such as (1). They found that whereas in German, as expected, ambiguous pronouns were preferentially bound to the first mentioned referent and subject (the postman, in this case); in French, the second noun and object was preferred.

(1) a. German

Der	*Briefträger*	*hat*	*den*	*Straßenfeger*	*getroffen*	*bevor*
The	postman	has	the	street-sweeper	met	before
er	*nach*	*Hause*	*ging.*			
he	to	home	went.			

b. French

Le	*facteur*	*a*	*rencontré*	*le*	*balayeur*	*avant*
The	postman	has	met	the	street-sweeper	before
qu'	*il*	*rentre*	*à*	*la*	*maison.*	
that	he	went	to	the	home.	

'The postman met the street-sweeper before he went home.'

A possible explanation for the preference for the second noun and object in French is the fact that when the subjects of the matrix clause and of the subordinate clause are co-referential, the use of a non-ambiguous infinitival structure as in (2) is almost mandatory (Riegel et al. 1994), whereas co-reference with the object of the matrix clause can only be expressed with an overt anaphor. In this paper, we tested sentences with the conjunction *quand* 'when' for which the alternative infinitival structure is not possible, in order to find out whether the crosslinguistic difference between German and French established for *avant que* 'before' can be generalized to another conjunction.

(2)

Le	*facteur*	*a*	*rencontré*	*le*	*balayeur*	*avant*	*de*
The	postman	has	met	the	street-sweeper	before	to
rentrer	*à*	*la*	*maison.*				
go	to	the	home.				

'The postman met the street-sweeper before going home.'

Given the crosslinguistic differences established before, it is interesting to know whether other factors that have been assumed to hold crosslinguistically have a similar influence in German and French or not. In particular, it has often been assumed that information structural markings such as the topicalization of a referent foreground this referent in the discourse, and thus make it more accessible for pronouns across languages (e.g., Gundel et al. 1993). In German, topicalization of any referent, be it the syntactic subject or not, can be achieved by placing this referent in the sentence-initial position, which is claimed to be a possible topic position in German (Frey 2004). In contrast, in a configurational language such as French, explicit topicalization can only be achieved by more explicit syntactic constructions such as dislocation (Lambrecht 1994; Doherty 2001). It is thus interesting to test the effects of

explicitly topicalizing subjects and in particular objects, which are not topics by default. To date, however, the effects of explicit topicalization devices on pronoun resolution have rarely been studied. Instead, many authors have operationalized topicality solely by the first position in the sentence (e.g., Arnold 1998; Arnold et al. 2000; Järvikivi et al. 2005; Clifton and Ferreira 1987) or by repeated mentioning in the context (Arnold 1999; Cowles et al. 2007). It is possible that the greater reliance on explicit topicalization devices explains the lack of a first mention preference in French. If the crosslinguistic difference in interpretational preferences is in fact linked to the way information structure is marked in the two languages under investigation, this crosslinguistic difference should disappear when the first referent is explicitly topicalized. This explicitly topicalized referent should then be the preferred antecedent in French as in German.

Similar to topicalization, focusing has also been claimed to enhance the salience or prominence, and hence the accessibility, of an antecedent. For instance, Joshi and Weinstein (1981) claim that in a cleft sentence such as "It was John who hit Bill.", the forward-looking centre "John", and not the backward-looking centre "Bill",[1] would be the preferred antecedent of a pronoun in the following sentence (e.g., "He was taken to the hospital"). Experimental data confirm that an antecedent is particularly available for a pronoun when it is focused (Arnold 1998; Cowles et al. 2007; Foraker and McElree 2007; Ellert 2010). This raises the question of the relative influence of the two foregrounding devices (topicalization *vs.* focusing). Theories of information structure may provide the means to analyze different types of foregrounded referents in more detail. Such theories analyze the informational role that different parts of an utterance play, including determining which parts of the sentence present new or unpredictable information and which present referents to which such new information can be applied. Following Reinhart (1982), we assume that the topic of an utterance is what the utterance is about, while the focus presents information that is unpredictable and may be applied to the topic. It is conceivable that these different discourse functions have a different impact on the resolution of subsequent pronouns. However, the available evidence (Cowles et al. 2007) suggests that although the linguistic functions of topicalization and focusing devices may be different, the two devices both appear to render referents more accessible for pronoun resolution. It is important to note that Cowles and colleagues tested the influence of topicalization and focusing on pronouns in subsequent sentences. In a cross-modal naming task, they found shortened naming times, both, for topicalized as well as for focused antecedents for between sentence pronoun resolution. Information structural values are, however, determined anew for each sentence in a discourse (see e.g., Klein and von Stutterheim 1992). As a consequence, it seems worthwhile to test whether topicalization and focusing have comparable effects when pronouns within the same sentence are concerned.

The aim of the present paper is to investigate:

1) Whether the crosslinguistic differences observed for *bevor / avant que* 'before' (Hemforth et al. 2010) also exists for *als / quand* 'when' for which a close non ambiguous alternative construction does not exist.

2) Whether informational foregrounding devices such as topicalization and focusing influence intra-sentential pronoun interpretation in the same way in both languages and across grammatical roles, and

3) whether these two devices have similar effects.

We will present two off-line experiments in which we report the results from five written questionnaires. In Experiment 1, we investigated the effects of explicit topicalization in both German (Questionnaire 1) and French (Questionnaires 2a and 2b). If explicit topicalization of a referent enhances its accessibility, we expect that the explicitly topicalized referent will be preferred as the antecedent of the pronoun in both languages. There are at least two ways to define topic: One of them is based on the current discourse, it defines what

the current discourse is about; in this case we talk about the discourse topic. There is, however, a more syntactic notion of a sentence topic, defining what is predicated about in a sentence (e.g., van Dijk 1977; Frey 2004), which is mostly defined by syntactic means such as its position in the structure of the sentence or morphological marking. In this paper, we will focus on sentence topics only (in the sense of Reinhart 1982 or Frey 2004). At the same time, Experiment 1 serves as a test of the generalizability of the language specific preferences established for sentences with *avant que/bevor*. The aim of Experiment 2 (Questionnaires 3 and 4 respectively in German and French) is to shed more light on the influence of focusing the first referent. Assuming that topicalization and focusing both affect the salience of a referent, a salience-based explanation of pronoun resolution would predict similar effects of both informational devices. The different pragmatic functions of topic and focus may however result in different preference patterns in within sentence pronoun resolution. The results of both experiments will allow us to disentangle the relative influence of the two foregrounding devices (topicalization *vs.* focusing) on intra-sentential pronoun interpretation.

2. Experiment 1: Baseline and topicalization structures

2.1. *Method*

2.1.1. *Participants.* 33 German native speakers and 51 French native speakers volunteered for completing a written questionnaire. The German participants were students of Saarland University, the French participants were students at the University of Paris 8.

2.1.2. *Materials*. We constructed 27 experimental sentences, all containing a main clause followed by a subordinate clause starting with *als/quand* 'when' (for a full list of materials, see Appendix 1). The main clause contained an activity verb with an agentive subject and an object. In each sentence, the subject and the object were proper names of the same gender. Half of the proper names were female. The subordinate clause contained an ambiguous subject pronoun that could refer to the subject or the object of the main clause. Each sentence was followed by a paraphrase of the subordinate clause starting with a gap. Interpretational preferences for the ambiguous pronoun were measured by asking participants to fill this gap, which necessitated the resolution of the pronoun. Sentences were presented in three different conditions: a baseline condition (3a), as well as two conditions in which either the subject (3b) or the object (3c) of the matrix clause was topicalized by the construction *was betrifft / quant à* 'as for'.

(3) a. Baseline

Peter	*hat*	*Hans*	*geohrfeigt,*	*als*	*er*	*jung*	*war.*
Peter	has	John	slapped,	when	he	young	was.
			war	*jung.*			
			was	young.			
Pierre	*a*	*giflé*	*Jean*	*quand*	*il*	*était*	*jeune.*
Peter	has	slapped	John	when	he	was	young
			était	*jeune.*			
			was	young.			

'Peter has slapped John when he was young.
was young.'

b. Topicalized Subject

Was	*Peter*	*betrifft,*	*er*	*hat*	*Hans*	*geohrfeigt,*	*als*	*er*	
What	Peter	concerns,	he	has	John	slapped,	when	he	
jung	*war.*								

young was.
Quant à Pierre, il a giflé Jean quand il était
As for Peter, he has slapped John when he was
jeune.
young.
'As for Peter, he has slapped John when he was young.'

c. Topicalized Object
Was Peter betrifft, Hans hat ihn geohrfeigt, als er
What Peter concerns, John has him slapped, when he
jung war.
young was.
Quant à Pierre, Jean l' a giflé quand il était
As for Peter, John him has slapped when he was
jeune.
young.
'As for Peter, John has slapped him when he was young.'

Three versions of the questionnaire were created, such that each item appeared in a different condition in each version. There were nine items per condition in each version. The experimental items were interspersed with 40 filler items of various syntactic structures. The filler items were also followed by a paraphrase with a gap but contained no ambiguous pronouns.

2.1.3. *Procedure.* The questionnaire consisted of 8 pages and a cover sheet, which informed the participants that there were no incorrect responses to the questions and that they were supposed to answer spontaneously. Participants were instructed to read each sentence and then fill the gap in the following sentence. Answers were coded according to whether participants chose the first (N1) or the second (N2) mentioned entity as an antecedent for the pronoun. We chose this coding over other possibilities (e.g., coding of grammatical roles) for our major analyses because, in this experiment, we are varying the information structural status of the first noun phrase, which is either default topic, being first mentioned, as well as subject (baseline), explicitly marked sentence topic and subject, or explicitly marked sentence topic and object. We will only refer to choices of subjects and objects where this dependent variable helps clarifying our results. Five out of 1377 (0.4 %) answers in the French questionnaires mentioned neither N1 nor N2 and were thus discarded from further analyses.

2.2. *Results and discussion*

The data were analyzed in two repeated measurements analyses of variance (ANOVAs), one treating subjects as random factor (F1) and one treating items as random factor (F2). The three sentence structures (Baseline *vs.* Topicalized Subject *vs.* Topicalized Object) were treated as a within-subject and within-item factor. Language (German *vs.* French) was treated as a between-subject and within-item factor.
Figure 1 presents the percentage of N1 interpretations in the three structure conditions (Baseline, Topicalized Subject and Topicalized Object) for the two languages.

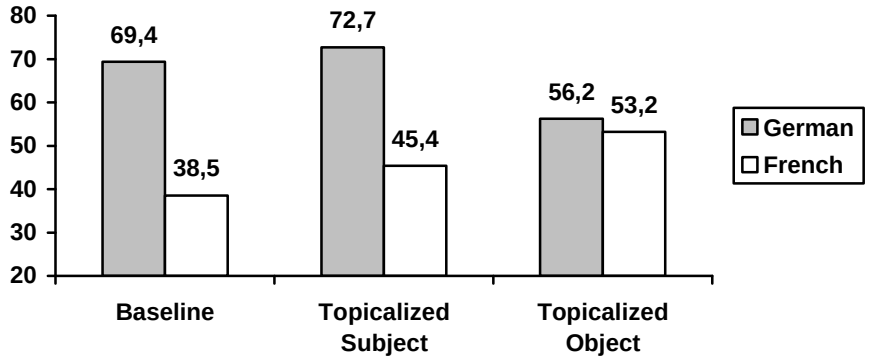


Figure 1. *Percentage of N1 interpretations in the three structural conditions (Baseline, Topicalized Subject and Topicalized Object) in German and French.*

There was a main effect of Language, due to the fact that N1 interpretations were more frequent in German than in French (66 % *vs.* 45.7 %; $F1(1,78) = 17.02$, $p < .0001$; $F2(1,24) = 139.43$, $p < .0001$). There was no main effect of Structure ($F1(2,156) < 2$, ns; $F2(2,48) < 2$, ns). The interaction Language × Structure was, however, significant ($F1(2,156) = 11.62$, $p < .0001$; $F2(2,48) = 19.46$, $p < .0001$).

We tested whether the percentage of N1 interpretations in the Baseline condition was significantly different from a random preference of 50 % for each antecedent. This was the case for German ($t1(32) = 4.32$, $p < .0001$, $t2(26) = 5.69$, $p < .0001$) as well as for French ($t1(50) = 2.97$, $p < .005$; $t2(26) = 4.12$, $p < .0001$). It can be concluded that in both languages, a clear preference for one of the antecedents exists, and that this preference is opposite in the two languages: The first mentioned referent is preferred in German, but the second mentioned one in French. This pattern confirms the crosslinguistic difference already observed between French and German (Hemforth et al. 2010) so that we can conclude that this crosslinguistic difference also holds for sentences with the conjunction *als / quand* 'when'.

The interaction Language × Structure indicates, however, that the structural conditions tested here had a different influence in the two languages. To further explore this pattern of results, we performed a series of simple comparisons.

2.2.1. *Simple comparisons on German data*. In the German version of the questionnaire, we find a small numerical but non-reliable increase in choices of N1 referents for the Topicalized Subject condition compared to the Baseline condition (72.7 % *vs*. 69.4 %, all $ts < 1$). For the Topicalized Object condition, the number of N1 choices decreases reliably compared to the Topicalized Subject condition as well as compared to N1 in the Baseline condition (respectively, 43.8 % *vs*. 72.7 %, $t1(32) = 3.41$, $p < .005$; $t2(26) = 3.48$, $p < .005$; 43.8 % *vs*. 69.4 %, $t1(32) = 2.82$, $p < .01$; $t2(26)=2.89$, $p < .01$). This decrease of N1 choices in the Topicalized Object condition is most probably due to a preference for the subject. Previous studies have shown that pronouns are preferentially resolved towards first-mentioned and subject antecedents in various languages, such as English, Dutch, or Finnish (Crawley et al. 1990; Frederiksen 1981; Järvikivi et al. 2005; Kaiser and Trueswell 2008). For German specifically, Bouma and Hopp (2006) have shown that subject antecedents are preferred referents independent of their position in the sentence. As argued in the introduction, this subject preference may be due to the fact that the subject is topic by default. This interpretation is consistent with the observation that additional topicalization does not enhance preferences for subject antecedents, and that non-topicalized subjects in sentences in which

the object is topicalized are chosen less often as the antecedent of the pronoun (43.8 % subject interpretations in the Topicalized Object condition). Although topicalized objects are chosen even less often than N1 in the baseline condition, we cannot conclude that topicalization does not enhance accessibility of a referent at all. Looking at choices of object antecedents, topicalization does show an effect for topicalized objects as evidenced by the reliable difference in choices of the topicalized object (realized as N1) *versus* the object in the Baseline condition where it is realized as N2 (56.2 % *vs*. 30.6 %, t1(32) = 3.23, p < .005; t2(26) = 5.7, p < .0001). Topicalization thus enhances the accessibility of the topicalized referent, but only when the topicalization structure is marked, that is, when it does not correspond to the canonical word order. The conflict arising from a preference for the topic and/or first position and a dispreference for the object as an antecedent bring the choices of N1 down to close to 50 % in the Topicalized Object condition. The absence of an effect of the explicit subject topicalization could be due to the fact that in canonical subject-verb-object sentences, the subject is by default the topic of the sentence.

2.2.2. *Simple comparisons on French data*. The results of the French questionnaire do not reveal a clear effect of explicit topicalization, given that the number of N1 choices does not significantly increase in the Topicalized Subject condition compared to the Baseline condition (45.4 % *vs*. 38.5 %, t1(50) = 1.51, ns; t2(26) = 1.89, .05 < p <. 10). The difference in N1-choices between Subject Topicalization and Object Topicalization is marginally significant (45.4 % *vs*. 53.2 %, t1(50) = 1.87, .05 < p < .10; t2(26) = 2.09, p < .05). We observed however a significant difference between the number of N1 choices in the Baseline and the Topicalized Object conditions (38.5 % *vs*. 53.2 %, t1(50) = 2.73, p < .01; t2(26) = 3.55, p < .005). This increase in N1 choices is probably mainly due to a preference for the object as the antecedent as it is generally found for French. This is confirmed by the fact that numerically, though only reliably across items, the number of object antecedent choices even decreases in the Topicalized Object (realized as N1) compared to the Baseline conditions (realized as N2) (53.2 % *vs*. 61.5 %, t1(50)=1.37, ns; t2(26) = 2.25, p < .05). French speakers apparently prefer objects and disprefer antecedents in the first position. These conflicting cues bring the choices for N1 close to 50 % in the Topicalized Object condition just as in German. It is, however, a preference for the first position and/or the topic and a dispreference of object antecedents that may account for the German data.

To sum up, we do not find a clear effect of topicalization enhancing accessibility of an antecedent in French. Note, however, that one might wonder whether, in French, the moderate influence of the *was betrifft / quant à* construction could be due to the fact that this construction is not very frequent and maybe more apt for contrastive topics than for aboutness topics (see e.g., Charolles 2003). At least in spoken French, the most frequent way of topicalizing an entity is to use a simple left dislocation of the type exemplified in (4a). As shown in (4b), it is also possible to topicalize objects this way.

(4) a. Dislocated Subject

Pierre, il	*a*	*giflé*	*Jean*	*quand*	*il*	*était*	*jeune.*
Peter, he	has	slapped	John	when	he	was	young.

'Peter, he has slapped John when he was young.'

(4) b. Dislocated Object

Pierre, Jean	*l'*	*a*	*giflé*	*quand*	*il*	*était*	*jeune.*
Peter, John	him	has	slapped	when	he	was	young.

'Peter, John has slapped him when he was young.'

To test whether the results would change by using such a more natural construction, we ran a different version of the French Questionnaire 2a. We will call it Questionnaire 2b in the following.

2.3. *Questionnaire 2b*

Questionnaire 2b tested subject and object topicalization structures with simple left dislocations such as (4a) and (4b).

2.3.1. *Participants*. Participants were 58 students of the University of Paris 8 who had not completed the questionnaire 2a.

2.3.2. *Materials*. The experimental items were adapted from those in Questionnaire 2a, filler sentences were the same.

2.3.3. *Procedure*. The procedure was the same as for the previous questionnaires.

2.3.4. *Results and discussion*. As shown in Table 1, the results were highly similar to the results obtained with *quant à* in Questionnaire 2a. An analysis of variance with sentence structure (Topicalized Subject *vs*. Topicalized Object) as within-subject factor revealed a marginal effect (47.5 % *vs*. 56.6 %, $F(1, 56) = 2.88$, $.05 < p < .10$; $F2(1,27)= 5.94$, $p < .05$). As in Questionnaire 2a, there were more N1 interpretations when N1 was the topicalized object than when it was the topicalized subject.

Table 1. *Percentage of N1 interpretations in the Subject and Object Topicalization structural conditions of the French questionnaires 2a and 2b.*

	Quant à	**Simple dislocation**
Subject Topicalization	45.4	47.5
Object Topicalization	53.2	56.6

The results of Questionnaire 2b replicated those of Questionnaire 2a. Similar effects were established independent of the specific realization of topicalization with the more formal *quant à* construction or as the simple dislocation.

To sum up, the baseline preference is different in the two languages, the crosslinguistically valid first mention and subject preference is not replicated in French as already observed (Hemforth et al. 2010). The results for the topicalized conditions mainly reflect a preference for the subject in German (with the possible exception of topicalized objects) and an object preference in French. Before discussing the role of explicit topicalization in more detail, we will look into the role of focus for the accessibility of antecedents in German and French.

As noticed in the introduction, focusing has also been claimed to enhance the salience or prominence, and hence the accessibility, of an antecedent (e.g., Cowles et al. 2007; Foraker and McElree 2007). This leaves open the question of the relative influence of these two foregrounding devices (topicalization *vs.* focusing). Experiment 2 was conducted in order to test the effects of focusing an antecedent in a cleft construction in the case of intra-sentential ambiguous pronoun interpretation.

3. Experiment 2: Baseline and cleft constructions

3.1. *Method*

3.1.1. *Participants*. 24 native speakers of German and 64 native speakers of French completed a written questionnaire. The German participants were students at the University of Munich, the French participants were students at the University of Geneva.

3.1.2. *Materials*. The experimental items were adapted from those in Experiment 1, filler sentences were the same. To focus an antecedent, we used *C'est / Es ist* 'It's' clefting structures.[2] Items were constructed in three conditions:[3] a Baseline condition (5a), a Focused Subject condition with a clefted subject (5b), and a Focused Object condition with a clefted object (5c).

(5) a. Baseline (same as in Experiment 1)
Peter hat Hans geohrfeigt, als er jung war.
Pierre a giflé Jean quand il était jeune.
'Peter has slapped John when he was young.'

b. Focused Subject
Es ist Peter, der Hans geohrfeigt hat, als er jung war.
It is Peter, who John slapped has, when he young was.
C' est Pierre qui a giflé Jean quand il était jeune.
It is Peter who has slapped John when he was young.
'It is Peter who has slapped John when he was young.'

c. Focused Object
Es ist Peter, den Hans geohrfeigt hat, als er jung war.
It is Peter, whom John slapped has, when he young was.
C' est Pierre que Jean a giflé quand il était jeune.
It is Peter whom John has slapped when he was young.
'It is Peter who John has slapped when he was young.'

3.1.3. *Procedure*. The procedure was the same as in Experiment 1. Six out of 648 (0.9 %) answers in the German questionnaires mentioned neither N1 nor N2 and were thus discarded from further analysis.

3.2. *Results and discussion*

Figure 2 presents the percentage of N1 interpretations in the three sentence structures (Baseline, Focused Subject and Focused Object) for the two languages.

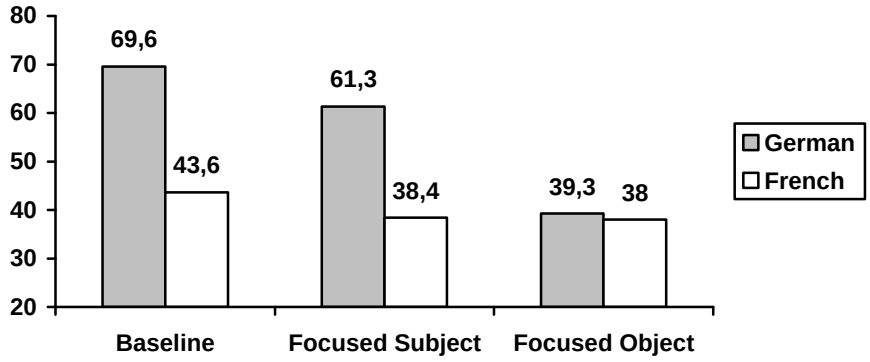


Figure 2. *Percentage of N1 interpretations in the three structural conditions (Baseline, Focused Subject and Focused Object) in German and French.*

The data were analyzed in a repeated measurements analysis of variance with Structure (Baseline, Focused Subject, Focused Object) as a within-subject factor, Language (German *vs.* French) as a between-subject and within-item factor and the percentage of N1 interpretations as dependent variable.

As in Experiment 1, there was a main effect of Language, due to the fact that N1 interpretations were more frequent in German than in French (57.1 % *vs.* 40 %; $F1(1,80) = 17.23$, $p < .0001$; $F2(1,24) = 41.06$, $p < .0001$). Concerning the Baseline condition, t-tests showed that the percentage of N1 interpretations was significantly different from a random preference of 50 % in each language ($t1(23) = 4.63$, $p < .0001$, $t2(27) = 4.27$, $p < .0001$ for German, and $t1(63) = 1.99$, $p = .051$; $t2(27) = 2.23$, $p < .05$ for French). This replicates the findings of Experiment 1.

There also was a main effect of Structure ($F1(2,160) = 9.21$, $p < .0001$; $F2(2,24) = 13.82$, $p < .0001$), and a significant interaction between the two factors ($F1(2,160) = 4.7$, $p = .01$; $F2(2,48) = 6.22$, $p < .005$). To further explore this pattern of results, we performed a series of additional analyses.

3.2.1. *Simple comparisons on German data*. In German, we observed that subjects which are focused by the means of clefting, are chosen less frequently numerically but not reliably so than subjects in the Baseline condition (61.3 % *vs*. 69.6 %, $t1(23) = 1.39$, ns; $t2(27) = 1.8$, $.05 < p < .10$). This numerical decrease could be due to an anti-focus effect: referents in focus seem to be slightly less accessible than non-focused referents. For the Focused Object condition, the number of N1 choices decreases reliably compared to the Focused Subject condition as well as compared to N1 in the Baseline condition (respectively, 39.3 % *vs*. 61.3 %, $t1(23) = 2.45$, $p < .05$; $t2(27) = 3.29$, $p < .005$; 39.3 % *vs*. 69.6 %, $t1(23) = 3.78$, $p < .005$; $t2(27) = 5.37$, $p < .0001$). This decrease is most probably due to a preference for the subject in German as already observed before.

3.2.2. *Simple comparisons on French data*. In French, no reliable difference could be established between N1 choices in the Baseline condition compared to the Focused Subject condition or to the Focused Object condition (respectively, 43.6 % *vs*. 38.4 %, all $ts < 2$; 43.6 % *vs*. 38 %, all $ts < 2$) although the number of N1 choices is decreasing numerically in the two clefting conditions. There is no significant difference between N1 choices in the Focused Subject condition compared to the Focused Object condition (38.4 % *vs*. 38 %, all $ts < 1$).

Experiment 2 confirms that grammatical role information strongly influences the resolution preferences in German, such that even the second mentioned referent is more accessible when it is the subject than when it is the object (60.7 % N2-interpretations in the Focused Object condition, but 30.4 % and 38.7 % in the Baseline and Focused Subject conditions respectively). In French, grammatical role has the opposite influence: the object is preferentially chosen as the antecedent of the pronoun.
In contrast to these crosslinguistic differences with respect to grammatical roles, information structural effects seem more alike across the two languages under investigation: The results for focusing show an interesting difference with those for topicalization in Experiment 1: While topicalization tends to increase the N1 preference, focusing the first mentioned referent by means of a clefting construction leads to less N1 interpretations in both languages. In order to confirm these apparent differences, we performed a series of additional analyses across experiments.

3.3. *Comparison across Experiment 1 and Experiment 2 for French and German results*

3.3.1. *German results*. Across experiments, we can see that topicalized referents are chosen as antecedents more often than focused referents for topicalized compared to focused subjects (72.7 % *vs*. 61.3 %, $t1(55) = 1.7$, $.05 < p < .10$; $t2(53) = 2.44$, $p < .05$), as well as for topicalized compared to focused objects (56.2 % *vs*. 39.3 %, $t1(55) = 2.09$, $p < .05$; $t2(53) = 2.55$, $p < .05$).

3.3.2. *French results*. Across experiments, we can see that, as in German, topicalized referents are chosen as antecedents more often than focused referents, though only numerically so for topicalized compared to focused subjects (45.4 % *vs*. 38.4 %, $t1(113) = 1.23$, ns; $t2(53) = 1.74$, $.05 < p < .10$), but reliably so for topicalized compared to focused objects (53.2 % *vs*. 38 %, $t1(113) = 3.15$, $p < .005$; $t2(53) = 4.5$, $p < .001$).

4. General discussion

Confirming the crosslinguistic difference already observed by Hemforth et al. (2010), the results of both experiments revealed a baseline difference between the two languages: in the Baseline condition, following canonical word order in both languages, we established a N1 preference in German, and a N2 preference in French. This crosslinguistic difference observed for *bevor/avant que* 'before' persists with the conjunction *als*/*quand* 'when'. In the constructions under investigation here, the French Baseline condition replicates the finding that in French, interpretations go more often to the second-mentioned object than to the first-mentioned subject of the sentence, similarly to sentences with *avant que.* In sentences with *avant que*, as argued in the introduction, this preference may be attributed to the fact that in French, reference to the subject is usually obtained with an infinitival construction introduced by *avant de* (Riegel et al. 1994). Following Gricean reasoning (Grice 1975), this might lead to a preference for the object referent in the interpretation of overt pronouns in *avant que* sentences. There is no similar alternative construction for sentences with *quand*. However, the infinitival alternative exists for a variety of conjunctions (e.g., *avant que* and *après que* 'before'), so that in many temporal subordinate clauses there is a very strong preference for the full pronoun to refer to the second-mentioned NP (mostly the object). This general distribution in the input may influence the processing of pronouns even in temporal subordinate clauses without a close alternative, thus leading to a general bias for the object antecedent in French. Note that in the constructions under investigation, matrix clauses only contained a subject and a direct object. In this configuration the French preference shows up

as a preference for the object. Our data do, however, not allow distinguishing between an object and an anti-subject preference.

On top of the crosslinguistic baseline difference, we have found effects of the grammatical role and the information status of the antecedents, which we will now discuss for each of the languages. For German, we find a general subject bias. In Experiment 2, the subject is the preferred antecedent in all three structural conditions. In Experiment 1, the subject is the preferred antecedent except when the object is topicalized. This subject preference is compatible with previous results observed for German (see Bouma and Hopp 2006; Järvikivi et al., submitted) as well as for a variety of other languages, such as English, Dutch, and Finnish (Crawley et al. 1990; Frederiksen 1981; Järvikivi et al. 2005; Kaiser and Trueswell 2008). If, however, grammatical role were the only determining factor, we would have expected to find a subject preference even when the object is topicalized which was not the case. The change in preferences in this condition could be explained by a preference for the first-mentioned antecedent (Gernsbacher and Hargreaves 1988; Gernsbacher et al. 1989; Gernsbacher 1990). However, if this were the case, we should also find a comparable preference for the first-mentioned focused object in Experiment 2. As no such preference was established, it seems more plausible that the preference for the topicalized object reflects an effect of topicalization. The fact that the topicalized subject is not chosen more often than the non-topicalized subject does not speak against such an effect of topicalization, as the non-topicalized subject is the topic by default. Additional explicit topicalization does not further enhance the accessibility of this referent. The object, however, is not generally perceived as a topic. Explicit topicalization can thus significantly increase the number of attachments to object antecedents. When comparing Experiment 1 and 2, we observe that focusing has an opposite effect to the effect of topicalization in German.

For French, we find a general object bias. In Experiment 1, the object is the preferred antecedent in all three structural conditions. In Experiment 2, the object is also the preferred antecedent except when it is focused. As will be discussed in more detail below, this can be explained by an anti-focus effect. As for the influence of explicit topicalization in Experiment 1, we did not find evidence for a strong effect in French. Assuming such a topicalization effect, we would have expected more object interpretations when the object is topicalized than when it is not topicalized. However, there are even less object interpretations in this condition. A possible way to explain this pattern of results relates to a generalization of grammatical role based preferences to position based preferences: French word order is fairly rigid at least with respect to the ordering of the subject and other verbal arguments. There are only few linguistic structures in which the object can be the first mentioned entity. Therefore, it seems plausible that French speakers may have generalized the object preference to a general preference against the first position in pronoun resolution. This could explain why there are relatively few interpretations for the topicalized object. This is, however, not to say that there is no effect of the information status of the antecedents in French at all. When Experiment 1 and Experiment 2 are combined, it can be observed that, as in German, topics are more accessible than focused referents.

All in all, French speakers' preferences seem to be driven mainly by an object preference, whereas German speakers rely on a subject preference. Grammatical role is thus of influence in both languages. However, the underlying reasons for its influence are different. The subject preference in German replicates findings for other languages. It has generally been assumed that subjects are perceived as particularly important referents to which the following discourse is likely to refer. This might be due to the fact that subjects are often also the agents of the described actions, i.e., a semantic role that is dominant in a traditional thematic role hierarchy (e.g., Jackendoff 1990). These factors should push for subject-interpretations of ambiguous pronouns also in French. But another factor is of influence in

French, apparently overriding the crosslinguistically valid subject preference and leading to an object preference. As argued above, it seems likely that the influence of alternative unambiguous constructions, which are frequent in French, is responsible for this difference.

While information structural markings do not cancel out this crosslinguistic difference, they do have similar effects in the two languages. In both languages, preferences are modulated by a preference for topicalized referents compared to a dis-preference for focused referents. As has been shown above, this is not due to a preference for the first mentioned antecedent as postulated by Gernsbacher and colleagues (Gernsbacher and Hargreaves 1988; Gernsbacher et al. 1989; Gernsbacher 1990). Topicalized as well as focused referents occupied the first position in the sentence. An explanation in terms of salience or prominence of the referent cannot account for this preference for the topicalized referent over the focused referent either. Explicit topic and focus marking both foreground the referents, thus making them more salient (Cowles et al. 2007). Topic and focus do, however, not serve the same discourse functions. Topicalizing a referent signals that this referent is the entity that the sentence is about. In other words, a sentence in which the first entity is topicalized, such in "Peter, he has slapped John when he was young." would be a felicitous answer to the question: "What has happened to Peter?".[4] A sentence such as "It is Peter who has slapped John when he was young.", in contrast, is a felicitous answer to the question: "Who has slapped John?". This sentence is thus about who slaps John, rather than about Peter. Binding a pronoun in the subordinate clause to "Peter" would imply a change in topic within the sentence, thus reducing coherence. This might explain why focusing the first referent increases the number of N2 interpretations in both languages, given that the second referent is part of the sentence topic. Cowles et al. (2007) found that topicalization (through multiple mentions) and focusing (through a cleft construction) had similar effects on the resolution of a pronoun in the following sentence. Both the topicalized and the focused referents were more accessible for an overt pronoun than other potential antecedents. It seems that the effects of topicalizing and focusing are thus different within and between sentences. How can this be explained? As Grosz (1977) states (see also, Miltsakaki 2002; Joshi et al. 2005), within an utterance, a single entity is in the centre of attention, the entity the sentence is about (see Foraker and McElree [2007], for experimental data compatible with this idea). Given that the subordinate clause can be regarded as part of the main utterance, changing topics between the main clause and the subordinate clause can be assumed to be dispreferred. Between sentences, however, both information structural devices may show similar effects though for different reasons: Whereas a sentence topic makes a good antecedent for reasons of discourse coherence, focusing a referent in a given sentence may induce the possibility of a topic shift, thus establishing this referent as a potential topic of the following sentence. A pronoun in the following sentence may thus access both foregrounded referents more easily: either because they have already been the topic of the preceding sentence (marked by topicalization), or because they have been introduced as a potential new topic (marked by focusing) (see Arnold 1999 for a similar idea). Within sentences, however, coherence is more important: Binding a pronoun to the topic makes the sentence more coherent by keeping the sentence topic constant between the matrix clause and the subordinate clause.

Our results suggest that not all "syntactic highlighting" constructions have the same effect. The effect that they have depends on their discourse function. Topic and focus differ with respect to their influence on accessibility within sentences. If accessibility is a consequence of salience, stating that pronouns are attached to the most salient antecedent is at the very least not sufficient. The current results may be taken to suggest that the concept of salience is less useful than it has been assumed to be. Salience is often seen as a kind of aggregate function, integrating a variety of factors known to increase accessibility. It may, however, be possible that discourse functions such as topicalization or focusing have a direct

influence on pronoun resolution, which can be explained without postulating an intervening effect of salience or prominence.

More generally, there are two major conclusions to draw from our data. Firstly, it has been argued repeatedly that the existence of a frequent alternative construction can influence the interpretation of an ambiguous structure (e.g., Frazier and Clifton 1996; Hemforth et al. 2010; Baumann et al. 2011) following the Gricean principle of clarity (Grice 1975). For the constructions studied in this paper, there is no such alternative however. As we argued before, the language specific differences in pronoun resolution may be explained by a Generalized Frequency Principle, where distributional properties of highly similar constructions (for example temporal clauses with *avant que* or *après que* in this case) exert an influence on the constructions at hand (e.g., temporal subclauses with *quand*). Preferences seem to be able to spread from one construction to a strongly related one. This hypothesis will have to be investigated more systematically in future work. Secondly, our data clearly show that linguistic structure has to be taken into account much more seriously in models of anaphor resolution. Different information structural devices such as topic and focus cannot be confounded because they have different effects on interpretational preferences, which are based on the different functions they serve within and across sentences. What really counts is the specific function of a device for the construction of a model of the current discourse. This function can differ within and between sentences, but it may also vary between different kinds of coherence relations, different event structures and the like (Kehler 2002; Wolf et al. 2004; Rohde et al. 2006). A general heuristic such as "look for the most salient antecedent" cannot be sufficient to explain interpretational preferences of ambiguous pronouns. A precise analysis of the information structural function of each antecedent in a given construction is a prerequisite of a predictive model of pronoun resolution. Such a model has to take into account the informational status of the antecedents at the moment the pronoun is processed. This status may effectively change in a dynamically updated discourse model.

Received 8 March 2011
Revised version received 14 January 2012

CNRS
University of Paris 8
University of Paris 5

Appendix 1. Experimental items

NOTE: There were 28 items in the French Questionnaire 2b (14 items per condition), as well as in the questionnaires 3 and 4 (Experiment 2) in both languages (see Note 3, 7 items per condition), but only 27 in the questionnaires 1 and 2a (Experiment 1) (9 items per condition). The item that was not included in the questionnaires 1 and 2a (Experiment 1) is item 27 below. Note also that the female names in items 14–28 were changed to male names in Experiment 2 in German, as it is not possible in German to distinguish subject and object cleft constructions if the subject noun phrase has feminine gender.

1. Peter hat Hans geohrfeigt, als er jung war.

   Pierre a giflé Jean quand il était jeune.

   Peter has slapped John when he was young.

2. Erich hat Laurenz erstochen, als er in Rom arbeitete.

   Eric a poignardé Laurent quand il travaillait à Rome.

   Eric has stabbed Laurent when he was working in Rome.

3. Patrick hat Julius getötet, als er Student war.

   Patrick a tué Jules quand il était étudiant.

   Patrick has killed Jules when he was a student.

4. Robert hat Stefan eingeladen, als er im Urlaub war.

   Robert a invité Stéphane quand il était en vacances.

   Robert has invited Stephan when he was on vacation.

5. Matthias hat Jan festgenommen, als er in Afrika lebte.

   Mathieu a arrêté Cédric quand il vivait en Afrique.

   Matthew has arrested Cedric when he was living in Africa.

6. Christoph hat Philip versteckt, als er beim Militär war.

   Cyril a caché Philippe quand il était militaire.

   Christopher has hidden Phillip when he was in the military.

7. Lukas hat Rolf gepflegt, als er in München wohnte.

   Lucien a soigné Roger quand il habitait à Marseille.

   Luke looked after Roger when he was living in Marseille.

8. Paul hat Julius geholfen, als er bei IBM arbeitete.

   Paul a aidé Julien quand il travaillait chez IBM.

   Paul has helped Jules when he was working at IBM.

9. Christian hat Sebastian befragt, als er im Ausland studierte.

   Christian a questionné Sébastien quand il étudiait à l'étranger.

   Christian has questioned Sebastian when he was studying abroad.

10. Anton hat Pascal empfangen, als er als Manager arbeitete.

    Antoine a reçu Pascal quand il était dans les affaires.

    Anthony has received Pascal when he was working as a businessman.

11. Bruno hat Denis beherbergt, als er allein stehend war.

    Bruno a hébergé Denis quand il était célibataire.

    Bruno has housed Denis when he was single.

12. Gerhard hat Franz verfolgt, als er beurlaubt war.

    Gérard a poursuivi François quand il était en permission.

    Gerry has hounded Frank when he was on a leave of absence.

13. Roland hat Michael misshandelt, als er ein Teenager war.

    Roland a malmené Michel quand il était adolescent.

    Roland has mistreated Michael when he was an adolescent.

14. Bert hat Max angeschrien, als er betrunken war.

    Bertrand a engueulé Maurice quand il était soûl.

    Bert has yelled at Max when he was drunk.

15. Marie hat Julia geschlagen, als sie Paris besuchte.

    Marie a frappé Julie quand elle visitait Paris.

    Mary has hit Julie when she was visiting Paris.

16. Sophie hat Patricia gedankt, als sie sich in Italien aufhielt.

    Sophie a remercié Patricia quand elle demeurait en Italie.

    Sophie has thanked Patricia when she was staying in Italy.

17. Martina hat Christine eingestellt, als sie für eine Weile in Frankreich war.

    Muriel a engagé Christine quand elle séjournait en France.

    Muriel has hired Christine when she was living in France.

18. Renate hat Nathalie bedroht, als sie bei der Post arbeitete.

    Aurélie a menacé Nathalie quand elle travaillait à la Poste.

    Aurelia has threatened Nathalie when she was working at the post office.

19. Martha hat Christa informiert, als sie in Rente war.

    Martine a renseigné Christelle quand elle était à la retraite.

    Martha has informed Christelle when she was retired.

20. Helene hat Claudia geschubst, als sie klein war.

    Hélène a poussé Céline quand elle était petite.

    Helen has hustled Céline when she was little.

21. Gisela hat Marianne beeinflusst, als sie verheiratet war.

    Gisèle a influencé Manon quand elle était mariée.

    Giselle has influence Marianne when she was married.

22. Anne hat Laura angeklagt, als sie bei der Gemeinde angestellt war.

    Anne a accusé Laurence quand elle était employée à la Mairie.

    Anne has accused Laure when she was working at the city hall.

23. Beatrice hat Jutta verhauen, als sie auf dem Gymnasium war.

Béatrice a tapé Jeanne quand elle était lycéenne.

Beatrice has spanked Jean when she was in high school.

24. Veronika hat Maria frisiert, als sie frei hatte.

Véronique a coiffé Maria quand elle était en congé.

Veronique has dressed Mary's hair when she had a holiday.

25. Valerie hat Monika ausgefragt, als sie eine Wohnung in London hatte.

Valérie a interrogé Monique quand elle résidait à Londres.

Valerie has interrogated Monique when she was living in London.

26. Sandra hat Bettina angerempelt, als sie ein Praktikum machte.

Sandrine a bousculé Cécile quand elle était stagiaire.

Sandra has bumped into Cecile when she was an intern.

27. Miriam hat Juliane beleidigt, als sie ein Geschäft hatte.

Mireille a insulté Juliette quand elle était commerçante.

Mireille has insulted Julie when she owned a shop.

28. Paula hat Klara gratuliert, als sie in Madrid vorbeikam.

Pauline a félicité Claire quand elle était de passage à Madrid.

Pauline has congratulated Claire when she was visiting Madrid.

Notes

***** We wish to thank Anne-Katharina Ochsenbauer for her help with conducting the questionnaire study in Munich. Correspondence address: Saveria Colonna, UMR 7023 Structures formelles du langage, , Université Paris 8 & CNRS, 59–61 rue Pouchet, 75849 Paris cedex 17, France. E-mail: saveria.colonna@univ-paris8.fr.

1. According to Joshi and Weinstein (1981), the notion of backward-looking centre is roughly the same as the notion of topic, and the notion of forward-looking centre is roughly the same as the notion of focus.
2. In the explicit topic construction, the left dislocation of N1 as well as its pronominalization contribute to its topic status. For the explicit focus constructions in our study, it is the cleft as well as the relative pronoun which mark the informational status of N1. At least in German, the relative pronoun is marked for gender and number as much as the simple pronoun so that there is no difference in the information provided.
3. There were four conditions in the questionnaire, only three of which are presented in the text. The remaining condition corresponds to the dislocated object condition of Questionnaire 2b in French and to a similar object dislocation condition in German (more precisely, in order to match the French dislocation structure as closely as possible, we used a dislocation in German as well: Peter, den hat Hans geohrfeigt, als er jung war. Peter, that-one(obj) has Hans(subj) slapped when he was young). The results for this

condition are comparable to the ones obtained before with the same (French) or a similar (German) construction (in French: 56.6 % N1 interpretations in Questionnaire 2b, 54 % in Questionnaire 3 (Experiment 2), in German: 55.9 % N1 interpretations in Questionnaire 1 (Experiment 1), 51.5 % in Questionnaire 3 (Experiment 2), for topicalized objects in all cases). As these results do not contribute any new information, they are not discussed any further.

4. Note that using a simple left dislocation such as “Peter, he slapped John when he was young” or a more complex form such as “As for Peter, he slapped John when he was young”, which has been claimed to be used mainly for marking contrastive topic, does not really change the interpretation of the pronoun (as shown by the comparison of questionnaire 2a and 2b in French).

References

Ariel, Mira. 1990. *Accessing noun-phrase antecedents*. London: Routledge.

Arnold, Jennifer E. 1998. *Reference form and discourse patterns*. Stanford, CA: Stanford University dissertation.

Arnold, Jennifer E. 1999. *Marking salience: The similarity of topic and focus*. Unpublished manuscript, University of Pennsylvania.

Arnold, Jennifer E., Janet G. Eisenband, Sarah Brown-Schmidt & John C. Trueswell. 2000. The rapid use of gender information: Evidence of the time course of pronoun resolution from eyetracking. *Cognition* 76. B13–B26.

Baumann, Peter, Lars Konieczny & Barbara Hemforth. 2011. Expectations and coreference: how alternative constructions and referring expressions can serve as cues. In *Proceedings of the 33rd Annual Conference of the Cognitive Science Society.* Austin, TX.

Bouma, Gerlof & Holger Hopp. 2006. Effects of word order and grammatical function on pronoun resolution in German. In Ron Artstein & Massimo Poesio (eds.), *Ambiguity in Anaphora Workshop proceedings* (ESSLI 2006).

Charolles, Michel. 2003. *De la topicalité des adverbiaux détachés en tête de phrase* (Travaux de Linguistique 47). Louvain la Neuve: De Boeck Université.

Clifton, Charles & Fernanda Ferreira. 1987. Discourse structure and anaphora: some experimental results. In Max Coltheart (ed.), *Attention and performance XII: The psychology of reading*, 635–654. Hillsdale, NJ: Lawrence Erlbaum Associates Ltd.

Cowles, H. Wind, Matthew Walenski & Robert Kluender. 2007. Linguistic and cognitive prominence in anaphor resolution: topic, contrastive focus and pronouns. *Topoi 26*. 3–18.

Crawley, Rosalind. 1986. Some factors influencing the comprehension of pronouns. In Charles Clifton (ed.), *Proceedings of the Eighth Annual Conference of the Cognitive Science Society*, 613–620. Hillsdale, NJ: Lawrence Erlbaum Associates.

Crawley, Rosalind, Rosemary Stevenson & David Kleinman. 1990. The use of heuristic strategies in the interpretation of pronouns. *Journal of Psycholinguistic Research* 4. 245–264.

van Dijk, Teun. 1977. *Text and context*. London: Longman.

Doherty, Monika. 2001. Cleft-like sentences. *Linguistics* 39(3). 607–638.

Ellert, Miriam. 2010. *Ambiguous pronoun resolution in L1 and L2 German and Dutch* (MPI Series in Psycholinguistics 58). Wageningen: Ponsen & Looijen.

Foraker, Stephani & Brian McElree. 2007. The role of prominence in pronoun resolution: Availability versus accessibility. *Journal of Memory and Language* 56. 357–383.

Frazier, Lyn & Charles Clifton. 1996. *Construal*. Cambridge, MA: MIT Press.

Frederiksen, John. 1981. Understanding anaphora: Rules used by readers in assigning pronominal referents. *Discourse Processes* 4. 323–347.

Frey, Werner. 2004. The grammar-pragmatics interface and the German prefield. *Sprache & Pragmatik* 52. 1–39.

Gernsbacher, Morton A. & David J. Hargreaves. 1988. Accessing sentence participants: The advantage of first mention. *Journal of Memory and Language* 27. 699–717.

Gernsbacher, Morton A. 1990. *Language comprehension as structure building*. Hillsdale, NJ: Lawrence Erlbaum.

Gernsbacher, Morton A., David J. Hargreaves & Mark Beeman. 1989. Building and accessing clausal representations: The advantage of first mention versus the advantage of clause recency. *Journal of Memory and Language* 28. 735–755.

Givón, Talmy. 1983. *Topic continuity in discourse: A quantitative cross-language study*. Philadelphia & Amsterdam: John Benjamins.

Gordon, Peter C., Barbara J. Grosz & Laura A. Gilliom. 1993. Pronouns, names, and the centering of attention. *Cognitive Science* 17. 311–347.

Grice, Herbert P. 1975. Logic and conversation. In Peter Cole & Jerry L. Morgan (eds.), *Syntax and semantics*, Vol. 3, 41–58. New York: Academic Press.

Grosz, Barbara J. 1977. *The representation and use of focus in a system for dialogue understanding*. Technical report 151, Menlo Park, CA: SRI International.

Gundel, Jeanette, Nancy Hedberg & Ron Zacharski. 1993. Cognitive status and the form of referring expressions in discourse. *Language* 69(2). 274–307.

Hemforth, Barbara, Lars Konieczny, Cristoph Scheepers, Saveria Colonna, Sarah Schimke & Joël Pynte. 2010. Language specific preferences in anaphor resolution: Exposure or gricean maxims? In *Proceedings of the 32nd Annual Conference of the Cognitive Science Society*, Portland, OR, 11–14 August.. http://csjarchive.cogsci.rpi.edu/proceedings/2010/papers/0520/paper0520.pdf (accessed 22 June 2012)

Jackendoff, Ray. 1990. *Semantic structures*. Cambridge, MA: MIT Press.

Järvikivi, Juhani, Roger P. G. van Gompel, Jukka Hyönä & Raymond Bertram. 2005. Ambiguous pronoun resolution: Contrasting the first-mention and subject preference accounts. *Psychological Science* 16. 260–264.

Järvikivi, Juhani, Pirita Pyykkönen, Sarah Schimke, Saveria Colonna & Barbara Hemforth. submitted. Information structure cues for 4-year olds and adults: Tracking eye movements to visual anaphoric referents.

Joshi, Aravind, Rahsmi Prasad & Eleni Miltsakaki. 2005. Anaphora resolution: A centering approach. In *Encyclopedia of Language and Linguistics*, 2nd edn. London & Amsterdam: Elsevier.

Joshi, Aravind & Scott Weinstein. 1981. Control of inference: Role of some aspects of discourse structure-centering. *Proceedings of the International Joint Conference on Artificial Intelligence*, Vancouver, August, 385–387. http://ijcai.org/Past%20Proceedings/IJCAI-81-VOL%201/PDF/071.pdf. (accessed 22 June 2012)

Kaiser, Elsi. 2006. Effects of topic and focus on salience. In Christian Ebert & Cornelia Endriss (eds.), *Proceedings of Sinn und Bedeutung 10 (ZAS Papers in Linguistics* 44), 139–154. Berlin: Zentrum für Allgemeine Sprachwissenschaft. http://www.zas.gwz-berlin.de/78.html?&L=1 (accessed 22 June 2012)

Kaiser, Elsi & John C. Trueswell. 2008. Interpreting pronouns and demonstratives in Finnish: Evidence for a form-specific approach to reference resolution. *Language and Cognitive Processes* 23(5). 709–748.

Kehler, Andy. 2002. *Coherence, reference and the theory of grammar*. Stanford, CA: CSLI Publications.
Klein, Wolfgang & Christiane von Stutterheim. 1992. Textstruktur und referentielle Bewegung. *Zeitschrift für Literaturwissenschaft und Linguistik* 86. 67–92.
Lambrecht, Knud. 1994. *Information structure and sentence form: Topic, focus, and the mental representation of discourse referents.* Cambridge: Cambridge University Press.
Miltsakaki, Eleni. 2002. Towards an aposynthesis of topic continuity and intra-sentential anaphora. *Computational Linguistics* 28(3). 319–355.
Reinhart, Tanya. 1982. *Pragmatics and linguistics: An analysis of sentence topics.* Bloomington, IN: Indiana University Linguistics Club.
Riegel, Martin, Jean-Christophe Pellat & René Rioul. 1994. *Grammaire méthodique du français*. Paris: P.U.F.
Rohde, Hannah, Andrew Kehler & Jeffrey Elman. (2006). Event structure and discourse coherence biases in pronoun interpretation. In *Proceedings of the 28th Annual Conference of the Cognitive Science Society*, Vancouver, Canada. http://csjarchive.cogsci.rpi.edu/proceedings/2006/docs/p697.pdf (accessed 22 June 2012)
Sanders, Ted & Leo Noordman. 2000. The role of coherence relations and their linguistic markers in text processing. *Discourse Processes* 29. 37–60.
Stevenson, Rosemary J., Rosalind A. Crawley & David Kleinman. 1994. Thematic roles, focus and the representation of events. *Language and Cognitive Processes* 9. 473–592.
Wolf, Florian, Edward Gibson & Timothy Desmet. 2004. Discourse coherence and pronoun resolution. *Language and Cognitive Processes* 19(6). 665–675.