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International Review of Pragmatics 2 (2010) 266–297

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Investigating the Consequences of Focus on the Production and Comprehension of Referring Expressions

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Abstract

This paper investigates issues related to referent tracking in discourse, in particular whether and how contrastive focus interacts with other factors – in particular pronominalization and subjecthood – to influence comprehenders' and speakers' expectations about what entities will be referred to/mentioned in upcoming discourse. On the basis of data from two psycholinguistic experiments, I argue that to better understand the discourse-structuring effects of contrastive focus, we need to consider not only pronoun interpretation but also production-based questions having to do with choice of upcoming referent and choice of referential form. I suggest that looking at the discourse-level consequences of contrastive focus from the perspective of the comprehender as well as the perspective of the speaker (i) allows us to gain new insights about the effects of focus and the discourse-status of focus-induced alternatives, and (ii) highlights (potentially unexpected) asymmetries between likelihood of upcoming mention and likelihood of pronominalization.

Keywords

contrastive focus, topic, pronoun interpretation, production of referring expressions, psycholinguistics

1. Introduction¹

This paper investigates issues related to referent tracking in discourse, in particular how the presence of contrastive focus influences comprehenders' and

¹ Thank you to Sofiana Chiriacescu and Klaus von Heusinger for organizing the International Conference on Reference and Discourse Structure at the University of Stuttgart in January 2010. I would also like to thank the conference participants as well as two reviewers for their insightful comments. In addition, thanks go to Rebekka Puderbaugh, Edward Holsinger, Sasha Elio and Joyce McDonough for assistance with the experiments, and Christine Gunlogson, Jeffrey Runner, and Michael Tanenhaus for comments on the initial stages of this work. Earlier versions of some aspects of this research are discussed in Kaiser (2006, 2009a, 2009b).

speakers' expectations about what entities will be referred to/mentioned in upcoming discourse. I present two psycholinguistic experiments that investigated whether and how focus interacts with other factors – in particular pronominalization and subjecthood – to influence how prominently entities are represented in speakers' and comprehenders' mental representations, and what role focus-induced alternatives play in subsequent discourse.

Prior research suggesting that contrastive focus increases referent salience/prominence offers a striking counterpart to other findings that emphasize the role of topicality-related factors (such as subjecthood, givenness and pronominalization). However, recent research comparing the effects of topicality vs. contrastive focus on referent prominence has led to mixed results. Our understanding of the consequences of focusing is further complicated by other research suggesting that the presence of competitors/alternatives could be lowering the salience of the intended referent.

In this paper, I show that we can gain new insights into these issues – as well as more general questions regarding referent tracking in discourse – when we explore focus-related effects from two angles: (i) The perspective of the *comprehender*: When faced with a pronoun, how does a comprehender interpret it? (ii) The perspective of the *speaker*: When continuing a discourse fragment, what entities are speakers most likely to refer to, and with what kind of referring expressions (see also Kehler et al., 2008)? On the basis of data from two psycholinguistic experiments, I suggest that looking at the discourse-level consequences of contrastive focus from these two angles (i) allows us to better understand the effects of focus as well as the discourse-status of focus-induced alternatives, and (ii) highlights (potentially unexpected) asymmetries between likelihood of upcoming mention and likelihood of pronominalization. I also present data from a third experiment that looked at additive focus, to see whether the patterns observed for contrastive focus extend to other types of focus. Broadly speaking, this research aims to contribute to our understanding of the notion of accessibility/salience by looking at an entity's likelihood of pronominalization and likelihood of subsequent mention, and how they are affected by the entity's focus status and its connections to other previously-mentioned entities.

This paper is structured as follows: In Section 2, I review prior research on the factors that influence pronoun *interpretation*, including existing findings regarding contrastive focus. In Section 3, I outline the main aims of this paper and discuss the importance of understanding not only how language users interpret pronouns but also how they make choices about *production*: what referent to mention next and with what kind of referring expression (Section 3.1). Once we broaden our investigation of contrastive focus effects into the

domain of production, we are also able to ask questions regarding the discourse status of focus-induced alternatives (Section 3.2) – more precisely, the discourse status of a previously-mentioned referent that has been replaced by a new, contrastively-focused referent. Sections 4 and 5 present the results of two psycholinguistic experiments which show that once we look at both comprehension and production of referring expressions, we gain not only a better understanding of how contrastive focus influences language users' discourse models, but also a new appreciation of the sub-components of the referent tracking process. The results of the third experiment (in Section 5) show that the discourse-level consequences of additive focus differ from those of contrastive focus, suggesting that adding another alternative to the discourse model has different consequences than rejecting a previously-mentioned alternative. Section 6 presents the general discussion and conclusions.

2. Pronoun Interpretation

The general area of reference resolution and referent tracking has been intensively researched from a range of perspectives. A large body of research has investigated what influences the interpretation and use of different referring expressions (e.g. Ariel, 1990; Gundel, Hedberg and Zacharski, 1993). It is commonly assumed that reduced referring expressions, such as pronouns in English, tend to be interpreted as referring to entities that are highly salient/prominent at that point in the discourse (see Gundel (2010) for detailed discussion regarding the nature of the form-function mapping, including a commentary on the differences between Gundel et al.'s Givenness Hierarchy and Ariel's Accessibility Hierarchy). Positing a relation between referring expressions and the salience of their intended referents brings up the important question of what influences referent salience; some of the key findings from existing work are summarized in Section 2.1. One issue that is of particular interest to us in this paper is the mixed results that have been obtained concerning the effects that contrastive focus has on the interpretation of subsequent referring expressions, as summarized in Section 2.2.

2.1. Factors that Guide Pronoun Interpretation

Previous research has argued that a range of factors guide the interpretation of pronouns (see e.g. Arnold, 1998; Garnham, 2001, for a summary). Properties such as (i) occupying the grammatical position of subject, (ii) being given/old information and (iii) being realized as a pronoun make referents more likely to be interpreted as antecedents of subsequent pronouns (e.g. Bosch, Katz and

Umbach, 2007; Brennan, Friedman and Pollard, 1987; Chafe, 1976; Crawley and Stevenson, 1990; Kameyama, 1996; Strube and Hahn, 1996, 1999). Other factors include verb type, connectives and word order. Many of these properties have also been linked to the notion of *topicality* (on topicality, see also Chiriacescu and von Heusinger, 2010; Geist, 2010; and Ionin, 2010), and one might thus be tempted to conclude that the general notion of topicality serves as a good basis for explaining salience and reference resolution preferences. However, as we will see in the next section, results concerning the effects of contrastive focus suggest that a purely topicality-based approach is not sufficient.²

2.2. Existing Work on Focus Effects

A considerable body of cognitive psychology research has found that, independently of reference resolution, focus affects the processing and representation of linguistic information (most studies used *it*-clefts and looked at contrastive focus). In an early study, Hornby (1974) tested the consequences of focusing in *it*-clefts. Participants saw pictures and sentences and were asked to indicate whether they match. Hornby found that participants were better at detecting mismatches when the mismatching information was focused in an *it*-cleft (e.g. “It is *the girl* who is riding the bicycle”) than when it was presupposed (see also Cutler and Fodor, 1979). Other research suggests that the focused/non-presupposed part of a sentence is remembered better (e.g. Singer, 1976; Birch and Garnsey, 1995; see also Birch and Rayner, 1997) and attended to more than the presupposed part (Zimmer and Engelkamp, 1981). Looking more specifically at reference resolution, Almor (1999) found that definite NPs with focused antecedents are read faster than definite NPs whose antecedents are not in focus, regardless of the antecedent’s grammatical role. Further evidence for the claim that focused entities are represented differently from non-focused entities comes from Birch, Albrecht and Myers (2000) and Foraker and McElree (2007).

Broadly speaking, existing work indicates that contrastive focus, as well as topicality-related factors like subjecthood and pronominalization, increase entities’ salience/prominence. Recently, looking specifically at *pronoun interpretation*, Arnold (1998, 1999), Cowles (2003) and Cowles, Walenski and Kluender (2007) conducted experiments looking at how the effects of

² Even though contrastive focus and topicality are not mutually exclusive, they are commonly regarded as cognitively separable notions. Crosslinguistic research in theoretical linguistics also suggests that focus and topic are distinct (e.g. Molnár, 2006 for an overview; see also Steedman, 2000 for related work).

topicality-related factors and contrastive focus compare to each other.³ More specifically, they investigated comprehenders' interpretation of ambiguous pronouns to see whether these pronouns would be interpreted as referring back to topical or to focused referents in the preceding discourse. Their results, however, are not entirely consistent with each other. Arnold concludes that pronoun interpretation is more sensitive to topicality than to contrastive focus. In contrast, Cowles argues that “[a]ll three information statuses [contrastive focus, discourse-topic and sentence-topic] appear to make their referent more likely to be interpreted as the antecedent of a subsequent pronoun” (Cowles, 2003: 93). However, this difference may be connected to differences in grammatical roles: whereas Arnold looked at topics that were subjects and foci that were objects, in Cowles' research both topics and foci were in subject position.

To shed light on these conflicting findings, I conducted two earlier experiments on pronoun interpretation using visual-world eye-tracking (Kaiser, forthcoming). Given that existing work has repeatedly found that the grammatical role of potential antecedents influences the interpretation of subsequent pronouns, I manipulated the grammatical role of the focused constituent, and looked at focused subjects and focused objects in clefted sentences ((1a-b)) as well as SVO sentences. Both SVO sentences and *it*-clefts were included to see whether a focus-marking construction patterns differently from the default SVO order. As discussed below, *it*-clefts also allow us to control for potential effects of structural parallelism. In earlier corpus-based and psycholinguistic work, Arnold (1998, 1999) obtained mixed results for the cleft/SVO distinction.

Participants' eye-movements were recorded as they listened to dialogues and looked at visual scenes that contained the characters mentioned in the sentence. In light of a large body of eye-tracking work showing that eye-movements provide an indication of what potential antecedents participants are considering, we were especially interested in seeing which referent participants look at most (the preceding subject or object) when they encounter the ambiguous pronoun “he” in speaker B's response (underlined in (1a-b)). The sentence with the ambiguous pronoun was spoken with normal intonation, without any special accenting of the pronoun.

- (1) a. [Cleft.Object=focus]

Speaker A: I heard that Greg congratulated Mike enthusiastically yesterday.

³ Arnold (1998, 1999) also looked at *wh*-clefts (pseudo-clefts) in a corpus, a more production-oriented type of data.

Speaker B: No, that's not quite right. ***It was John that he congratulated.*** The prizes for the best-ranked tennis players were about to be announced, and he was holding a new yellow tennis racket...

b. [Cleft.Subject=focus]

Speaker A: I heard that Greg congratulated Mike enthusiastically yesterday.

Speaker B: No, that's not quite right. ***It was John who congratulated him.*** The prizes for the best-ranked tennis players were about to be announced, and he was holding a new yellow tennis racket...

The participants' task was a picture-verification task: They were told that some items might contain picture-sentence mismatches and that in such cases, they should click on the part of the picture that contained the error. On all target trials, the critical sentence with the ambiguous pronoun was incorrect with respect to both pictured characters. For example, in (1a-b), both are holding tennis rackets but neither one is yellow. This way, I could avoid biasing participants towards one of the referents.

Dialogues were used to make sure that use of contrastive focus was felicitous. In this eye-tracking experiment, as in the new experiments described in the present paper, I used dialogues where one speaker corrects the other, i.e., dialogues involving *corrective focus*, which is a type of contrastive focus (see e.g. Halliday, 1967; Gussenhoven, 2007) (in the present paper, the term "contrastive focus" refers to a particular subtype, namely corrective focus). Using an explicit context also ensured that comprehenders interpret both SVO sentences and clefts as having the intended kind of contrastive focus structure.

The results show that pronouns exhibit a significant interpretation bias towards the preceding subject: comprehenders' eye-movements showed that they have a preference to interpret a subject-position pronoun (e.g. "he" in (1a-b)) as referring to the preceding subject rather than the preceding object. Importantly, this subject preference is present in all conditions, (i) regardless of whether the subject is pronominalized (1a) or focused (1b), and (ii) regardless of whether the critical sentence is an *it*-cleft or a regular SVO sentence (e.g. "He congratulated John").

The finding that the subject is the preferred antecedent regardless of whether it is pronominalized or focused helps to explain the apparent discrepancy between Arnold's and Cowles et al.'s results: Arnold found that discourse-topics were better pronoun antecedents than foci, and she looked at topics that were discourse-old *subjects* and foci that were *objects*. Cowles et al. found no clear distinction between topics and foci, and both their foci and topics were in *subject* position. Given my findings regarding the importance of subjecthood, the divergent results of Arnold and Cowles et al. can be reconciled once we take into account the differences in grammatical role in their materials.

Overall, this eye-tracking experiment, combined with another study which looked at subjecthood and pronominalization in the absence of focus, shows that subjecthood influences pronoun interpretation even when separated from information-structural notions. The results also suggest that (i) when subjecthood is taken into account, we can detect effects of contrastive focus on pronoun interpretation even in the presence of a discourse-old, pronominalized (“topical”) referent, and (ii) when pronominalization and contrastive focus are pitted against each other, both influence pronoun resolution during real-time processing at roughly equal levels (see below for a discussion of why the subjecthood effects observed here cannot be straightforwardly reduced to effects of syntactic parallelism).

3. Aims of This Paper

3.1. Production and Comprehension

So far, we have been focusing on the role that contrastive focus plays in guiding pronoun interpretation. This bias on *interpretation* is widespread in existing psycholinguistic work, which focuses mainly how people interpret ambiguous pronouns, i.e., pronouns that have more than one featurally-compatible antecedent in the preceding discourse, such as “he” in (1a-b). In other words, when a comprehender is faced with an underspecified form that is semantically compatible with more than one potential antecedent, how does s/he interpret that form?

However, to fully understand the processes involved in pronoun usage and referent tracking more generally, we need to consider not only comprehension but also production (see also Zeevat, 2010). In fact, we have at least three components to consider: on the comprehension side, (i) when faced with a pronoun, comprehenders have to make a decision about what entity it refers to. On the production side, speakers have to make decisions about (ii) which entity to mention next, as well as (iii) what form to use for that referent (see Kehler et al., 2008 for related discussion).

Existing work tends to assume that these components all point in the same direction. For example, it has been claimed and/or assumed that a high likelihood of subsequent mention is correlated with a high likelihood of pronominalization, such that (i) the most “predictable” referents (most likely to be mentioned next) are also most likely to be pronominalized by speakers – and hence (ii) comprehenders can interpret pronouns (or other reduced expressions) as referring to the most predictable referents (see e.g. Arnold’s (1998,

2010) Expectancy Hypothesis, see also the notion of “preferred center” in Centering Theory, e.g. Grosz, Joshi and Weinstein (1995), Walker, Joshi and Prince (1998)). In fact, if we regard likelihood of being realized with a pronoun as an indication of how prominent/salient or how “important” a referent is, then it seems reasonable to assume that likelihood of subsequent mention provides another, presumably correlated, way of measuring referent prominence (see also Givón’s (1983) notion of topic persistence).

However, at first glance the series of experiments presented in this paper appears to pose a challenge for the view that these two metrics – likelihood of pronominalization and likelihood of subsequent mention – are correlated. The results show that sentences involving contrastive focus provide a clear illustration of a situation where likelihood of subsequent mention diverges from pronoun-related processes: we have a situation where the referent that is most likely to be mentioned next (i.e., most “predictable” from the perspective of the comprehender) is *not* the same referent that is most likely to be pronominalized by a speaker (Experiment 2) or chosen as the referent of a pronoun by a comprehender (Experiment 1). As we will see, speakers have a clear preference to use pronouns to refer to the immediately preceding subject – echoing what I observed with comprehenders engaged in the task of pronoun interpretation (Kaiser, forthcoming). However, it turns out that despite speakers’ preference for pronominalizing reference to the immediately preceding subject, the immediately preceding subject is not the referent that is most likely to be mentioned next. Rather, we find that focus-induced alternatives – in particular older referents that have been replaced/corrected by a contrastively-focused subject – play an important role in shaping upcoming discourse (Experiment 2).

At first glance, this finding that the most predictable referents are not the ones that are most likely to be pronominalized seems problematic, because it suggests that two metrics for measuring referent prominence/salience, commonly regarded as being correlated, result in conflicting outcomes. This appears to be an undesirable outcome, because it seems to eliminate an elegant account of pronoun interpretation, i.e., the idea that comprehenders interpret pronouns as referring to the most predictable referents.

However, in this paper I argue that the apparent tension can be resolved if we consider the experimental results from both the perspective of the comprehender and the perspective of the speaker, and treat the three components mentioned above – (i) the *comprehender’s task* of resolving pronouns and other referring expressions and the *speaker’s tasks* of (ii) deciding what entity to refer to and (iii) what form to use for that entity – as distinct components that all feed into the process of referent tracking (see Kehler et al., 2008). Thus, this

paper aims to highlight the insights that can be gained once we take a close look at these three aspects of referent tracking.

3.2. Alternatives to the Focused Element

To explore the issues mentioned in the preceding section, I used contrastive focus as a “testing ground”, building on and extending my earlier eye-tracking work (Kaiser, forthcoming). It is well-known that contrastive focus evokes alternatives (e.g. Rooth, 1992). For example, although (2a) explicitly mentions only London, it indirectly evokes other cities as well, e.g. Berlin and Paris. Thus, contrastive focus – unlike the other salience-influencing factors discussed above, such as pronominalization and subjecthood – is intrinsically connected to the existence of alternative referents. In addition to being implicitly/indirectly evoked, the alternative referents can also be explicitly mentioned, for example in a correction context as in (2b). The experiments reported in this paper focus on correction contexts, i.e., contexts where the alternative to the focused element has been mentioned in the preceding discourse.

- (2) a. It was LONDON that my cousins visited last summer.
b. Speaker A: I heard your cousins visited Paris last summer.
Speaker B: No, that's wrong. It was LONDON that they visited.

Prior work on the production of referring expressions has not looked specifically at the discourse status of these alternative referents. However, on a general level, existing research suggests that the presence of competitors/alternatives can have consequences for the salience of the intended referent. For example, in a picture-description study, Arnold and Griffin (2007) found that other *visually-present* referents compete with the intended referent, lowering its salience and decreasing pronoun use. In their study, participants were less likely to use a pronoun to refer to the intended referent when a second entity was present, even when the two referents differed in gender. This finding suggests that mere visual presence of another referent results in competition (see also Dahan, Tanenhaus and Chambers, 2002; Sedivy, 2002; Weber, Braun and Crocker, 2006, for research on the effects of competitors during comprehension).

Thus, existing work suggests that the presence of competitors/alternatives can lower the salience of the intended antecedent and potentially decrease its suitability as the antecedent of a subsequent pronoun. However, what about the discourse status of the alternatives themselves? What role do they play in subsequent discourse?

The experiments presented in this paper focus on how the presence of contrastive focus guides speakers' choices about subsequent discourse, with respect to (i) the role that the *contrastively-focused constituent* plays in subsequent discourse and (ii) the role that a previously-mentioned *alternative to the focused constituent* plays in subsequent discourse. For both, I will explore the relation between likelihood of subsequent mention and likelihood of pronominalization, to see how closely (or not) these two aspects are related. Thus, in addition to contributing to our understanding of how contrastive focus shapes language users' expectations about upcoming discourse, these questions have broader implications that reach beyond contrastive focus, as they contribute to our understanding of the nature of the relation between likelihood of mention and likelihood of pronominalization.

4. Experiment 1: Interpretation of Pronouns

Experiment 1 is a “baseline” experiment that we need in order to be able to interpret the results of the main experiment, Experiment 2. Because Experiment 2 aims to investigate language users' choices about which referent to mention next and what form to use, I opted to use a *sentence continuation* paradigm (also known as the sentence-completion paradigm). In a sentence continuation study, participants are given a sentence or a sequence of sentences and asked to write a natural-sounding continuation sentence. Thus, they can freely choose who to refer to and with what kind of referential form.

However, because we want to be able to compare production and comprehension patterns, we would like to be able to compare the production data from Experiment 2 to data concerning pronoun interpretation in the presence of contrastive focus. Unfortunately, comparing the Experiment 2 sentence continuation data directly to the eye-tracking data from Kaiser (forthcoming) could be problematic: because the methods are different, potential differences could be due to methodological differences rather than differences between comprehension and production.

Thus, to ensure that we can interpret the production data from Experiment 2 in a meaningful way, I first conducted Experiment 1, a sentence-continuation study focusing on *comprehension*, to see if the interpretation bias towards subjects that was exhibited by pronouns in my earlier visual-world eye-tracking study is replicated with sentence-continuation methodology. This was done by running a sentence continuation study in which each critical sentence was followed by a *pronoun prompt* that participants used as the start

of their continuation sentence. Thus, to complete the sentence continuation task, participants first had to interpret the pronoun prompt.

4.1. Method

4.1.1. Participants

Twenty-four adult native English speakers from the University of Rochester community participated in this experiment in exchange for \$7.50.

4.1.2. Materials

This experiment employed a sentence-continuation task based on dialogues between two hypothetical speakers (speaker A and speaker B). Sixteen target dialogues and sixteen filler dialogues were constructed. As in Kaiser (forthcoming), dialogues with corrective focus were used. In target items, speaker B's response contained the critical sentence, and ended with a pronoun prompt ((3)). Following the design of Kaiser (forthcoming), in the critical sentence, I manipulated (i) syntactic form (cleft vs. SVO) and (ii) the grammatical role of both the contrastively focused constituent and the given constituent, as illustrated in (3). Thus, I investigate both focused subjects and focused objects. There were four conditions: [Cleft.Object=focus], [Cleft.Subject=focus], [SVO.Object=focus] and [SVO.Subject=focus]. In the *it*-clefts, I use the term *subject* to refer not to the expletive “*it*” but to the agent of the action being described.

- (3) a. [Cleft.Object=focus]

A: The maid scolded the bride.

B: No, that's wrong! It was the secretary_{focus} that she scolded. She...

- b. [Cleft.Subject=focus]

A: The maid scolded the bride.

B: No, that's wrong! It was the secretary_{focus} who scolded her. She...

- c. [SVO.Object=focus]

A: The maid scolded the bride.

B: No, that's wrong! She scolded the secretary_{focus}. She....

- d. [SVO.Subject=focus]

A: The maid scolded the bride.

B: No, that's wrong! The secretary_{focus} scolded her. She...

Looking at both clefts and SVO structures allows us to explore whether potential effects of focusing are strengthened/boosted by a marked syntactic construction (see Arnold, 1998, 1999) and also allows us to control for potential effects of structural parallelism (see Section 4.3). The subject and object in

the target sentences were human and had the same gender; (stereotypically) male or female. As in Kaiser (forthcoming) all verbs were agent-patient verbs.⁴

In the clefted conditions ((3a-b)), the preceding context and the syntactic construction mark one of the arguments as being contrastively focused; the remainder of the sentence is presupposed.⁵ In the SVO conditions ((3c-d)), although the focus/presupposition division is not encoded in surface syntax, it follows clearly from the preceding context. In all conditions, the argument in the presupposed part of the sentence is discourse-old and pronominalized (the subject in (3a), (3c), the object in (3b), (3d)). In all target items, the contrastively focused entity was discourse-new, following Arnold (1998, 1999), Cowles (2003) and Cowles et al. (2007).

4.1.3. Procedure, Data Analysis

Participants were asked to provide a natural-sounding continuation sentence using the pronoun prompt following the critical sentence in each of the 16 target items (the 16 filler items also contained prompt words for the participants to start with). They were instructed to imagine that someone had just made the claim in part A, and they were now responding to this person's

⁴ Some of the verbs used in Experiments 1 and 2 can be categorized as “implicit causality” verbs which, when followed by an explanation continuation (*X verbed Y because she...*), exhibit a preference for the pronoun to be interpreted as referring to the *preceding object* (N2). Out of the 16 target verbs, 11 exhibit an N2 preference in implicit causality contexts (classification done on the basis of existing work on implicit causality and a large-scale norming study by Joshua Hartshorne at Harvard University). The 5 other verbs have not been analysed as N1 or N2 implicit causality verbs, to the best of my knowledge. However, due to their semantic similarity to the first group, if they have any kind of implicit causality bias, one might also expect it to be for N2. Thus, according to implicit causality one might expect pronouns to show an *N2 (object) preference*. However, as becomes clear below, the results of the experiments do *not* provide any indication of an object preference, suggesting that the results presented here cannot be attributed to an implicit causality confound. The absence of implicit causality effects also fits with work by Rohde (2008) showing that the behaviour of both N1 and N2 implicit causality verbs changes when the coherence relation between the two clauses changes (e.g. N1 implicit causality verbs no longer exhibit an N1 preference when the semantic relation between the clauses is changed from *explanation to result*).

⁵ Corpus studies show that regarding all clefts as structures where the clefted constituent is contrastively focused and the rest of the sentence is presupposed is an oversimplification (see e.g. Delin, 1995; Hedberg, 2000). Nevertheless, the *it*-clefts used in the experiments described here were straightforward in that the focused constituent was contrastively focused new information and the rest of the sentence was old/presupposed information, resembling the type that Hedberg (2000) calls topic-clause clefts.

statement by saying part B and providing a continuation. Parts A and B, as well as the pronoun prompt, were presented to the participants in writing. Each item was presented individually. Participants' responses were recorded with a Shure unidirectional head-mounted microphone onto digital tape using a Tascam tape recorder.

The continuations were digitized and transcribed, and the referent of the pronoun prompt in each continuation was double-coded by two coders working independently. The coders marked whether the pronoun referred to the subject of the immediately preceding clause, the object of the immediately preceding clause, or the third character (only mentioned in the first clause). Examples are given in Table 1. On 5.2% of the trials, it was not clear who the pronoun referred to, and the item was coded as "unclear". On 2.6% of the trials, participants did not use the pronoun prompt (e.g., inadvertently changed the pronoun prompt into a full noun). Overall, 92.2% of the trials were unambiguous cases of the pronoun prompt being used to refer to one of the three characters. On the vast majority of these trials, participants used the pronoun prompt for the immediately preceding subject or object, as expected, and these are the continuations I will be focusing on. The pronoun was used for the third character (mentioned only in the first sentence) on only 2.3% of trials.

Because our focus is on the proportion of continuations that refer to the preceding subject or object, trials where the pronoun prompt was not used or did not refer to one of these two characters were excluded from subsequent analyses.

Table 1. Sample continuations for the sentence-continuation task in Experiment 1

-
- (i) A: The waiter criticized the sailor.
 B: No, that's wrong! He criticized the businessman. **He** gave him too small a tip.
Coded as: he = businessman, i.e., object of immediately preceding sentence
- (ii) A: The waiter criticized the sailor.
 B: No, that's wrong! He criticized the businessman. **He** didn't get a very good tip.
Coded as: he = waiter, i.e., subject of immediately preceding sentence
- (iii) A: The maid scolded the bride.
 B: No, that's wrong! She scolded the secretary. **She** told me about it after it happened.
Coded as: she = unclear
-

4.2. Results

The data show a clear interpretation preference for the subject: As shown in Figure 1, participants showed an overarching bias to interpret the pronoun prompt as referring to the immediately preceding subject, replicating the pattern observed by Kaiser (forthcoming). One-group t-tests show that the proportion of subject continuations is significantly above chance in all conditions both by subjects and by items ([Cleft.Subject=focus]: $t_1(23)=2.78$, $p<.05$, $t_2(15)=4.1$, $p<.001$; [SVO.Subject=focus]: $t_1(23)=2.96$, $p<.01$, $t_2(15)=3.96$, $p<.005$; [Cleft.Object=focus]: $t_1(23)=3.91$, $p<.001$, $t_2(15)=3.16$, $p<.01$; [SVO.Object=focus]: $t_1(23)=5.24$, $p<.0001$, $t_2(15)=8.38$, $p<.0001$). Conversely, the proportion of object continuations is significantly below chance in all conditions (these analyses were conducted on the proportion of subject and object continuations only – “other” and “unclear” were excluded – such that the hypothesized mean was 0.5). In sum, all conditions exhibit a clear preference for the subject of the immediately preceding sentence, regardless of whether it is pronominalized or focused.

To assess effects of focus position (subject focus vs. object focus) and syntactic form (SVO vs. cleft), analyses of variance (ANOVA) were conducted on participant and item means of subject continuations and object continuations (with two factors: structure, SVO vs. cleft, and focus position, subject vs. object). The analyses show that there is no main effect of focus position on the proportion of subject continuations or on the proportion of object

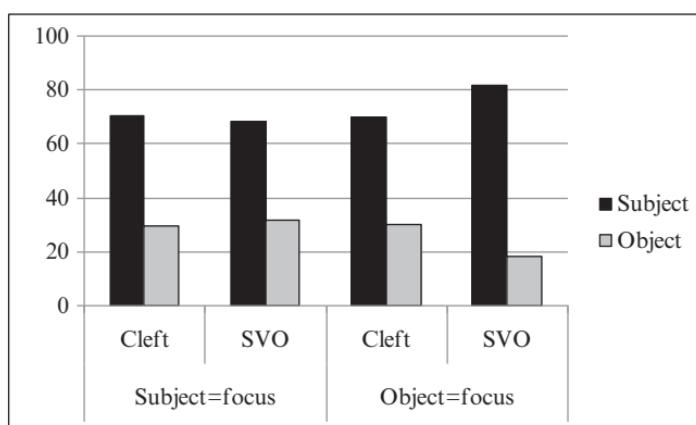


Figure 1. Percentages of subject continuations and object continuations in the four conditions of Experiment 1 (sentence continuation with a pronoun prompt) [all graphs show % on the y-axis].

continuations, either by subjects or by items ($F's<3, p's>.11$). In other words, the subject preference is equally strong regardless of whether the subject or object is focused. There is also no significant syntactic form \times focus position interaction, either by subjects or by items ($F's <2.7, p's>.1$). There is also no clear effect of syntactic form, except for a weak effect on the proportion of subject continuations, significant only by items ($F1(1,23)=2.64, p=.12, F2(1,15)=5.54, p=.03$) – there are numerically more subject continuations with SVO sentences than with clefted sentences.

4.3. Discussion

The results of Experiment 1 pattern like the eye-tracking data in Kaiser (forthcoming), in that both types of data show that when comprehenders are faced with a subject-position pronoun, they are more likely to interpret it as referring to the preceding subject than the preceding object. This subject preference holds with both pronominalized, discourse-old subjects and contrastively focused, discourse-new subjects, in both SVO sentences and clefts. Because all subjects were either pronominalized or focused, the emergence of an over-arching subject preference suggests that the effects of contrastive focus and pronominalization are similarly weighted, which results in them “cancelling” each other out and allowing the effects of subjecthood to become visible. As noted by Kaiser (forthcoming), the observed subjecthood effects help explain the divergent results of Arnold and Cowles et al., indicating that they can be attributed to differences in grammatical role in their materials.

In addition, the results of Experiment 1 show that a sentence-continuation task where participants are given a pronoun prompt patterns like the “traditional” listening-comprehension task used in Kaiser’s (forthcoming) eye-tracking experiments. This also addresses a potential concern one might have regarding intonation or accenting: it is widely agreed that stressed/accented pronouns (e.g. Solan, 1983; Kameyama, 1999; Venditti et al., 2002) are interpreted differently from regular un-accented pronouns. However, because the stimuli in Experiment 1 were presented in written form, intonation was not controlled. Crucially, though, the auditorily-presented pronoun sentences in the eye-tracking study had neutral intonation, with no special pitch accent on the pronoun. The finding that both Experiment 1 and the eye-tracking study reveal a subject preference indicates that this pattern cannot be attributed to the participants construing the pronouns as stressed/accented in Experiment 1.

When considering the results of this experiment, it is also worth noting that while the subject is the preferred antecedent in all four conditions, the object

nevertheless receives some attention as well: participants interpret the pronoun as referring to the object more than 20% of the time. This suggests that the factors pushing comprehenders towards the subject are subject to competition from other factors that push comprehenders towards the object (e.g. pronominalization or contrastive focus).

When discussing the subject preference exhibited by all four conditions, we are faced with the question of whether this effect is due to subjecthood (and its semantic correlates such as agentivity) or whether it could be due to *structural parallelism*. Structural parallelism is the well-known preference for pronouns to prefer antecedents that are realized in parallel syntactic positions (e.g. Solan, 1983; Smyth, 1994; Stevenson, Nelson and Stenning, 1995; Chambers and Smyth, 1998). Thus, at least at first glance, it appears that both structural parallelism effects and grammatical role/subjecthood effects predict a preference for the preceding subject in the stimuli used for this experiment.

However, note that both SVO and cleft conditions exhibited a subject preference. This is an important finding because the clefted sentences are not syntactically parallel to participants' continuations – they diverge in various ways, e.g. the subject pronoun in the continuations is in the canonical subject position whereas with clefts, the expletive "it" occupies the highest subject position and the actual agentive subject is in a lower position in the syntactic structure. This lack of syntactic parallelism is important, because Smyth (1994) showed that parallelism effects obtain only when both sentences have the same global structure and matching thematic roles (e.g. *Peter pushed John. Alex pinched him*). Thus, the subject preference observed in the clefted conditions presumably cannot be attributed to structural parallelism, at least not in any straightforward way. In fact, even when we look at the SVO conditions, an examination of participants' continuations suggests that the required degree of matching across sentences (as determined by Smyth, 1994) does not appear to be consistently present, which casts doubt also on the idea that the subjecthood effect in the SVO conditions is due to parallelism.

In sum, it seems that the subjecthood effects observed in Experiment 1 cannot be "blamed on" structural parallelism and are probably best attributed to the syntactic and semantic properties associated with subjecthood.

5. Experiment 2: Production of Pronouns and NPs

To gain a better understanding of what influences language users' expectations about subsequent discourse, in Experiment 2 we look beyond pronoun

interpretation and explore how contrastive focus, subjecthood and pronominalization guide speakers' choices about *what to mention next* and *with what kind of referring expression*. Using an open-ended sentence continuation task with no pronoun prompt allows us to probe not only the discourse properties of the focused referent itself but also the role that previously-mentioned alternatives to the focused referent play in subsequent discourse.

5.1. Method

5.1.1. Participants

Twenty-four adult native English speakers from the University of Rochester community participated in this experiment in exchange for \$7.50.

5.1.2. Materials

The materials were the same as in Experiment 1, except that speaker B's responses ended right after the critical sentence – i.e., no pronoun prompt was included. This is exemplified in (4).

- (4) a. [Cleft.Object=focus]
A: The maid scolded the bride.
B: No, that's wrong! It was the secretary_{focus} that she scolded. ...
- b. [Cleft.Subject=focus]
A: The maid scolded the bride.
B: No, that's wrong! It was the secretary_{focus} who scolded her. ...
- c. [SVO.Object=focus]
A: The maid scolded the bride.
B: No, that's wrong! She scolded the secretary_{focus}. ...
- d. [SVO.Subject=focus]
A: The maid scolded the bride.
B: No, that's wrong! The secretary_{focus} scolded her. ...

5.1.3. Procedure, Data Analysis

As in Experiment 1, participants were instructed to imagine that someone had just made the claim in part A, and they were now responding to this person's statement by saying part B and providing a continuation sentence. The procedure was the same as in Experiment 1. The continuations were transcribed and analysed. As this study included no prompt pronoun and the participants had the flexibility of choosing which referring expression to use, two coders analyzed (i) the referential form that participants used for the *subject* of the continuation sentence, and (ii) which entity that subject refers to. Examples are given in Table 2 below.

Table 2. Sample continuations for the sentence-continuation task in Experiment 2

(i)	A: The waiter criticized the sailor. B: No, that's wrong! He criticized the businessman. The sailor left before anything happened. <i>Coded as: form = NP, referent = sailor ('rejected' entity from A's sentence)</i>
(ii)	A: The waiter criticized the sailor. B: No, that's wrong! He criticized the businessman. The businessman was the one who was giving him trouble. <i>Coded as: form = NP, referent = businessman (object)</i>
(iii)	A: The priest praised the policeman. B: No, that's wrong! It was the mayor that he praised. He said "fabulous job!" <i>Coded as: form = pronoun, referent = priest (subject)</i>

Out of the entire data set, 12.7% of the trials were excluded from subsequent analysis because they did not contain a subject that refers to a concrete entity. For example, I excluded cases of discourse deixis (e.g. "That surprised me"), generic statements (e.g. "you should not go around..."), and reference to the speaker (e.g. "I heard her").

5.2. Results and Discussion

Let us first take a broad look at the referential forms that participants used in their continuations. Overall, participants used more full nouns than pronouns: participants produced continuations with subject-position pronouns 23% of the time, and used full NPs as subjects 74% of the time. The remaining 3% of trials used other forms, e.g. conjoined nouns that refer to multiple antecedents (e.g. "The waiter and the sailor").

In Section 5.2.1., I start by looking at those trials where participants produced pronouns, as they allow for the clearest comparison between the use of freely-produced pronouns (Experiment 2) and the interpretation of prompt pronouns (Experiment 1). Then, in Section 5.2.2, I turn to trials where participants produced full NPs. Section 5.2.3. combines the pronoun continuations and the NP continuations, allowing us to see what kinds of choices participants make about what form to use for which antecedent.

5.2.1. Pronoun-Initial Continuations

Data: The continuations where participants produced a pronoun in subject position (e.g. example (iii) in Table 2) show an overwhelming preference for the immediately preceding subject. Overall, averaging across all conditions, 65% of all pronouns referred to the immediately preceding subject, 26% to

the immediately preceding object, and only 1.3% to what I am calling the “Alternative”, i.e., the character that is mentioned in speaker A’s utterance but rejected by the contrastively focused constituent in speaker B’s response. The clear subject preference can be seen in Figure 2.

Statistical analysis: To test whether the subject preference is equally strong in all conditions, I used a mixed-effects logistic regression model to analyse the proportion of subject continuations and object continuations as a function of syntactic form (SVO vs. cleft) and the grammatical role of the focused element, which I’ll be calling “focus position” (i.e. subject-focus vs. object-focus). Participant and item were included as random effects.⁶ List and list order were also included as factors. The independent variables were centred in order to avoid collinearity in the interaction terms (see Jaeger, 2008; and others). I used a mixed-effects regression model because the pronoun-initial continuations are a subset of the full dataset – i.e. do not constitute a fully balanced dataset – and thus not well-suited for ANOVAs (analyses of variance). The categorical nature of the dependent variables is a further reason for using mixed-effects logistic regression.

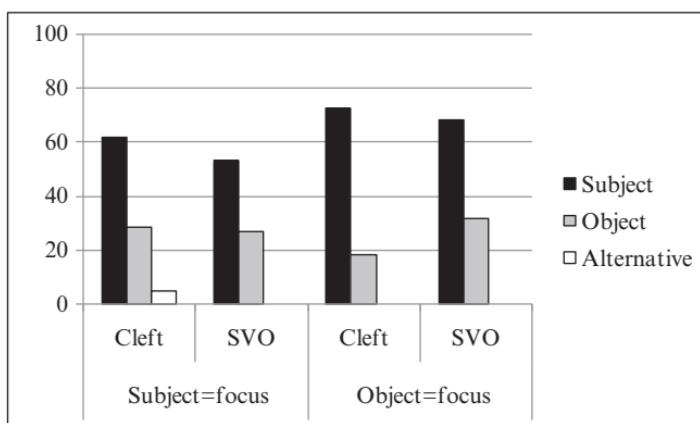


Figure 2. Percentage of different continuation types in pronoun-initial continuations: when participants produced a pronoun, what did it refer to? (The bars do not add up to 100% due to a small number of continuations where the intended referent of the pronoun was unclear or where a plural pronoun was used, which are not shown here.)

⁶ When specifying the structure of random effects, we started with fully crossed and fully specified random effects, tested whether the model converges, and reduced random effects (starting with item effects) until the model converged (see Jaeger at <http://hlplab.wordpress.com>, May 14, 2009). Then, we used model comparison to test each random effect; only those that were found to contribute significantly to the model were included in the final analyses. However, all models contained random intercepts for subjects and items.

Analyses of the proportion of *subject continuations* reveal no significant effects of syntactic form $\beta = 0.388$, Wald Z = 0.734, p = .46 or focus position ($\beta = -0.811$, Wald Z = -1.49, p = .13), and no form x focus interaction ($\beta = 0.24$, Wald Z = 0.23, p = .82). Here and in the discussion below, β denotes the estimated regression coefficient. Wald's Z-score (Wald, 1943) is calculated by dividing β by the estimate for its standard error and provide a measure of how far the estimated regression coefficient is from zero in terms of its standard error. If this distance is sufficient – i.e., the coefficient is judged to be significantly different from zero – the factor is considered to contribute significantly to the model (see Jaeger, 2008 for further details).

Analyses of the proportion of *object continuations* also reveal no significant effects of form ($\beta = -0.47$, Wald Z = -.84, p = .4) or focus position ($\beta = 0.52$, Wald Z = 0.91, p = .3), and no form x focus interaction ($\beta = 0.67$, Wald Z = 0.59, p = .55). (The proportion of alternative continuations could not be analyzed in a parallel way because there were so few alternative continuations.)

Discussion: The data show that the subject preference is *equally strong*, regardless of which argument is focused and which is pronominalized, and regardless of syntactic form (SVO vs. it-cleft). This fits with what was found in Experiment 1: in Experiment 1, we saw that when comprehenders are faced with a pronoun, they tend to interpret it as referring to the preceding subject. In Experiment 2, we similarly observed that when comprehenders choose to *produce* a pronoun, it is likely to be used to refer to the preceding subject, and that the strength of this pattern is not influenced by whether the subject is pronominalized or focused.

5.2.2. NP-Initial Continuations

Having observed a connection between pronouns and subjects both in comprehension and production, let us now turn to those trials where speakers chose to start their continuations with a full NP in subject position. As the data in this section and Section 5.2.3 will show, likelihood of subsequent mention does not necessarily coincide with likelihood of pronominalization.

Data: Recall that pronoun-initial continuations make up only 23% of all trials. The majority of continuations (74%) start with an NP.⁷ Figure 3 below shows how often NPs refer back to the subject of the immediately preceding sentence, the object of the immediately preceding sentence, or the alternative to the focused entity (i.e. the character from speaker A's sentence that was

⁷ This predominance of NP continuations holds for all four conditions: [SVO.Subject=focus] = 82% NP continuations, [Cleft.Subject=focus] = 74% NP continuations, [SVO.Object=focus] = 71% NP continuations, [Cleft.Object=focus] = 70% NP continuations.

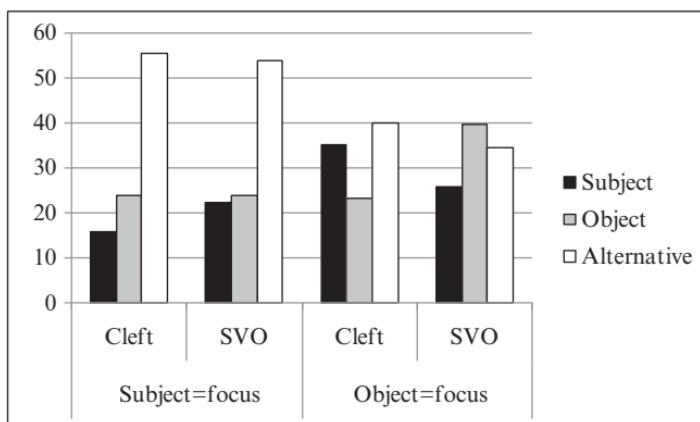


Figure 3. Percentage of different continuation types in NP-initial continuations: when participants produced an NP, what did it refer to?

rejected/corrected by the contrastive focus in speaker B's utterance, e.g. "maid" in (4b)).

In contrast to pronoun continuations, continuations that began with NPs showed no overarching preference for the subject of the immediately preceding sentence. Instead, as can be seen in Figure 3, in the **[Subject-focus] conditions**, the most frequent continuation type (55% of all NP-initial continuations, collapsing SVO and cleft) actually referred to the alternative to the focused entity, i.e., the *subject of the first sentence* that is rejected/corrected by the second speaker (e.g. "maid" in speaker A's utterance in (5)). In other words, we observed a preference to start with the rejected *alternative to the focused constituent* ("the secretary" in (5)).

(5) A: The maid scolded the bride.

B: No, that's wrong! It was the secretary_{focus} who scolded her. *The maid wouldn't have the audacity to scold the bride.*

Let us now turn to NP-initial continuations in the **[Object-focus] conditions**. These pattern differently from the [Subject-focus] conditions. When the object was focused, regardless of syntactic form, there was no overarching preference to start with the alternative to the focused object. In fact, out of all [Object-focus] NP-initial continuations, only 37% started with the alternative (the object of speaker A's sentence). The remaining two-thirds of continuations started with a reference to one of the other two entities (that is, the subject or object of the immediately preceding sentence).

Statistical analysis: To analyse these patterns statistically, I again used mixed-effects logistic regression. Analyses of the proportion of *alternative*

continuations reveal significant effects of focus position ($\beta = 0.877$, Wald Z = 2.95, $p < .005$), but no effects of form ($\beta = 0.19$, Wald Z = 0.65, $p = .52$) and no form x focus interaction ($\beta = -0.023$, Wald Z = -0.039, $p = .96$). This confirms the statistical significance of our observation that participants are more likely to continue by talking about the alternative to the focused *subject* than the alternative to the focused *object*. This grammatical-role asymmetry pattern holds with both SVO sentences and *it*-clefts.

Analyses of the proportion of *subject continuations* reveal no significant effects of form ($\beta = -0.14$, Wald Z = -0.39, $p = 0.69$), focus position ($\beta = -0.73$, Wald Z = -1.46, $p = .14$) and no form x focus interaction ($\beta = -1.09$, Wald Z = -1.59, $p = .11$). Analyses of the proportion of *object continuations* also reveal no significant effects of form ($\beta = -0.49$, Wald Z = -1.45, $p = .15$), focus position ($\beta = -0.35$, Wald Z = -1.03, $p = .3$) and no form x focus interaction ($\beta = 0.93$, Wald Z = 1.37, $p = .17$). Thus, the likelihood of referring to the preceding subject or the preceding object was not influenced by focus position or by syntactic form.

Discussion: Looking at NP-initial continuations, we find that in the [Subject=focus] conditions, participants are most likely to mention the “rejected” entity from Speaker A’s sentence (i.e. the alternative to the focused subject), whereas there is no such preference in the [Object=focus] conditions. There appears to be *an asymmetry in the role that “rejected” subjects vs. objects play in subsequent discourse*. It seems that a *subject* that is rejected via correction still maintains some significance. For example, in (5) above, people might want to know, if the maid didn’t scold the bride, what *did* the maid do? In contrast, a rejected object seems easier to forget: it seems that in [Object=focus] items like (6), there is less of a tendency to explain the fate of the rejected object.

- (6) A: The maid scolded the bride.
B: No, that’s wrong! She scolded the *secretary* ...

As discussed in Kaiser (2009b), this grammatical-role asymmetry may stem from information-structural differences between subjects and objects, in particular from the common view that (agentive) subjects are default *topics* (e.g. Chafe, 1994; Lambrecht, 1994; Reinhart, 1982). It seems reasonable to posit that topical entities are less easily dismissed from the discourse model than non-topics (see also Chiriacescu and von Heusinger, 2010, for relevant discussion regarding referential persistence and topicality).

For example, let us assume that in the subject-focus ((5)) above, Speaker A’s utterance has the consequence of making “the maid” the current topic by virtue of it being realised in subject position, especially as there are no other

cues to topicality present in this utterance. Speaker B realises that Speaker A provided incorrect information about the topical referent, and corrects the misunderstanding. Furthermore, because that referent (the maid) has been introduced as the topic and thus has some level of importance, Speaker B wants to say more about it, e.g. to present the correct information, or to explain why Speaker A's statement was incorrect. In contrast, in the object-focus example in (6), if we assume again that "the maid" is the topic of the first sentence, then the rejected object "the bride" (the alternative to the focused entity "the secretary") is not the topic and does not occupy a privileged position in the discourse model. It is thus more likely to be dismissed without further explanation.

In sum, it seems that the asymmetrical behaviour of focused subjects vs. focused objects with respect to subsequent discourse may be related to information-structural differences.

5.2.3. Overall Continuation Patterns

If we put together the pronoun continuations in Figure 2 and NP continuations in Figure 3, what emerges is shown in Figure 4 below. Figure 4 shows how frequently participants use NPs vs. pronouns when referring to different antecedents.

In the [Object-focus] conditions, when participants refer back to the immediately preceding (pronominalized) *subject*, they use a pronoun about half of the time. This is shown by the "Subject" bar in the [Object-focus] condition being about half black, half gray (this pattern holds with both clefts and SVO sentences; they are collapsed in Figure 4 for ease of presentation). However, when mentioning the focused *object*, full NPs are preferred (the "Object" bar in the [Object-focus] conditions is mostly grey), and in fact reference to the rejected *alternative* to the focused object (in speaker A's utterance) is accomplished entirely with full NPs (the "Alternative" bar is entirely grey). Thus, comparatively speaking, the relatively highest likelihood of pronominalization is observed for reference to the *immediately preceding subject*.

In the [Subject-focus] conditions, we again find that the preceding *subject* has a special status when it comes to pronoun use. Reference to the immediately preceding focused *subject* is done by means of a pronoun about half of the time (the "subject" bar is about half black, half grey). Reference to the immediately preceding pronominalized *object* is accomplished with a pronoun approximately a third of the time (the "object" bar is partly black). And, similar to what we saw in the [Object-focus] condition, reference to the alternative to the focused subject (i.e. the subject in Speaker A's utterance that was rejected/corrected by Speaker B) is almost never accomplished with a pronoun (only 3% of all alternative-referring continuations in this condition are

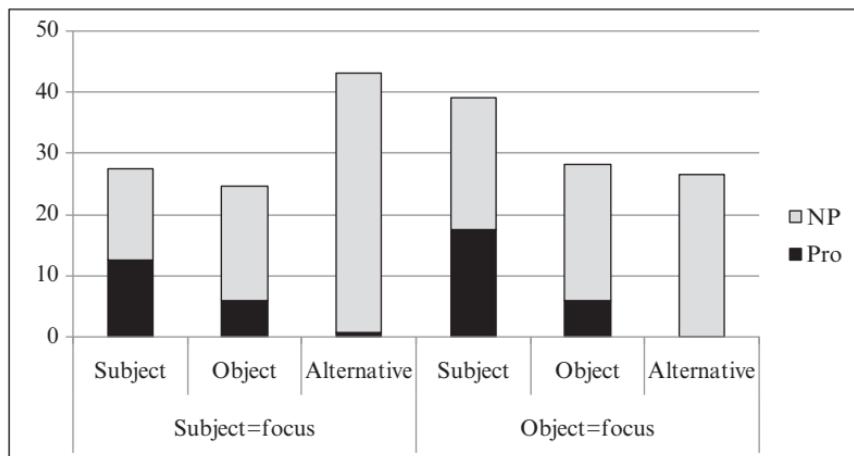


Figure 4. How frequently do participants use NPs vs. pronouns when referring to different antecedents? (It-clefts and SVO sentences are grouped together. The full height of each bar shows what percentage of continuations starts by referring to the preceding subject, object or alternative, with the black/gray distinction showing the breakdown of pronoun-initial vs. NP-initial continuations.)

pronominalized). Thus, the numerically highest likelihood of pronominalization was observed for the *immediately preceding subject*, which echoes what was found for the [Object-focus] conditions.

In addition, Figure 4 also highlights the dissociation between likelihood of pronominalization and likelihood of subsequent mention. In particular, in the [*Subject-focus*] conditions, the referent that is most likely to be mentioned next after the critical sentence (i.e. the tallest bar in Figure 4) is the alternative to the focused subject (the “rejected” character from Speaker A’s sentence). However, despite this preference to continue by talking about the rejected/corrected entity, reference to this entity is extremely unlikely to be pronominalized. Thus, the [*Subject-focus*] conditions constitute a situation where likelihood of pronominalization and likelihood of subsequent mention are clearly dissociated. However, as mentioned above, [*Object-focus*] conditions pattern differently: the alternative to the focused object does not seem to be as “privileged”; there is an asymmetry between focused subjects and focused objects in this regard,⁸ potentially due to topicality-related reasons.

⁸ Statistical analyses of the proportion of continuations that start by referring to the alternative (using mixed-effects logistic regression) reveal significant effects of focus position ($\beta = 1.01$, Wald Z = 3.77, $p < .001$), no significant effects of syntactic form ($\beta = 0.08$, Wald Z = 0.30, $p = .7$), and no form x focus interaction ($\beta = -0.1$, Wald Z = -0.19, $p = .85$). Thus, even when we collapse NP-initial and pronoun-initial continuations, we still find an asymmetry between focused subjects and focused objects, like with NP-initial continuations (Section 5.2.2).

As a whole, Figure 4 highlights (i) the connection between pronouns and subject-position antecedents, (ii) the dissociation between likelihood of mention and likelihood of pronominalization as well as (iii) the asymmetrical importance of the previously-mentioned alternatives to focused subjects vs. focused objects.

5.3. Effects of Focus Type

Before turning to the general discussion and considering the implications of Experiments 1 and 2 in more depth, in this section, I briefly summarize a study that builds on Experiment 2 by investigating whether the effects that were observed with contrastive focus for likelihood of subsequent mention extend to other types of focus. In Experiments 1 and 2 we looked at the consequences of rejecting an earlier alternative (corrective focus). Experiment 3 (see also Kaiser, 2009a) tested what happens when another alternative is added (additive focus). This study looked at purely additive focus ((8a-b)) and scalar additive focus ((8c-d)), to see if the presence of scalarity has an effect.

(7) A: The maid scolded the bride.

(8) B: Yeah, that's right.

- a. In fact, she also scolded [the secretary]_F. ... [Also//Object=focus]
- b. In fact, [the secretary]_F also scolded her. ... [Also//Subject=focus]
- c. In fact, she even scolded [the secretary]_F. ... [Even//Object=focus]
- d. In fact, even [the secretary]_F scolded her. ... [Even//Subject=focus]

The task was the same as in Experiment 2 (no prompt); 32 native English speakers participated. An analysis of participants' continuations revealed a clear preference to start by referring to the *pronominalized entity* (i.e. the pronominalized subject or object) in the preceding sentence. This pattern was present with both scalar additive focus and purely additive focus, and with both pronoun-initial and NP-initial continuations. The preference to refer to the pronominalized referent in the preceding sentence was, perhaps not surprisingly, especially strong with pronoun-initial continuations.

In contrast to Experiment 2, there were hardly any continuations that began with reference to the previously-mentioned alternative of the focused entity (approx. 5% of NP continuations, 0% of pronoun continuations). This indicates that not all focus types pattern alike: unlike contrastive focus, additive focus apparently does not boost the subsequent-mention likelihood of the member(s) of the alternative set. The contrast between Experiments 2 and 3 suggests that the results for correctively-focused subjects in Experiment 2 are probably not due to anything having to do with the general notion of focus,

and are probably best attributed to the information-structural and rhetorical consequences of correction (see Section 5.2.2).

6. General Discussion and Conclusions

Put together, the results of Experiments 1 and 2 present us with what may – at first glance – appear to be rather divergent findings. Experiment 1, focusing on the interpretation of pronouns, highlights the *importance of the immediately preceding subject*, independently of pronominalization or contrastive focus, a finding which is echoed by the pronoun-initial continuations in Experiment 2. In contrast, the NP-initial continuations in Experiment 2 reveal the *importance of the previously-mentioned alternative to the contrastively focused constituent*, in particular the “rejected” subject of the first sentence. The findings from Experiment 3 suggest that this effect is specific to corrective focus – its rhetorical consequences, presumably – and does not arise with purely additive or scalar focus.

Thus, it may initially seem that two different metrics of measuring the “importance” or prominence of a referent – pronominalization and likelihood of mention – point to different antecedents. However, in this section I show that the apparent tension between Experiments 1 and 2 can be resolved once we make the nature of the relation between comprehension and production more explicit. More specifically, if we follow Kehler et al. (2008) and regard referent tracking as a process with various subcomponents – including *comprehenders’ decisions* when faced with a pronoun and *speakers’ decisions* about which entity to mention next and what form to use for that referent – the results of Experiments 1 and 2 fit together smoothly.

6.1. A Bayesian Approach to Production and Comprehension

One way of formalizing the relation between the different components of production and comprehension has been put forth by Kehler et al. (2008) and Rohde (2008). Kehler and colleagues suggest that pronoun interpretation and production can be considered from a Bayesian perspective, as illustrated in (9):

$$(9) \quad P(\text{referent}|\text{pronoun}) = \frac{P(\text{pronoun}|\text{referent}) P(\text{referent})}{P(\text{pronoun})}$$

Let us assume, following Kehler et al. and a growing body of experimental evidence, that comprehenders have expectations about what is likely to

happen next in a particular stretch of discourse, e.g. who will be mentioned and how. Kehler et al. suggest that when considering how likely a pronoun is to be interpreted as referring to a particular referent – denoted with $P(\text{referent}|\text{pronoun})$, i.e. given a pronoun, what is the probability that it refers to a particular referent – it can be useful to regard the interpretation preferences/biases as composed of two expectations: first, the probability that a particular referent will be mentioned subsequently ($P(\text{referent})$) (see also earlier work by Arnold, 2001), and second, the probability that a particular referent will be referred to with a pronoun ($P(\text{pronoun}|\text{referent})$). Pronoun interpretation is of course also sensitive to the overall probability of using a pronoun, $P(\text{pronoun})$. Thus, from the perspective of the comprehender, the task of pronoun resolution involves $P(\text{referent}|\text{pronoun})$, i.e. given a pronoun, what is the probability that it refers to a particular referent x . In addition, comprehenders are assumed to have expectations about $P(\text{referent})$, who/what will be mentioned next, and $P(\text{pronoun}|\text{referent})$, whether reference to a particular entity will be pronominalized.

The results of Experiment 1, with the pronoun prompt, showed that $P(\text{referent}|\text{pronoun})$ – i.e., given a pronoun, what is the probability that the pronoun is interpreted as referring to a particular referent x – is higher for subjects than objects or alternatives (the alternative to the focused element). As we saw in Figure 1, there is a clear interpretation bias for the subject in all conditions: $P(\text{subject}|\text{pronoun})$ is around .7 (70%) or higher in all conditions.

In Experiment 2, with no prompt, we can look at $P(\text{pronoun}|\text{referent})$ – i.e. what is the probability that reference to a particular referent (e.g. preceding subject or object) will be accomplished with a pronoun. For example, to compute $P(\text{pronoun}|\text{subject})$ for the [SVO.Object=cleft] condition, we take the total number of subject references in this condition, 37, and use that to divide the total number of subject references that were accomplished with a pronoun, namely 16. Thus, $P(\text{pronoun}|\text{subject}) = (16/37) = .43$, as shown in Table 3. Thus, Table 3 tells us about how likely speakers are to use a pronoun when referring to the preceding subject, the preceding object or to the

Table 3. $P(\text{pronoun}|\text{referent})$ computed for Experiment 2 (no-prompt sentence continuation)

	[SVO. Subject=focus]	[Cleft. Subject=focus]	[SVO. Object=focus]	[Cleft. Object=focus]
$P(\text{pro}|\text{subject})$	.35	.57	.46	.43
$P(\text{pro}|\text{object})$	.2	.29	.21	.22
$P(\text{pro}|\text{alternative})$	.03	0	0	0

alternative to the focused referent: the higher the probability, the more likely a pronoun is to be used. As can be seen in Table 3, $P(\text{pronoun}|\text{subject})$ is higher than $P(\text{pronoun}|\text{object})$, and also much higher than $P(\text{pronoun}|\text{alternative})$. (The relative rate of pronoun use can also be seen in the pronoun vs. NP distinctions illustrated in Figure 4, where they are shown relative to the percentage of different continuation types, i.e. $P(\text{referent})$.) Table 3 thus differs crucially from Figure 1, which tells us about a comprehension-related component, namely $P(\text{referent}|\text{pronoun})$: when given a pronoun, what is the probability that this pronoun is interpreted as referring to a particular referent.

In sum, we find that (i) in production, when speakers mention the immediately preceding subject, they seem to use pronouns more than when mentioning other entities; (ii) in comprehension, when comprehenders encounter pronouns, they tend to interpret them as referring to the preceding subject.

However, likelihood of subsequent mention, $P(\text{referent})$, patterns differently. This can be seen in the Experiment 2 data, especially as depicted in Figures 3 and 4. In particular, when we focus on full-NP continuations, we find that *contrastive focus* and *grammatical role* have an important influence on what is mentioned next, with the alternatives to contrastively-focused subjects being especially likely to be mentioned. This leads to a striking disconnect between likelihood of mention and likelihood of pronominalization: In [Subject=focus] conditions, the subject of the first sentence (the “rejected alternative”) is most likely to be mentioned next, but very unlikely to be pronominalized, as we saw above.

The dissociation between likelihood of mention and likelihood of pronominalization is hard to capture if salience is regarded as a broad or “monolithic” phenomenon that applies equally to comprehenders’ expectations about both of these things. For example, if likelihood of upcoming mention is greater for salient referents and likelihood of pronominalization is also greater for salient referents, it is unclear how one could end up with a situation where a referent that is most likely to be mentioned is unlikely to be pronominalized. However, if we distinguish $P(\text{referent})$ and $P(\text{pronoun}|\text{referent})$, then no inconsistency arises (see Kehler et al., 2008 for further discussion).

In their 2008 paper, Kehler et al. are careful to note that their aim is not to argue for a Bayesian analysis over other possibilities, as it brings with it a number of still unresolved questions. In this paper, I would also like to emphasize that I am not arguing for a specifically Bayesian approach. Rather, my more modest aim is to explore in general terms whether this kind of approach can lead to new insights when applied to data from a series of experiments investigating contrastive focus and its interaction with other factors.

6.2. Importance of Subjecthood

Although the results from Experiments 1 and 2 highlight the importance of distinguishing likelihood of mention from likelihood of pronominalization, it is also worth noting that, at least for the configurations tested here, both pronominalization and subsequent-mention patterns *converge to highlight the importance of the general notion of subjecthood*.⁹ In Experiment 1, we saw that subjecthood renders an entity a preferred antecedent for a pronoun, regardless of topicality-related factors or contrastive focus. In Experiment 2, we saw that a “rejected” subject remains important in the discourse whereas a “rejected” object is more easily dismissed.

This higher-level connection in terms of subjecthood brings up interesting broader questions, which also relate to discourse structure, concerning the relationship between the factors that render an entity likely to be mentioned next and the factors that make an entity likely to be referred to with a pronoun. In particular, if it turns out that an approach that treats these as distinct probabilities (such as the Bayesian view discussed by Kehler et al., 2008) is on the right track, one can then ask, how separate are the factors that shape these probabilities? Could the same set of weighted/ranked factors contribute to both likelihood of pronominalization and likelihood of mention, but at different levels of contribution/influence (see also Kehler et al., 2008)? These questions reach beyond the aims of this paper, but offer interesting directions for future work. A better understanding of these issues could also contribute to our understanding of the cognitive representations that underlie comprehenders’ and speakers’ sensitivity to and use of these probabilities.

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⁹ As all the subjects used in the experiments reported here were agentive subjects, our conclusions regarding the importance of subjecthood are by necessity restricted to agentive subjects.

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