July 2012 draft, submitted to Competing Motivations, ed. by Edith Moravcsik and Andrej Malchukov, Oxford University Press

Why move? How weight and discourse factors combine to predict relative clause extraposition in English

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Abstract

In relative clause extraposition (RCE) in English, a subject-modifying relative clause is displaced to a position following the verb phrase, as in *Some research was conducted that supports the existing theory*. Previous studies have revealed that both grammatical weight (i.e. relative constituent length) and discourse factors are important for determining when and why speakers use RCE. However, the current study is the first to examine the interaction of these factors. A quantitative analysis of RCE and comparable non-RCE tokens in the International Corpus of English Great Britain (ICE-GB) showed a strong effect of grammatical weight: there was a strong preference for RCE when the relative clause was at least five times longer than the verb phrase, and a strong preference for canonical (non-RCE) order when the relative clause was the same length or shorter than the verb phrase. However, for those tokens with length ratios falling

in between these limits, choice of structure appeared to depend primarily on discourse factors. Tokens with an indefinite subject NP and a passive or presentative main verb were much more likely to contain RCE than were tokens with other combinations of features. In addition, RCE was more likely with discourse-accessible predicates than with new predicates. In short, it appears that the selection of RCE versus a canonical structure involves the joint satisfaction of processing-based goals and discourse-based goals, rather than meeting one set of aims at the expense of the other: length ratio sets soft limits on RCE based on ease of processing, while discourse factors regulate choice of structure within these limits.

X.1 Introduction

In this chapter, we examine a well-known constituent-order option of English, relative clause extraposition (RCE), and ask whether it subserves sentence processing, information structure or both. In RCE from subject NP position (referred to by Ross 1967 as Extraposition from NP), a subject-modifying relative clause occurs following the VP, as in the example from the International Corpus of English Great Britain (henceforth ICE-GB) in (1a)[1], rather than adjacent to its head noun, as in the corresponding non-RCE sentence (1b).

(1) a. Further research has been conducted on this that indicates this criticism may not be just. (ICE-GB)

b. Further research that indicates this criticism may not be just has been conducted on this.

The alternative sentences in (1a-b) seem to express exactly the same meaning. Structurally, however, (1a) is more complex: there is a discontinuous dependency between the subject NP and

the relative clause, whereas in (1b), this same dependency is contained within a single phrase. The structure in (1a) thus appears to involve a discontinuous NP, violating the typical X-bar phrase structure pattern of English, whereby a modifier or complement must occur within the same maximal projection as its head. Most syntactic accounts of RCE have avoided positing an actual discontinuous constituent (but see McCawley 1987), instead licensing RCE through rightward movement (Ross 1967, Baltin 1981), leftward movement (Kayne 1994), or adjunction and co-indexing (Culicover and Rochemont 1990). Nevertheless, this kind of dependency relation adds complexity to the syntax, as confirmed by the experimental findings of Levy et al. (2012), who show that in the absence of any facilitating cues, RCE sentences are more difficult for readers to process than non-RCE sentences. For example, one experiment showed that for sentences like (2), reading times were slower in the first four words of the relative clause (bracketed below) for RCE sentences, as compared with non-RCE sentences.

(2) After the show, a performer came on [who had really impressed] the audience and everyone went wild with applause. (Levy et al 2012: 17)

Further, unlike many other constructions featuring non-canonical word order, such as wh-movement and topicalization, RCE has no obvious functional motivation.

Given the added complexity of RCE, and its apparent lack of semantico-pragmatic effect, one can reasonably ask why speakers use the construction. The literature has provided two main answers. The first answer, which the majority of the studies have provided, is that RCE is used to place presentational focus on the denotatum of the subject NP, and thus has a function similar to that of the presentational *there*-construction (PTC), as in (3).

(3) There exists further research on this that indicates this criticism may not be just.

Although several different analyses of the discourse function of RCE have been proposed, the general consensus is that RCE is used to highlight new, contrastive, or important information contained in the subject NP while backgrounding the information contained in the main-clause predicate (Huck & Na 1990; Kuno & Takami 2004; Rochemont & Culicover 1990; Takami 1999). In both the RCE sentence in (1a) and the PTC sentence in (3), the speaker or writer asserts that research findings of a particular type exist rather than that research of this type was conducted. Accordingly, we would expect the primary focal stress in spoken English to fall on the word *research.*

Such a discourse-based approach has also been used to explain some of the formal properties that are typically, but not categorically, associated with RCE, including the tendency for the subject NP to be indefinite (Huck & Na 1990)—indefinite NPs are typically used to express discourse-new entities—and the tendency for the main verb to be a presentative predicate. Both of these properties are illustrated in example (2) above: the subject NP *a performer* is indefinite, and the predicate *came on* is presentative. Following Levy et al. (2012: 17), we define a presentative predicate as an intransitive verb which denotes a concept related to existence or appearance and which is typically used to introduce the referent of the subject NP into a scenario (see also Rochemont 1986; Rochemont & Culicover 1990; Kuno & Takami 2004). Although focal referents are typically expressed with an indefinite NP, Huck & Na (1990) point out that it is possible to use definite NPs in focal contexts (e.g., in contrastive or listing contexts), thus explaining why RCE is apparently felicitous with a definite subject NP

when there is a contrastive focus within the extraposed clause. In (4), the speaker has already introduced two guys, and is contrasting the guy from Treno's with the guy from a different restaurant:

(4) The guy just came in that I met at TRENO'S yesterday. (Huck & Na 1990: 54)

Similarly, Rochemont & Culicover (1990: 65-68) point out that it is possible to use a non-presentative verb as the main predicate in an RCE construction, provided that the predicate is "directly c-construable," as defined by Rochemont (1986). A directly c-construable predicate is one that it is already under discussion in the discourse (Rochemont 1986: 174). This apparently includes both discourse-given predicates—predicates that express a particular situation that has already been mentioned—and discourse-accessible predicates—predicates that express a *concept* that has already been mentioned. Rochemont & Culicover (1990) give an example of the latter type: the non-presentative predicate *scream* can be used in an RCE sentence when the concept of screaming is already evoked in the discourse, as in (5):

(5) Suddenly there was the sound of lions growling. Several women screamed. Then a man screamed who was standing at the very edge of the crowd.
(Rochemont & Culicover 1990: 65)

On the other hand, presentative predicates are felicitous in RCE constructions by virtue of being "indirectly c-construable" (Rochemont 1986: 174). This means that they are lexically specified as scene-setting predicates and need no additional context to be c-construable. In short, these

discourse-based theories predict that definiteness and predicate type may vary among different RCE sentences while presentational or contrastive focus on the subject NP should occur consistently in RCE sentences.

While these predictions are quite plausible, empirical support for them has mostly been provided by constructed examples (as in 4-5 above) rather than analysis of actual language use. One exception is Francis' (2010) study of grammatical weight, which did not investigate discourse status, but did look at predicate type. In a set of 391 tokens of RCE and non-RCE sentences from the ICE-GB corpus, Francis (2010) found that presentative verbs were indeed commonly used in RCE sentences, while non-presentative intransitives and transitive verbs were rare in this construction. However, the most common predicate type associated with RCE turned out to be passive verbs. Arguing that passive verbs are semantically similar to presentative verbs (as intransitive predicates which select a Theme argument) and just as felicitous in presentational contexts, Francis (2010: 63) concluded that these results were compatible with theories like that of Rochemont & Culicover (1990), which posit a presentational function for RCE sentences. Francis' study was limited in that it did not examine any other discourse-related variables. There is, therefore, a need for additional usage data bearing on the discourse conditions that most favor RCE.

The second functional rationale that has been offered for the existence of RCE involves grammatical weight. Arnold & Wasow (2000), Wasow (2002) and Hawkins (2004), among others, have shown that shifting heavy (i.e. long and/or syntactically complex) constituents to the end of a clause can facilitate language production and comprehension. In production, heavy constituents may be difficult to formulate. Therefore, postponing them can afford speakers a bit more time to finish formulating the sentence while they produce the shorter, easier phrases

(Arnold & Wasow 2000: 32). In comprehension, shifting heavy constituents to the end allows listeners to reduce the integration costs associated with resolving non-local dependencies in syntax and semantics (Hawkins 2004; Gibson 1998). For example, although RCE always increases the distance between the head noun and its relative-clause modifier, a long relative clause in a non-RCE sentence increases the distance between the subject NP and its predicate. For example, the RCE sentence in (6a) requires a much shorter distance within which to integrate the noun *conditions* with the verb *existed* than does the non-RCE sentence in (6b), while the distance between the noun *conditions* and its relative clause is only increased by one word in (6a) as against (6b). Hawkins' (2004) theory of domain minimization, which quantifies the notion of integration distance in terms of cumulative effects across different domains, thus predicts a greater overall processing cost for the non-RCE sentence (6b) as compared with the RCE sentence (6a). This is because the relative clause which separates the subject from the predicate in (6b) is much longer than the VP which separates the head noun from the relative clause in (6a).

(6) a. Certain conditions existed which cannot be applied to all other countries at all times. (ICE-GB)

b. Certain conditions which cannot be applied to all other countries at all times existed .

Consistent with these predictions, Francis (2010) found significant effects of grammatical weight in both production and comprehension of RCE and non-RCE sentences. An analysis of RCE and non-RCE tokens in the ICE-GB corpus showed that RCE was strongly preferred over canonical (non-RCE) order when the relative clause was at least five times longer (in words) than the main-

clause VP, whereas RCE occurred only rarely when the VP was the same length or longer than the relative clause. In addition, a full-sentence reading-time study showed that RCE sentences were read significantly faster than non-RCE sentences when the relative clause was long, but that there was no difference in reading time between RCE and non-RCE sentences with short relative clauses. Note that the latter result is somewhat at odds with the reading time results of Levy et al.(2012), in which RCE sentences were processed more slowly than non-RCE sentences. However, the Levy et al. study had a slightly different task (word-by-word reading) and did not include any weight manipulation.

As these previous studies have shown, both discourse factors and grammatical weight appear to play a role in speakers' use of RCE. However, no previous studies have examined both factors simultaneously. Thus, it is not known to what extent discourse factors are independent of weight, nor is it known which factors have the strongest influence over speakers' choice of structure. In addition, because previous discourse-oriented studies of RCE have relied on informally-collected intuitive judgment data, it is not known how well these analyses can account for actual language use. The aims of the present study are therefore twofold: (1) to test the predictions of discourse-based theories of RCE using data from naturally occurring discourse; (2) to determine the relative influence of grammatical weight and several discourse-related factors on speakers' choice of structure. To accomplish this, we conducted a quantitative analysis of naturally occurring examples of RCE and non-RCE tokens from the International Corpus of English-Great Britain (ICE-GB). Our findings confirmed that RCE is in fact typically associated with presentational contexts, and that grammatical weight and certain discourse-related factors independently contribute to speakers' choice of structure in language use.

However, the details, as described below, reveal a number of complexities not considered by previous studies.

Although this study is the first of its kind to examine RCE in English, it aligns with several other recent studies of constituent-order alternations in English, including the ditransitive alternation (Bresnan & Ford 2010), particle shift (Lohse et al. 2004; Gries 2003), genitive placement (Rosenbach 2005) and heavy NP shift (Arnold et al. 2000). These studies have all shown that constituent-order alternations tend to be conditioned by multiple interacting factors, including grammatical weight, information structure, animacy, lexical bias and structural priming. For example, in the case of heavy NP shift, Arnold et al. (2000) showed by means of a corpus analysis and elicited production experiments that grammatical weight and discourse information status (newness) independently influenced speakers' choice of a shifted versus non-shifted structure. In addition, the current study, though conducted independently, closely parallels another corpus study reported in this volume— a large-scale quantitative study of factors contributing to relative clause extraposition in German (Strunk, this volume). Strunk's study also showed that grammatical weight and discourse-related factors independently contributed to speakers' choice of constituent order in German relative clauses.

The remainder of this chapter is organized as follows. Section X.2 describes the methods and quantitative results of a corpus analysis of RCE and non-RCE tokens in the ICE-GB corpus; this corpus analysis consists of two distinct studies: (a) a study that examines the cluster of discourse properties that define the typical RCE token (as against the typical non-RCE token) and (b) a study that compares these discourse factors to that of grammatical weight, asking whether any or all of these factors have an independent influence on the speaker's choice to employ an RCE as against non-RCE structure . Section X.3 presents a qualitative analysis of

exceptional cases from the corpus. Finally, Section X.4 briefly outlines some implications of the current study for linguistic theories and concludes the chapter.

X.2 Corpus study

The International Corpus of English Great Britain (ICE-GB) (Nelson, Wallis, and Aarts 2002) includes about one million words of British English in a variety of genres of both speech and writing, and is parsed and tagged in such a way as to facilitate identification of syntactic structures, including RCE. The current analysis is based on a subset of sentences from the ICE-GB, which were originally collected for Francis' (2010) study of grammatical weight and relative clause extraposition in English. Making use of Francis' (2010) original coding for phrase length and predicate type, the current analysis provides additional coding for several discourse-related categories including definiteness of the subject NP, discourse status (givenness) of the subject NP and discourse status (givenness) of the predicate VP. The remainder of this section describes the coding scheme, hypotheses, and quantitative results.

X.2.1 Coding scheme

This analysis includes 345 sentences with a lexical subject NP modified by a finite relative clause—the total number of such sentences found in the ICE-GB corpus. These were collected as a subset of the 391 sentences from Francis (2010), excluding the 46 tokens with pronominally headed relative clauses. Pronominally headed relative clauses were excluded from the present analysis because they are known to have somewhat different information-structure properties than lexically headed RCs, and we wanted to eliminate any such variation due to the activation status of the nominal-head denotatum (Gundel at al. 1993, Michaelis & H. Francis 2007). These

sentences were originally extracted from the corpus using tree-fragment searches to identify the non-RCE tokens and function labels (specifically, the ICE-GB category "floating post-nominal modifier") in combination with manual checking to identify the RCE tokens. Grammatical weight was coded according the original measurements in Francis (2010): VP length (in words), RC length (in words), and VP-to-RC length ratio (VP length divided by RC length).[2] VP-to-RC length ratio was used as a measure of relative length, in accordance with previous corpus and experimental studies that have found relative length to be a more significant predictor of word order choice than absolute length (Hawkins 1994; Stallings & MacDonald 2011; Wasow & Arnold 2003). Length difference (VP length minus RC length) was calculated as an additional measure of relative length, to determine which measure made the more accurate predictions. We used the predicate type coding from Francis (2010). Specifically, we distinguished between passive or presentative predicates and other predicate types—the distinction found to be most relevant in the earlier study. All morphologically passive verbs (consisting of *be* + past participle) were counted in the passive category. Following Rochemont & Culicover (1990: 66), who claim that only presentative predicates are felicitous with PTC (whereas a wider range of predicates are felicitous with RCE), presentative predicates were operationally defined as active intransitive verbs that remained felicitous when the sentence was converted from an RCE or non-RCE sentence, as in (7a-b), into a PTC sentence, as in (7c):

(7) a. Certain conditions <u>existed</u> which cannot be applied to all other countries at all times. (ICE-GB)

b. Certain conditions which cannot be applied to all other countries at all times <u>existed</u>.

c. There existed certain conditions which cannot be applied to all other countries at all times

There was one minor complication in applying this operational definition. As Ward and Birner (1996: 469-471) show based on a corpus of 428 examples, PTC sentences appear to have an additional constraint besides requiring a presentative predicate: they also require a discourse-new NP following the predicate. Although they show that this requirement does not prevent PTC from sometimes occurring with morphologically definite NPs (i.e., those which are also discourse-new), an isolated sentence with PTC often seems more felicitous with an indefinite NP following the predicate. Because we wanted our presentative category to be independent from definiteness and discourse status of the NP, we also counted a predicate as presentative if it became felicitous with PTC when the NP was changed from definite to indefinite.

In addition to the codes from the previous study, we coded each sentence for definiteness of the main-clause subject NP, discourse status of the main-clause subject NP, and discourse status of the main-clause VP. Subject NPs with a definite article (*the*), demonstrative determiner (*this, that, these, those*), strong quantifier (*all, both, each, every, most*), or possessive determiner (*our, your, his,* etc.) were classified as definite, while subject NPs with an indefinite article (*a, an*), weak quantifier (*some, many, few, no, several, one,* cardinal numbers), or no determiner (e.g., *people*) were classified as indefinite based on Carlson's 1977 claim that bare nouns are intrinsically non-quantificational. Classifications for discourse status were based on the 20 lines of text preceding the target sentence. Following Michaelis & H. Francis (2007) and Gregory & Michaelis (2001), we used three categories to label information status: given (prior mention), superset mention, and new (no prior mention). Subject NPs with a prior mention of

the same referent within the preceding 20 lines were classified as given. Subject NPs with a prior mention of the category including the referent but no prior mention of the referent itself were classified as superset mention (Michaelis & H. Francis 2007: 28). For example, for the sentence *The point that Paula made was well justified,* the subject NP would be classified as superset mention if there were a prior mention of a point made by another speaker, or if the general idea of making a point had been brought up in the previous discourse. Subject NPs with no prior mention of the referent or of the category including the referent were classified as new. Predicate VPs were coded in a similar manner to Subject NPs. Predicate VPs with a prior mention of the exact same event/situation within the preceding 20 lines of text were classified as given. Predicate VPs with a prior mention of the type of event/situation (but not the exact event/situation) were classified as superset mention. In practice, this meant that predicates with (nearly) the same meaning but a different referent for the subject NP were classified as superset mention. For example, for the sentence *The organ which you hear is over 100 years old,* the predicate VP would be classified as superset mention if there were a previous discussion of something else (not this particular organ) being over 100 years old. Predicate VPs with no prior mention of the exact event/situation or of the type of event/situation denoted by the predicate were classified as new.

Because categorization of discourse status requires raters to make subjective judgments, we had two independent raters classify every item for the discourse status of the subject NP and the predicate VP. A third rater then independently rated all of the items for which the first two raters disagreed, and for those cases, the category selected by two out of the three raters was used for the analysis. Overall, the first two raters agreed for 69% of the subjects and 89% of the predicates.

X.2.2 Discourse-related properties of RCE and non-RCE tokens

The current corpus study had two main goals: (1) to test the predictions of discourse-based theories of RCE using data from naturally occurring discourse; (2) to determine whether grammatical weight and several discourse-related factors independently influence the speaker's choice to employ an RCE as against a non-RCE structure. This section describes corpus data relevant to the first goal. For this analysis, we contrast the respective discourse profiles of RCE and non-RCE clauses by comparing the set of RCE tokens against the set of non-RCE tokens. Specifically, we examined four factors: definiteness of the subject NP, predicate type of the main clause predicate, discourse status (givenness) of the subject NP, and discourse status of the main clause predicate. Based on previous proposals in the literature on RCE, we predicted the following:[3]

(1) RCE tokens will occur more often with a passive or presentative predicate than non-RCE tokens will (Francis 2010).

(2) RCE tokens will occur most often with an indefinite subject NP, while non-RCE tokens will occur most often with a definite subject NP (Huck & Na 1990; Michaelis & H. Francis 2007).

(3) RCE tokens will occur more often with a discourse-given predicate than non-RCE tokens will (Rochemont & Culicover 1990).

(4) RCE tokens will occur more often with a discourse-new subject NP than non-RCE tokens will (Rochemont & Culicover 1990).

For the sake of clarity, our hypotheses with respect to the second goal are postponed until section X.2.3.

Figure 1 below provides an overview of the properties of RCE sentences (n = 53) vs. non-RCE sentences (n = 292) stated in terms of proportions, while Table 1 and Table 2 show the proportions alongside the exact counts that were used in the statistical analyses. As shown in Figure 1 and Table 1, RCE tokens were predominantly indefinite, with passive or presentative predicates. Non-RCE tokens differed from RCE tokens in being predominantly definite and in having fewer passive or presentative predicates. (Further analysis revealed that non-RCE tokens occurred predominantly with transitive and copular predicates.) Chi square tests showed that RCE tokens differed significantly from non-RCE tokens with respect to definiteness ($X^2 = 32.05$, $p < 0.01$) and with respect to predicate type ($X^2 = 52.79$, $p < 0.01$). These differences confirm hypotheses (1) and (2) above.

Figure 1: Definiteness, predicate type, and discourse status for RCE tokens (n = 53) and non-RCE tokens (n = 292)

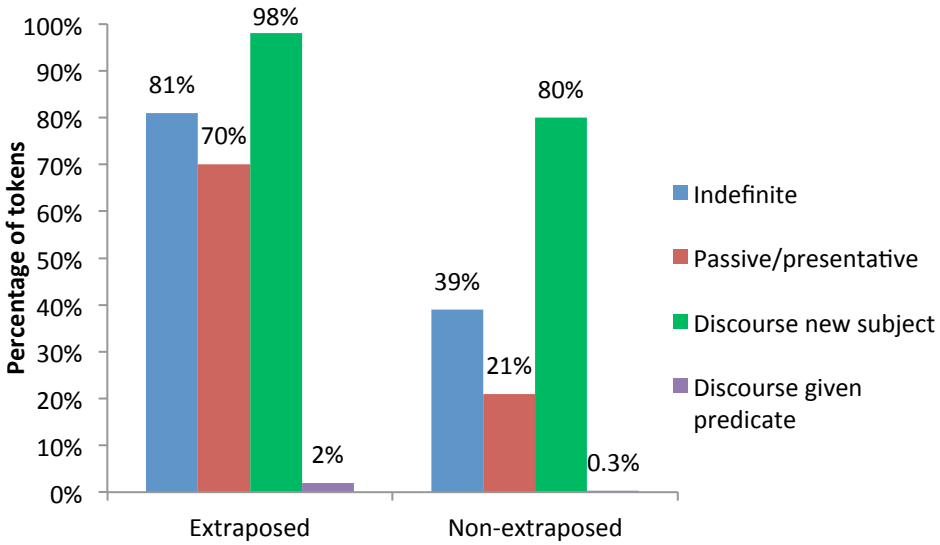


Table 1: Proportions and counts for RCE and non-RCE tokens with respect to definiteness and predicate type

Definiteness			**Predicate Type**		
	% of RCE Tokens	**% of Non-RCE Tokens**		**% of RCE Tokens**	**% of Non-RCE Tokens**
Definite	19% (n = 10)	61% (n = 178)	**Passive/ Presentative**	70% (n = 37)	21% (n = 61)
Indefinite	81% (n = 43)	39% (n = 114)	**Other Predicate**	30% (n = 16)	79% (n = 231)
Total	100% (n = 53)	100% (n = 292)	**Total**	100% (n = 53)	100% (n = 292)

As shown in Figure 1 and Table 2, RCE and non-RCE tokens differed relatively little in terms of discourse status: both word orders typically occurred with discourse-new subjects and discourse-new predicates.[4] However, there were some statistically significant differences related to both subject accessibility and predicate accessibility. With regard to subject accessibility, non-RCE tokens occurred more often with discourse-given subject NPs than non-RCE tokens did (19.9% vs. 1.9%), and this difference was significant ($X^2 = 10.27$, $p < 0.01$), as expected under hypothesis (4) above. This finding is consistent with the traditional analysis of RCE as a presentational construction and with the analysis of lexically headed (non-RCE) subjects as topics. However, it is interesting that both RCE tokens and non-RCE tokens occurred predominantly with discourse-new subject NPs. This tendency is not predicted by previous accounts of RCE, but is in line with a corpus study by Michaelis & H. Francis (2007), which found that subject NPs headed by a lexical (common) noun were typically discourse new despite

expressing a sentence topic and having a definite determiner. Based on these findings, Michaelis & H. Francis proposed that sentences with a lexically-headed subject NP typically serve a dual role of both introducing a new topic and commenting on it. Their analysis also fits the current data, since subject NPs of non-RCE tokens were typically both definite and discourse new.

Table 2: Proportions and counts for discourse status of subject and predicate for RCE tokens (n = 53) and non-RCE tokens (n = 291)[5]

	Subject Accessibility		**Predicate Accessibility**	
	% of RCE Tokens	% of non-RCE Tokens	% of RCE Tokens	% of non-RCE Tokens
Given	1.9% (n = 1)	19.9% (n = 58)	1.9% (n = 1)	0.3% (n = 1)
Superset Mention	49.1% (n = 26)	29.6% (n = 86)	18.9% (n = 10)	3.1% (n = 9)
No Prior Mention	49.1% (n = 26)	50.5% (n = 147)	79.2% (n = 42)	96.6% (n = 281)
Total	100% (n = 53)	100% (n = 291)	100% (n = 53)	100% (n = 291)

With regard to predicate accessibility, the finding that only one RCE token and one non-RCE token occurred with a discourse-given predicate was contrary to our expectation in hypothesis (3). RCE and non-RCE tokens did not differ in their dispreference for discourse-given predicates. However, breaking down the discourse-new category into "superset mention" and "no prior mention" reveals an interesting difference (see Section X.2.1 above for a description of these categories). Predicates of RCE tokens occurred more often than predicates of non-RCE tokens in the superset mention category (18.9% vs. 3.1%), as shown in Table 2. A chi square test which compared RCE and non-RCE tokens with respect to superset mention and

no prior mention categories revealed that this difference was significant ($X^2 = 21.86$, $p < 0.01$). Thus, although predicates of RCE sentences were almost never discourse given, they did occur more often with a predicate that was accessible from the preceding context. This finding is consistent with a weaker version of Rochemont & Culicover's (1990: 68) claim that (non-presentative) main-clause predicates of RCE sentences must be directly c-construable (accessible from context), since their notion of c-construable includes superset mention predicates (as in example 5 in section X.1 above). Their claim can thus be moderated as follows: predicates of RCE sentences are not required to be accessible from context, but they are more likely to be accessible than predicates of non-RCE sentences are.

In summary, the findings reported in this section generally support a presentational analysis of RCE as put forth in previous studies of extraposition (Huck & Na 1990; Rochemont & Culicover 1990; Kuno & Takami 2004): RCE tokens typically had indefinite, discourse-new subjects and passive or presentative predicates. In contrast, non-RCE tokens typically had definite, discourse-new subjects and transitive or copular predicates. These data are also consistent with Michaelis & H. Francis' (2007) study of lexical subjects in the Switchboard Corpus, specifically their claim that (non-RCE) lexical subjects tend to be new and topical at the same time. The major unexpected finding was that the predicates of RCE tokens were almost never discourse-given, and occurred with no prior mention in 79.2% of the cases examined here. It is interesting that predicates of RCE tokens did occur in the superset mention category more often than predicates of non-RCE tokens. However, greater discourse accessibility of the predicate did not appear to be a prominent or defining feature of RCE in this dataset. Thus, all of the hypotheses above were confirmed, provided that we revise hypothesis (4) by changing "discourse-given predicate" to "superset-mention predicate," and acknowledge that differences

in predicate accessibility only showed up in a small number of cases.

X.2.3 Discourse and weight-based factors as independent factors predicting RCE usage

The previous section compared RCE and non-RCE tokens with respect to their occurrence with several discourse-related features, thus providing a more detailed and nuanced description of the discourse properties of RCE than had been provided in previous studies. In this section, we report on the findings related to our second major aim for this study, which was to determine the relative influence of grammatical weight and discourse factors on speakers' choice of RCE as against a non-RCE structure. Although we will consider some of the same factors as in the previous section, we will begin to characterize factors like definiteness and predicate type as *predictors* of structural choices that speakers and writers make in language production. That is, definiteness and predicate type are examples of independent variables that we will use to predict the value of the dependent variable, extraposition status (RCE or non-RCE). In this section, our hypotheses are related to those in the previous section, in that most of the same factors are included in the model. However, the hypotheses are reframed such that the probability of speakers/writers choosing an RCE structure over a non-RCE structure is the dependent variable. (In the previous section, the goal was a basic description of the discourse profile for RCE and non-RCE tokens, and the hypotheses were framed in terms of finding a *difference* between RCE and non-RCE tokens.) Also, unlike the analysis in the previous section, in which each factor was considered separately, this analysis is based on a binary logistic regression model. By entering all of the factors into a logical regression model, we were able to determine whether each factor contributed independently to the predictive power of the model. Thus, for example, the standards for getting a significant main effect of definiteness are higher for the logistic regression

analysis than for the chi square analysis in section 2.2 because definiteness is considered in relation to all of the other factors, not just by itself. If it had been the case that definiteness and predicate type made largely overlapping predictions for extraposition status, for example, only one of these two factors would have been found significant. In addition, the logistic regression model allowed us to test for interactions among factors and to determine the relative strength of each factor for predicting extrapostion status.

Based on the results reported in the previous section, in which we found that only two tokens had a discourse-given predicate, we framed our hypothesis regarding predicate accessibility with reference to the "superset mention" category. In addition to the discourse-based factors considered in the previous section, we also included length ratio (a measure of grammatical weight) as a factor in this analysis, in order to test the relative importance of grammatical weight as compared with discourse-related factors. Our hypotheses were as follows:

(1) Probability of RCE should be highest for tokens with the lowest VP-to-RC length ratio, and should decrease as this ratio increases (Francis 2010).

(2) Probability of RCE should be higher for tokens with a passive or presentative predicate than for tokens with other predicate types (Francis 2010).

(3) Probability of RCE should be higher for tokens with an indefinite subject NP than for tokens with a definite subject NP (Huck & Na 1990).

(4) Probability of RCE should be higher for tokens with a superset-mention predicate than for tokens with a discourse-new (no prior mention) predicate (Rochemont & Culicover 1990).

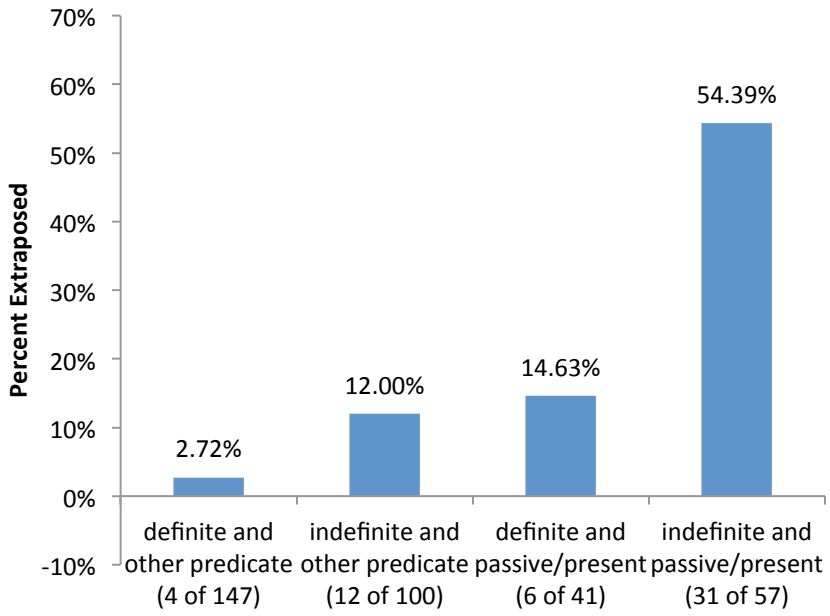
(5) Probability of RCE should be higher for tokens with a discourse-new subject (superset mention or no prior mention) than for tokens with a discourse-given subject (Rochemont & Culicover 1990).

We had no specific predictions regarding the relative strengths of the different factors, and no specific predictions regarding statistical interactions among the different factors. However, this information is also crucial to our investigation, and will be provided by the logistic regression analysis.

Before reporting the results of the logistic regression analysis, we will first provide some basic descriptive statistics showing the trends in our data in a visual form (Figures 2-6), to make our data more accessible to readers. In the discussion that follows, extraposition status will be expressed descriptively in terms of the percentage of all tokens from a particular category (e.g. tokens having an indefinite subject NP) which had an extraposed (RCE) word order.

Overall, canonical (non-RCE) word order was used much more frequently than RCE, with RCE used in only 15% of all tokens (53 of 345). However, frequency of RCE use increased to 54% (31 of 57) for items that both had an indefinite subject NP and a passive or presentative predicate (Figure 2), while frequency remained at 15% or less for items belonging to the other three definiteness/predicate type combinations.

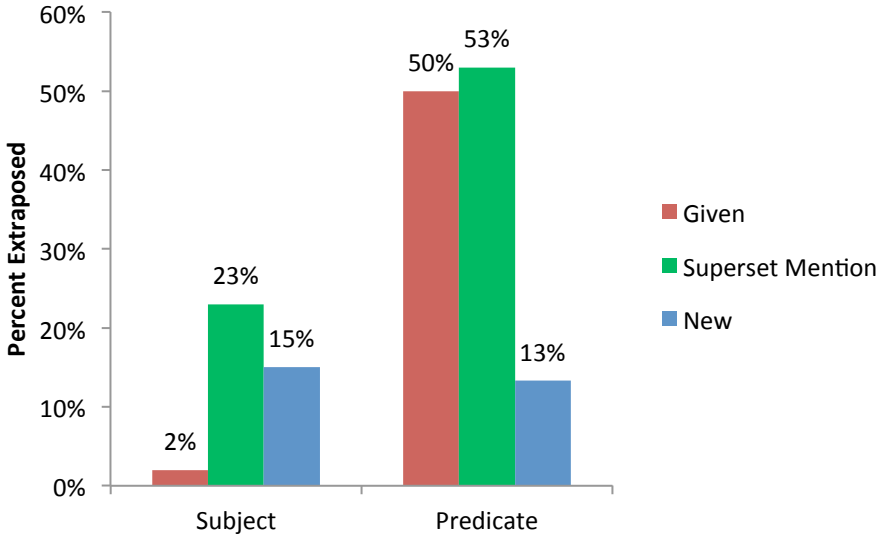
Figure 2: Percentage of RCE for four categories of definiteness and predicate type



Incidence of RCE also differed according to discourse status. As shown in Figure 3, RCE occurred very rarely in items with a given subject NP (1 of 59 tokens), but occurred more frequently in items with a superset-mention predicate (10 of 19 tokens). Consistent with the previous literature, the former trend suggests a dispreference for RCE outside of presentational contexts, while the latter trend suggests a slight preference for RCE when the main-clause predicate is relatively accessible. However, note that given subject NPs (n = 59) and superset-mention predicates (n= 19) occurred rather infrequently in the corpus overall, thus contributing relatively little to the overall discourse profile of RCE vs. non-RCE tokens reported in section X.2.2 above. One way to look at it is this: discourse-given subjects and superset-mention predicates are relatively rare, but when they do occur, these factors might be used to help predict whether a speaker or writer will use RCE. As discussed in section X.2.2 above, there were only

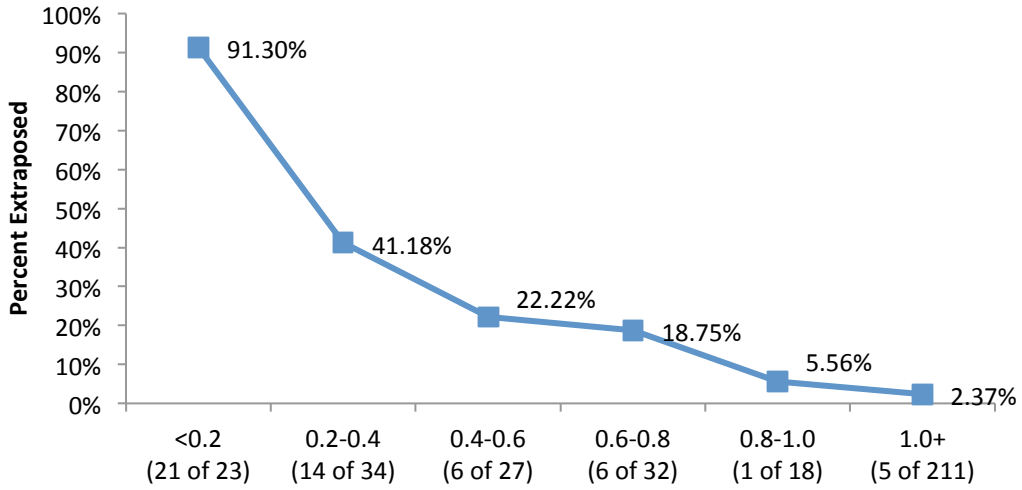
two tokens with discourse-given predicates in the entire sample. Thus, the apparently high rate of RCE shown in Figure 3 (50%) represents one out of two tokens, and therefore does not indicate any identifiable trend.

Figure 3: Percentage of RCE by discourse status of subject and predicate



Similar to the results of Francis (2010), dramatic differences in incidence of RCE were found for different ratios of VP to RC length. As shown in Figure 4, incidence of RCE was highest for length ratios of 0.2 (or 1:5) and lower (tokens for which the RC was at least five times longer than the VP), at 91%, and decreased as this ratio increased. For length ratios of 1.0 (or 5:5) and higher (tokens for which the RC was the same length or shorter than the VP), RCE occurred in only 2% of tokens.

Figure 4: Percentage of RCE for increasing ratios of VP length to RC length



Interestingly, the effect of length ratio appeared to differ for items of different definiteness statuses and predicate types, as shown in Figures 5-6. For tokens with a definite subject NP (Figure 5), RCE was preferred over non-RCE order only when the VP-to-RC length ratio was less than 0.2, or 1:5 (i.e. when the RC was at least five times longer than the VP). The same was true for items belonging to the "other" predicate type: 67% were extraposed for length ratios of 0.2 or less, but this immediately dropped to 29% for ratios between 0.2 and 0.4 (or 1:5 and 2:5) and less than 1% for items of length ratios greater than 0.6 (or 3:5). However, for tokens with an indefinite subject NP and a passive/presentative predicate, RCE was strongly preferred for items of length ratios up to 0.8, or 4:5 (Figure 6). This pattern suggests that grammatical weight played the strongest role in predicting extraposition status for ratios less than 0.2, or 1:5 (where extraposition is usually preferred) and for ratios greater than 0.8, or 4:5 (where extraposition rarely ever occurs). For ratios between 0.2 and 0.8 (1:5 and 4:5), extraposition status appears to depend more on definiteness and predicate type.

Based on these descriptive data, it appears that length ratio, definiteness, and predicate type

were important predictors of extraposition status, with possible interactions between definiteness and predicate type (Figure 2) and between definiteness and length ratio (Figures 5-6). Possible effects of subject accessibility (dispreference for RCE with given subjects) and predicate accessibility (preference for RCE with superset mention predicates) were also apparent (Figure 3).

Figure 5: Percentage of RCE for increasing ratios of VP length to RC length, definite tokens only

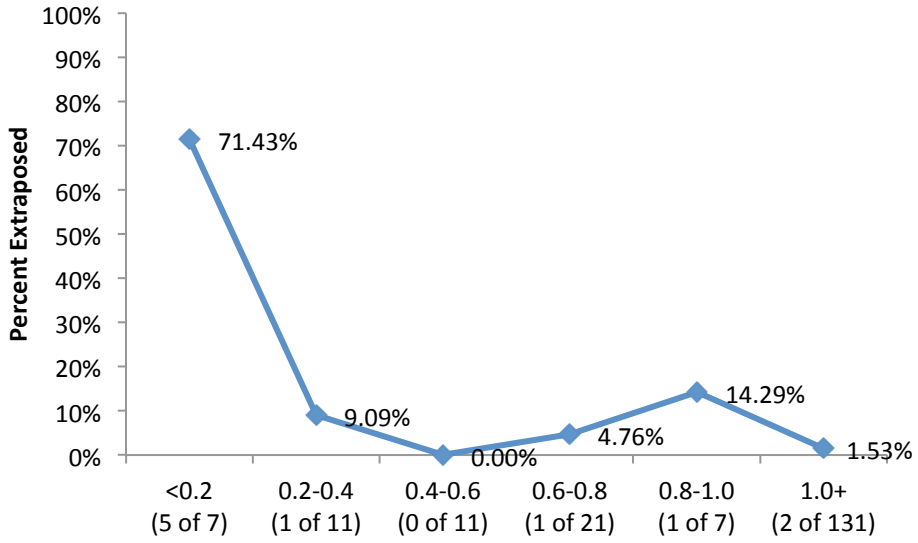
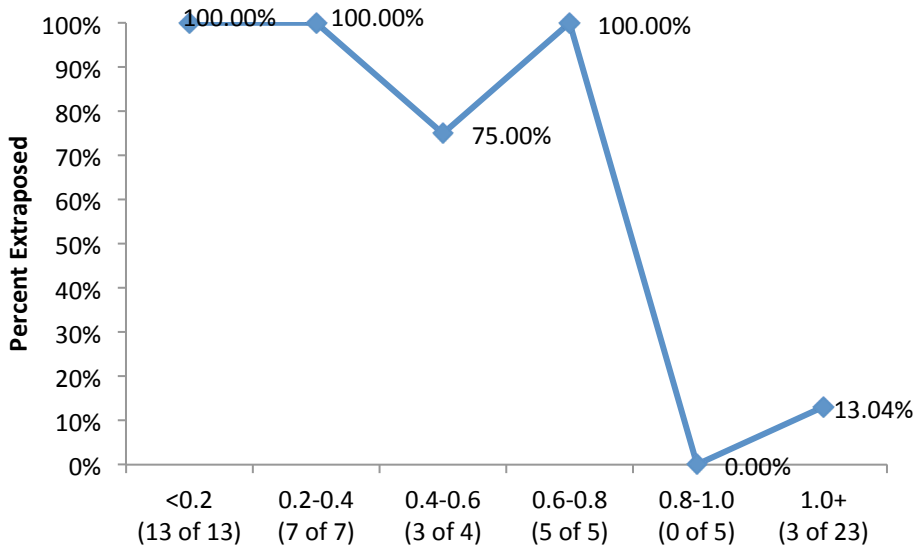


Figure 6: Percentage of RCE for increasing ratios of VP length to RC length, indefinite and passive/presentative tokens only



To test which factors were statistically significant for predicting choice of the RCE as against non-RCE structure, we used a binary logistic regression model with stepwise selection (cf. Diessel 2008), calculated using the PROC LOGISTIC function in SAS software. The dependent variable was extraposition status (RCE = 1, non-RCE = 0). The primary indicator chosen for determining the predictive power of the model and of each of the independent variables was the area under the Receiver Operating Characteristic (ROC) curve, where 0.5 indicates that the model predictions were at chance and 1.0 indicates that the model was 100% accurate (Zou et al 2007). To find the best measure of grammatical weight for predicting these data, alternative measures of grammatical weight were first tested one by one in a logistic regression model with no other independent variables: VP-to-RC length ratio (VP length divided by RC length), VP length alone, RC length alone, and length difference (RC length minus VP length). Of these four measures, the area under the ROC curve was highest (at 0.91) for length

ratio, and therefore length ratio was used as the measure for grammatical weight in the full model. The other independent variables included in the full model were as follows: definiteness (indefinite = 1, definite = 0), predicate type (passive/presentative = 1, other predicate type = 0), subject accessibility (given = 1, other = 0), predicate accessibility (superset mention = 1, other = 0), and all possible interactions. Note that "superset mention" was chosen as the relevant measure for predicate accessibility, in light of the paucity of examples of discourse-given predicates (only two) in the corpus sample.

Statistics for the significant factors are summarized in Table 3 and given in a format similar to that of Diessel's corpus study of temporal clause placement (Diessel 2008: 482). Following stepwise selection, four of the five independent variables tested were found to be significant predictors of extraposition status at an alpha level of $p < 0.05$: length ratio, predicate type, definiteness, and predicate accessibility.[6] In addition, there were significant interactions between length ratio and definiteness and between predicate type and definiteness. These main effects and interactions are indicated by the Wald X^2 values and associated p-values in Table 3. Subject accessibility (givenness of the subject) was not a significant factor. The regression coefficients in Table 3 indicate whether RCE is more or less likely given a particular value of an independent variable. The positive regression coefficients for definiteness, predicate type, and predicate accessibility show that a "1" value for each of these categorical factors increases the likelihood of RCE. Specifically, indefinite subject NPs, passive or presentative predicates, and superset mention predicates are each associated with a higher likelihood of RCE. The negative value for length ratio (a continuous variable) shows that higher length ratios are associated with a *lower* likelihood for RCE, as illustrated in Figure 4 above. As shown by the area under ROC curve values, length ratio was found to be the strongest predictor of extraposition status,

followed by predicate type, definiteness, and predicate accessibility. The overall prediction accuracy of the model, as indicated by the area under the ROC curve after inclusion of all the independent variables, was 0.9613 out of a maximum value of 1.0. This can be interpreted to mean that the model was highly accurate for predicting extraposition status on this dataset.

Table 3: Statistically significant factors from logistic regression analysis (n = 345)

Independent variable	**Wald X^2**	**p-value**	**Regression coefficient**	**Area under ROC curve when added first**
Length ratio	$X^2 = 7.207$	p = 0.007	-2.562	0.918
Predicate type	$X^2 = 2.736$	p = 0.098	1.218	0.745
Definiteness	$X^2 = 8.246$	p = 0.004	3.062	0.711
Predicate accessibility	$X^2 = 5.012$	p = 0.025	1.869	0.579
Interaction: Predicate type * Definiteness	$X^2 = 6.276$	p = 0.012	3.529	0.748
Interaction: Length ratio * Definiteness	$X^2 = 7.030$	p = 0.008	-5.639	0.425

Before concluding this section, it is worth asking how the discourse-related variables are related to each other in terms of function. For example, do all passive and presentative predicates occur with indefinite subject NPs? Are all given subject NPs also definite? Are all indefinite NPs also discourse-new? If such were the case, this would not weaken the statistical

analysis given above, since step-wise selection ensured that each factor contributed independently to the predictive power of the model. (If any two factors had been nearly or completely overlapping, one of them would have been rejected by the model. However, if it had been the case that, for example, given NPs were wholly included as a subset of definite NPs, it would still be possible that NPs that are both given and definite could predict a higher or lower rate of RCE than NPs that are definite but not given.) However, a description of the relationships among the independent variables coded in our sample can be useful for understanding the functional relationships among various discourse-related properties. These relationships are summarized descriptively in Table 4 below. Pairs of factors were chosen based on correlations sometimes noted in the literature. Not surprisingly, a high proportion of passive/presentative predicates (87.8%) occurred with discourse-new subject NPs. Similarly, indefinite subject NPs were predominantly discourse-new (82.8%). However, the reverse was not the case: only 45.5% of discourse-new subject NPs were indefinite. Also contrary to the typical correlation between givenness and definiteness, only 54.2% of discourse-given subject NPs were definite, while only 17% of definite subject NPs were discourse-given. These data apparently reflect the overall tendency for subject NPs that are modified by a relative clause to be discourse-new, even when they are topical and definite (cf. Michaelis & H. Francis 2007). It is also notable that only 58.2% of passive/presentative predicates occurred with an indefinite subject NP. This brief summary shows that the strongest tendencies in our data were for passive/presentative predicates to occur with a discourse-new subject NP, and for indefinite subject NPs to be discourse-new. Other factors that might generally be expected to occur together showed no clear relationship for these data, likely due to the special properties of clause-modified lexical subjects.

Table 4: Counts and percentages showing relationships between pairs of discourse-related factors

discourse-new NP	**passive/ presentative predicate**	**discourse-new and passive/presentative**	**% of passive/ presentative tokens that are discourse-new**	**% of discourse-new tokens that are passive/ presentative**
286	98	86	87.8%	30.1%
indefinite NP	**passive/ presentative predicate**	**indefinite NP and passive/presentative**	**% of passive/ presentative tokens that are indefinite**	**% of indefinite tokens that are passive/ presentative**
157	98	57	58.2%	36.3%
indefinite NP	**discourse-new NP**	**indefinite NP and discourse-new**	**% of indefinite tokens that are discourse-new**	**% of discourse-new tokens that are indefinite**
157	286	130	82.8%	45.5%
definite NP	**discourse-given NP**	**definite and discourse-given**	**% of definite tokens that are discourse-given**	**% of discourse-given tokens that are definite**
188	59	32	17.0%	54.2%

In summary, the statistically significant effects from the logistic regression analysis are consistent with our hypotheses, and also fill in details for which we had no clear predictions. Significant effects for length ratio, predicate type, definiteness, and predicate accessibility were as predicted in hypotheses (1-4) above. Subject accessibility (hypothesis 5) was not a statistically significant predictor of RCE, but numerically, the trend was in the expected direction: RCE occurred less often with given subject NPs than with new subject NPs. Interactions between predicate type and definiteness and between length ratio and definiteness, as illustrated in Figures 3, 5, and 6, were also found to be significant. In terms of relative strength as measured by the area under the ROC curve, grammatical weight (length ratio) was found to be

the most reliable predictor of extraposition status, followed by predicate type, definiteness, and predicate accessibility. Finally, a brief analysis of the relationships among the categorical variables showed that passive/presentative predicates tended to occur with a discourse-new subject NP, and that indefinite subject NPs tended to be discourse-new.

X.3 Qualitative analysis of exceptional cases

The trends reported in the quantitative analysis were in the expected direction based on previous studies of extraposition. However, previous discourse-based studies have relied on features or properties assumed to occur *consistently* in RCE tokens, and such studies have not considered the independent effects of grammatical weight. Therefore, it is of theoretical importance to examine a sample of the exceptional cases that showed up in our corpus data.

Exceptional cases were defined as RCE items that lacked some of the theoretically significant features predicted by previous discourse-based analyses of RCE. Such cases were first identified by running a SAS script to identify all of the RCE cases that were incorrectly predicted by the logistic regression model to have non-RCE (canonical) structure. Subsequently, all of the other RCE cases were examined manually to identify any additional exceptions. A total of 16 out of 53 RCE items were identified as "false negatives" by the logistic regression model—RCE tokens which were predicted by the model to have a non-RCE structure. An additional three items were then identified manually as exceptional, due to their apparent discourse function. Interestingly, four out of 292 non-RCE items were incorrectly predicted by the model to have an RCE structure. Because it is generally recognized that non-RCE order *can* be used to express a presentational focus, these items do not appear to be theoretically significant and so will not be considered here.

Of the 16 RCE items that the model failed to predict, at least six were theoretically unproblematic. In (8a-b), for example, all of the discourse and morphological features appropriate for RCE were present, with a focal stress on the word *changes* in (8a) and on the word *friends* in (8b) clearly possible. The model likely failed in these cases because of the relatively high VP-to-RC length ratio, which would have favored non-RCE structure, and which indeed makes these sentences sound rather awkward.

(8) a. This is because changes were made to the standard rate contributions paid by employees that do not affect the married woman 's reduced rate contributions. (written)

b. We've got some friends coming to supper whose daughter's there so I can question tomorrow so I can question her about it. (spoken)

More common among the exceptions were sentences that appeared to have topical subjects and focal predicates, as is more typical of non-RCE sentences. In each of the examples in (9a-c), the definite subject NP appears to be the topic of the sentence, with focal stress falling somewhere on the predicate. Note, in addition, that (9a-b) exceptionally have copular predicates.

(9) a. A: The one you did last time was for my wife actually, which was F name.
B: That probably explains why I can't find it under H. (spoken)

b. As you can imagine the first few days will be a bit hectic, during which time I will be ringing you , and every client personally to invite you into my office. (written)

c. In aeolian environments the sand is blown until it accumulates, which can take on various features e.g. barchans, etc. (written)

The examples in (10a-b) show a similar pattern. Although these tokens were correctly predicted by the regression model to contain RCE, presumably owing to their indefinite subject NPs and low length ratios, they appear to have topical subjects and focal predicates. Note especially the use of contrastive *did* with a non-presentative main verb *get in touch* in (10a), and the use of a transitive main verb in (10b-c).

(10) a. Various people did get in touch with me who had done informal trials with addicts in clinics and had found that if they gave strenuous and regular exercise regimes, the addicts did get better and did not relapse. (spoken)

b. A recent study in and around the Great Barrier Reef by Ian Anderson used core samples from the marine environment which discovered not only that the Great Barrier Reef was younger than was originally thought, but its development coincided with the cycles suggested by Milankovitch. (written)

c. Discriminating sensation may then re-establish itself in which the patient is capable of differentiating between textures. (written)

What the examples in (9-10) seem to have in common is the possibility of a non-restrictive interpretation of the relative clause. Although the subject is topical and the predicate is focal, the relative clause itself appears to express a distinct proposition with its own illocutionary force. For example, (9a-b) above can be considered as nearly equivalent to (11a-b).

(11) a. A: The one you did last time was for my wife actually. It was F name.
B: That probably explains why I can't find it under H.

b. As you can imagine the first few days will be a bit hectic. During this time I will be ringing you, and every client personally to invite you into my office.

If the RCE construction is used with restrictive relative clauses only, as is commonly assumed in the syntactic literature (see Baltin 2006), the cases in (9-10) can perhaps be treated as something other than RCE. It is worth noting, however, that we were not able to eliminate non-restrictive relative clauses from the corpus sample because we found no clear distinction between restrictive and non-restrictive clauses when the relative clause modified a common noun and was introduced by a *wh* relative pronoun. In (10a), for example, the relative clause seems to be restricting the interpretation of the subject denotatum to include only those people who had done informal trials with addicts in clinics. In other words, if we follow Lambrecht's analysis of restrictive relatives (1994: 51-56), (10a) presupposes an open proposition 'x did informal trials with addicts at clinics'. At the same time, however, the relative clause is conjoined with a clause describing the results of the trials, and thus carries assertoric (discourse-advancing) content. Therefore, it is problematic to exclude items like (9-10) from analysis within a theory of RCE.

We will close with one final RCE example, which was incorrectly predicted to be non-RCE by the logistic regression model and which is not amenable to a non-restrictive reading. In (12a), the subject, *the best singer,* is definite-marked and topical, and the predicate *is this Olaf Bergh,* appears to be focal. In addition, the relative clause is introduced by the complementizer *that*, preventing a non-restrictive reading, and the VP-to-RC length ratio of 4/3 should disfavor RCE.

(12). a. The best singer is this Olaf Bergh that I've seen. (spoken)

b. ?The singer is this Olaf Bergh that I like best. (constructed example)

At least out of context, the sentence in (12a) seems to us to be only marginally acceptable. What might be happening here? In (12a), the speaker seems to add the restrictive relative clause *that*

I've seen as an afterthought, in order to qualify the strong claim made in the previous statement. Consistent with this possibility, the sentence in (12a) seems somewhat more felicitous than the constructed sentence in (12b), in which the speaker does not use the relative clause as a hedge. Another difference between (12a) and (12b) comes from the fact that superlative adjectives tend to occur frequently with relative clauses, since relative clauses are a common means of restricting the reference set over which the superlative applies (Wasow et al. 2011). Thus, a listener hearing sentence (12a) would not be as surprised to hear a relative clause at the end as would a listener hearing sentence (12b). Support for this conjecture comes from Levy et al.'s (2012) study of RCE comprehension, in which it was found that reading times were faster for RCE sentences when the NP set up a strong expectation for a following relative clause (e.g., *only those executives…*), even though RCE sentences were read more slowly than non-RCE sentences under weak-expectation conditions (e.g., *the executives…*).

In this section, we have discussed several cases of RCE from the corpus that appear to be problematic for current theories of RCE. Especially troublesome are those cases in which RCE was apparently used with a topical subject and a focal predicate. Such cases call for an approach which both acknowledges the effect of grammatical weight and which expands the range of syntactico-semantic and discourse contexts that welcome extraposition.

X.4 General discussion and conclusions

The current study reveals a complex interplay among several different factors contributing to speakers' and writers' choice of RCE as against non-RCE word order in English. Overall, there was a strong preference for RCE when the relative clause was at least five times longer than the VP (length ratio less than 0.2), and a strong preference for canonical order when the relative

clause was the same length or shorter than the VP (length ratio 0.8 or higher). For those items with length ratios falling in the middle range (between 0.2 and 0.8), choice of structure appeared to depend primarily on the definiteness of the subject NP and on the type of predicate occurring in the main clause. Items with an indefinite subject NP and a passive or presentative main verb were much more likely to contain RCE than were items with other combinations of features. The accessibility of the predicate also had a small but significant effect: RCE was more likely with superset mention predicates than with new (no prior mention) predicates. In short, it appears that length ratio sets soft limits on RCE based on ease of processing, while discourse-related factors regulate choice of structure within these limits. More generally, this pattern of results appears to represent a strategy by which speakers/writers resolved any conflict between grammatical weight and discourse factors by giving preference to each under different conditions: grammatical weight was given priority in almost all cases, while discourse factors were given priority only for those tokens that fell within a relatively narrow range of length ratios – those that might be considered neutral with respect to RCE. However, our exceptional cases discussed in section X.3 show that this tradeoff was not always straightforward. For example, the sentences in (8a-b) show that occasionally, discourse factors prevailed in licensing an RCE clause even when the length ratio should have clearly favored a non-RCE structure. Future studies are needed to refine the conditions under which discourse factors may prevail over grammatical weight.[7]

The results of the current study also show interesting parallels with a corpus study by Jan Strunk on relative clause extraposition in German (Strunk, this volume). Similar to the current study, but on a larger scale (1300 tokens from the Tübingen Treebank of Written German), Strunk investigated a number of factors that independently contribute to writers' choice of

extraposed or non-extraposed relative clause placement in German. Unlike the current study, Strunk's study was not restricted to subject-modifying relative clauses but also included various kinds of complement-modifying relative clauses. Perhaps for this reason, in combination with language-specific differences, RCE was much more common in the German corpus. However, the results of the two studies, both of which used binary logistic regression to statistically model the factors underlying choice of word order, are strikingly similar. As in the current study, factors related to grammatical weight (extraposition distance and relative clause length) were among the strongest predictors of extraposition. Also similar to the current study, discourse-related factors including definiteness and position of the relative clause antecedent (head noun) within the sentence were significant predictors of extraposition status, independent of grammatical weight. As in the English data, RCE was more likely to occur with indefinite antecedents than with definite antecedents. More generally, both studies suggest that speakers and writers are simultaneously sensitive to several different kinds of factors, including processing factors, morphosyntactic factors, and discourse factors, when making structural choices in language production, thus supporting the general approach of several recent studies of word-order alternations (Arnold et al 2000; Bresnan & Ford 2010; Gries 2003; Lohse et al 2004; Rosenbach 2005).

In addition to highlighting the interplay of multiple factors in language use, the current study also calls into question common theoretical assumptions regarding the discourse function of RCE in English. Although a majority of tokens in the corpus were compatible with the predominant view of RCE as a presentational construction (Section X.2.2), a significant minority of RCE tokens (about 20%) appeared to have topical subjects and focal predicates (Section X.3). In contrast to previous analyses of RCE, which propose certain invariable discourse constraints

on the occurrence of extraposition (e.g. Rochemont & Culicover's claim that predicates of RCE sentences *must* be directly or indirectly c-construable), our results point toward a revised theoretical approach that allows for more flexibility in the way that extraposition is licensed. It is important to note that while length ratios favoring RCE (i.e. short VP and long relative clause) can help explain a subset of these exceptional cases, other cases such as those in (9a, c) and (12a) above cannot be explained in terms of a simple trade-off between discourse factors and weight. For (9a) and (12a), both the length ratios and the discourse properties should have favored a non-RCE structure, while for (9c), the discourse properties should have favored a non-RCE structure and the length ratio was in what we identified as the neutral range. Thus, if only one discourse function were available for this construction, these cases would be difficult to accommodate. More flexibility in the licensing of RCE could be accomplished in various ways, such as through a procedural approach in which possible output forms are evaluated by means of ranked constraints, as in Optimality Theory (e.g. Bresnan et al 2007), or through a declarative approach in which the possible construction types of a language (e.g., various RCE constructions) are organized in a type hierarchy, as in some versions of Construction Grammar (e.g. Fillmore 1999), Head-Driven Phrase Structure Grammar (e.g. Malouf 2003), and Sign-Based Construction Grammar (e.g., Sag 2010). While a theoretical account is beyond the scope of this short chapter, we tend to favor some version of the latter approach, in which non-prototypical construction types can inherit basic properties from the prototypical construction while lacking one or more of the properties that characterize the prototypical case. Cases like (9a-c) and (10a-c) could then be viewed as instantiations of a minor construction which inherits the syntactic properties of the basic RCE construction, while having a distinct discourse profile in which the relative clause contains assertoric content. More generally, we concur with Strunk that "it is important to look at

exceptional cases…and the existence of special strategies and constructions to compensate for the violation of strong constraints" (this volume, ms p.18).

The need for greater flexibility in the mapping between syntactic form and discourse function points to a more general issue in research on non-canonical constituent order. Despite the recent trend toward multi-factorial studies of the kind reported here and in Strunk's chapter, it is notable that many studies on non-canonical constituent order are still devoted to examining a relatively narrow domain of explanation (e.g., syntax, semantics, and/or discourse information structure) based on a few selected examples. As we hope to have shown here, however, multi-factorial studies examining naturally occurring language have much to contribute to theories of how non-canonical constituent order is used and represented.

Acknowledgements

We gratefully acknowledge the help of our wonderful research assistants: Maryana Bendus, Corinne Feight, and Sunny Park. We are also grateful to our statistics consultants, Kenny Wakeland and Gayla Olbricht, and to our colleagues and students who provided comments on earlier presentations or drafts of this work, especially Jill Duffield, Roger Levy, Jack Hawkins, Edith Moravcsik, Jan Strunk, and Tom Wasow. We gratefully acknowledge the detailed comments we received from two anonymous reviewers for this volume. This research was jointly funded by the Department of English and the Linguistics Program at Purdue University and by the Department of Linguistics at the University of Colorado at Boulder.

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Footnotes

[1] The International Corpus of English Great Britain (Nelson, Wallis, and Aarts 2002) includes about one million words of British English in a variety of genres of both speech and

writing. All example sentences culled from the corpus will be indicated with the abbreviation ICE-GB in parentheses, as in (1a). This is also the corpus that we used for the empirical study described in section X.2.

[2] For the purposes of statistical analysis, VP-to-RC length ratio is coded as a proportion. For example, for a ratio of 1:5, where the RC is five times longer than the VP, this was coded as 0.2.

[3] We offer no predictions concerning how RCE and non-RCE clauses differ in regard to the grammatical function of the relativized element, and so this factor was not included among our hypotheses. Analyses of this factor reveal little difference between RCE and non-RCE clauses: both had a preponderance of subject relatives (60% and 69%, respectively), and relatively few direct object relatives (6% and 13%, respectively). For unknown reasons, prepositional object relatives were more common in RCE (25%) than in non-RCE (11%) tokens. We find the preponderance of subject relatives in our RCE and non-RCE tokens mysterious, given Michaelis and H. Francis's 2007 finding that lexical-subject predications prefer *object or oblique relative clauses*, whose (predominantly) pronominal subjects serve to anchor the referents of those lexical subjects to prior discourse. It is worth noting, however, that while Michaelis and H. Francis 2007 based their findings on one exclusively spoken genre, English conversation, the ICE-GB corpus contains a variety of written and spoken genres of English, for which we might assume that fewer constraints exist on the introduction of new entities in subject position. This fact might account for the distinct trends in relative-clause types in the Michaelis and H. Francis (2007) study and the present one.

[4] In Figure 1, superset mention tokens are included in the discourse-new category. In Table 2, superset-mention tokens are counted separately.

[5] One of the 292 non-RCE tokens was not analyzed for discourse status due to inadequate context.

[6] As shown in Table 3, the p-value for predicate type of 0.098 was not significant due to the inclusion of the interaction between predicate type and definiteness in the model. When interactions are excluded from the model, predicate type becomes highly significant at $p < 0.0001$.

[7] We are grateful to Edith Moravcsik (p.c. July 2012) for helping us frame this discussion of conflict resolution.