

The processing of logophoric reflexives shows discourse and locality constraints

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1.1.1 Introduction

Logophoric anaphors occur in many languages, and are used to pick out a particular point of view (Clements, 1975), or to emphasize and draw focus to the antecedent (Kuno, 1987; Zribi-Hertz, 1989). In English, the “self” form can be used reflexively or logophorically. For example, in (1), the reflexive *himself* refers to the antecedent *Bill*, but the information predicated of *Bill* is not being emphasized or being reflected upon and related from his point of view. In (2), though, the information predicated of *Bill* is being emphasized, and in (3), that emphasized information is also being reflected upon and related from *Bill*’s own point of view. Either or both of these aspects appear to license using the “self” form as a logophor.

- (1) Judy said that *Bill*_i expressed *himself*_i clearly.
- (2) Judy explained to *Bill* that writers like *himself* were in short supply.
- (3) *Bill* explained to Judy that writers like *himself* were in short supply.

The logophoric use of reflexives (underlining) has been argued to be the province of discourse considerations, which is context-dependent. Thus logophors are considered to be resolved by non-syntactic means, such as through the access of pragmatic and discourse information (Reinhart & Reuland, 1993).

1.2.1 Distribution of Logophoric Reflexives

There are different types of logophoric constructions that have been identified in English. These include structures such as (2) and (3) above, (4) so-called “picture” noun phrases, (5) locative or directional prepositional phrases containing a logophor, and (6) conjoined noun phrases (Cantrall, 1974; Keenan, 1988; Kuno, 1987; Reinhart & Reuland, 1993; Zribi-Hertz, 1989)

- (4) *Margaret* thought that the pictures of *herself* were horrible.
- (5) *Tony* put the mistletoe above *himself*.
- (6) *Bill* knew that *Margaret* had defended *Tony* and *himself*.

Drawing on Reinhart and Reuland (1993), sentences (4-6) are considered logophoric uses of *himself* because the “self” anaphor and its antecedent are not co-arguments of the same predicate. In (4) and (5), the prepositional phrase containing the logophoric reflexive is proposed to form its own predicate, so that the “self” form is not an argument of the verb *thought* or *put*. Thus, the logophor does not syntactically reflexive-mark its antecedent. In (6), the conjoined noun

phrase *Tony and himself* is an argument of the verb *defend*. But note that *himself* per se is not a direct argument of *defend*, as it is contained within the conjoined noun phrase. As well, in this example, neither *Bill* nor *himself* are co-arguments of one and the same predicate.

The Reflexivity proposal is that the “self” anaphor marks the predicate as reflexive, not syntactically, but semantically. This difference renders *himself* in (4-6) a logophor (Reinhart & Reuland, 1993). This approach is also consistent with the fact that the pronoun form can acceptably alternate with the “self” form, as shown in (7-9), allowing the same interpretations as (4-6).

(7) Margaret thought that the pictures of her were horrible.

(8) Tony put the mistletoe above him.

(9) Bill knew that Margaret had defended Tony and him.

Note that there are two possible interpretations for the coreferent of the pronoun in each case: one as coreferring with the overt antecedent (underlined), the other as referring to a sentence-external, unmentioned antecedent. The use of the logophoric form more clearly picks out the sentence-internal coreferent, whereas when the pronoun form is used, the interpretation may rely more heavily on discourse factors in order to choose between the two possibilities.

1.3.1 Processing evidence for a non-syntactic operation

In order to reach an interpretation of a logophor or pronoun, it seems clear that access to information beyond that provided by syntax is necessary. Indeed, there is also psycholinguistic evidence supporting this view, as reported in Piñango, Burkhardt & Avrutin (2001) and Harris, Wexler & Holcomb (2000). Both of these studies, using different dependent measures, showed that the processing of regular reflexives differed from that of logophoric “self” forms. For prepositional phrase logophors, like (5), Piñango et al. (2001) found that the interpretation of logophors was more difficult than that of reflexives, as indexed by a secondary lexical decision task. They proposed that additional computations were needed for interpreting logophors, indicative of accessing discourse information. Harris et al. (2000) employed event-related potentials for comparing the violation patterns associated with regular reflexives and those of logophoric reflexives. For conjoined noun phrase logophors, resembling (6), they found that regular reflexives displayed a P600 waveform, indicative of a syntactic anomaly, while the logophor conditions displayed a different, indistinct waveform, at least indicative of a non-syntactic operation.

As introduced earlier, the choice of referent form, and by extension, the interpretation of a logophor versus a pronoun, is generally agreed to be the province of discourse considerations. Indeed, as the basic comparison of the design (logophors versus pronouns) reflects, substantial work on coreference and

discourse processing of written text has found that interpreting a pronoun involves the use of pragmatic and discourse information (Almor, 2000; Ehrlich & Rayner, 1983; Garnham, 2001; Garrod, Freudenthal & Boyle, 1994; Gordon, Grosz & Gilliom, 1993; Green, McKoon & Ratcliff, 1992; O'Brien, 1997; Sanford & Garrod, 1981). Although both Piñango et al. (2001) and Harris et al. (2000) presented processing evidence for logophor resolution involving more than syntactic operations or some source of information other than syntax, there is as yet, little indication of what logophor resolution does entail or the processes that it does require.

2.1.1 The present study

The present study examined whether pragmatic, discourse information is used for the successful interpretation of a logophor and its antecedent, and how similar the process is to pronoun coreference. As alluded to in the Piñango et al. (2001) study, logophor resolution required more computational work than reflexive binding. In the same vein, the use of a logophor may also be more costly to resolve than that of a pronoun if the emphasizing role of a logophor requires an additional or more complex operation, such as marking the antecedent representation as emphasized or constructing a richer, more complex antecedent representation. On the other hand, logophor resolution may be much the same process as that for pronouns, with the same types of information used to link the logophor/pronoun with its correct antecedent.

A related issue addressed in this study is that the conjoined noun phrase construction presents a case where the Reflexivity approach predicts a different outcome than an approach based on syntactically-governed binding domains. From a Reflexivity point of view, in (10), even when the antecedent is a co-argument of the same predicate as the conjoined noun phrase, the reflexive-marking is postulated to be done semantically, because *himself* is not a direct argument of *defend*.

(10) Margaret knew that Bill had defended Tony and himself.

However, when the antecedent *Bill* is local to the antecedent, within the same clause, the notion of a binding domain leads to the prediction that (10) is resolved through a syntactic binding operation, without need to look beyond the syntax. That is, on the one hand, cases like (10) may be processed like other logophors, (6), or they may be treated as true reflexives.

2.1.2 Distance as a non-syntactic factor involved in coreference

It seems that whether a logophor and its antecedent are in the same clause or not may well affect whether syntactic information is deployed for the resolution of the “coreference”, leading to a difference in how an interpretation is achieved in sentences like (6) and (10). There is, however, the possibility that during

coreference processing there is simply a bias to prefer linking with a more recent possible antecedent. There is ample evidence from memory paradigms, psycholinguistic, and linguistic research, that an item processed most recently is likely to have the greatest availability in memory (Ariel, 1990; Gernsbacher, Hargreaves & Beeman, 1989; McElree, 2001). But, there is also evidence that an antecedent in a first-mentioned position is preferentially available in memory (Gernsbacher & Hargreaves, 1988), which makes sentences like (6) and (10) difficult to differentiate on the basis of recency vs. first-mentioned explanations (Gernsbacher et al., 1989). In order to evaluate whether a potential difference between the processing of sentences like (6) and (10) is due to simply recency in memory or also includes stressing syntactic information, for this study the distance between the logophor/pronoun and its antecedent was varied across three antecedent positions, inserting an intermediate position. An antecedent in this middle position was hypothesized to be less available in memory than either a first-mentioned or a most recent antecedent representation. This allowed assessment of both a first-mention processing advantage as well as the role of recency versus clause-boundedness as a specific test of whether logophors and pronouns are resolved similarly.

2.2.1 Experiment 1: self-paced reading times

For this study, the main comparison of interest was the processing of a logophor and its antecedent as compared to that of a pronoun and its antecedent to assess whether pragmatic information is accessed and used similarly. The other issue was to compare the processing patterns across three different antecedent positions in order to evaluate the similarity between logophors and pronouns in a specific way, focusing particularly on whether logophors with an antecedent in the same clause might also utilize a syntax-based operation.

2.2.2 Materials

The stimulus sentences contained three possible antecedent positions and a conjoined noun phrase containing the logophoric *himself* or *herself* and a matching gender name. Due to the relatively complex nature of the sentences, and to ensure as much as possible the measurement of correct coreference interpretation, names of unambiguous gender were used, and only one antecedent matched the gender of the logophoric reflexive. A set of example stimuli are presented in Table 1. Ten stimulus triads were developed for logophoric reflexives and ten for pronouns. According to the experimenter's intuitions, for each triad, the antecedent in each position was equally plausible.

Table 1. Stimulus materials

Sentences contained either a logophoric reflexive or pronoun which co referred with an antecedent in either a first-mentioned, intermediate, or most recent position (underlining). Slashes indicate the phrase breaks during reading for Experiment 1.

Logophoric Reflexive	
First-mentioned	<u>Megan</u> wondered / if Isaac had found out / that Rick wanted to invite / Sally and <u>herself</u> / to the birthday party.
Middle	Isaac wondered / if <u>Megan</u> had found out / that Rick wanted to invite / Sally and <u>herself</u> / to the birthday party.
Most Recent	Rick wondered / if Isaac had found out / that <u>Megan</u> wanted to invite / Sally and <u>herself</u> / to the birthday party.
Pronoun	
First-mentioned	<u>Albert</u> was upset / when Debbie didn't care / that Rachel had endangered / Gordon and <u>him</u> / on the climbing trip.
Middle	Debbie was upset / when <u>Albert</u> didn't care / that Rachel had endangered / Gordon and <u>him</u> / on the climbing trip.
Most Recent	Rachel was upset / when Debbie didn't care / that <u>Albert</u> had endangered / Gordon and <u>him</u> / on the climbing trip.

2.2.3 Participants

Fifty-one undergraduate students (18 male, 33 female, mean age = 19.6) from New York University consented to participate in exchange for course credit.

2.2.4 Procedure

Each sentence was presented phrase-by-phrase in a self-paced reading time procedure, with a moving window. At the beginning of each trial, a display of dashes representing each word in the sentence appeared. The participant then pressed a key to reveal the first phrase of the sentence (e.g. *Megan wondered ---*). Each subsequent key press revealed each subsequent phrase. Participants were instructed to read at a natural and comfortable pace. Each sentence was presented across the monitor in one line of text.

Upon having read through a sentence, the participant was presented with two statements from which to choose the correct one, pertaining to the just-read stimulus sentence. This two-alternative forced-choice measure of comprehension was adopted due to the relative complexity of the stimulus sentences. Feedback was presented after each judgment, and participants were instructed to maintain a level of at least 85% correct on the judgments. Participants began with 10 practice trials to ensure familiarity with the procedure. Stimulus sentences were presented randomly, intermixed with filler sentences that also contained four characters, but did not entail coreference processing.

2.2.5 Results

Repeated-measures ANOVAs were performed both with subjects as a random factor (Ss) and with stimulus items (i.e. triads) as a random factor (Items). Unless otherwise noted, the analyses reported here are for uncorrected reading time means, with both correctly and incorrectly answered trials included, as the pattern of results did not differ substantially when reading times were trimmed or adjusted for outliers, or when only correct trials were examined.

Participants attained acceptable levels of comprehension ($mean = .78$). Accuracy for the six conditions did not differ according to reference type (Ss and Items: $F < 1$) or antecedent position (Ss: $F(2, 96) = 2.52, p = .08$; Items: $F < 1$), and there was no interaction of these factors (Ss: $F(2, 96) = 2.58, p = .08$; Items: $F(2, 36) = 1.16, p = .33$).

The pattern of reading times for the phrase containing the logophor or pronoun was the same across the three antecedent positions. At first glance, logophor conditions appeared to be read more slowly than pronoun ones (Ss: $F(1, 48) = 12.85, p = .001$; Items: $F(1, 18) = 5.88, p = .03$), but this difference was not reliable when the reading times for the conjoined noun phrase (*Sally and herself* vs. *Gordon and him*) were adjusted for number of characters (Ss and Items: $F < 1$). Planned contrasts supported the hypothesis that a logophor or pronoun coreferring with the middle antecedent position was more difficult to resolve than those coreferring with the first-mentioned or most recent positions (Ss: $F(1, 48) = 3.05, p = .09$; Items: $F(1, 18) = 5.21, p = .03$).

For the spillover phrase following the logophor/pronoun region, Figure 1 illustrates a striking difference between logophor and pronoun conditions. They were processed similarly, but only for the first-mentioned and middle antecedent positions.

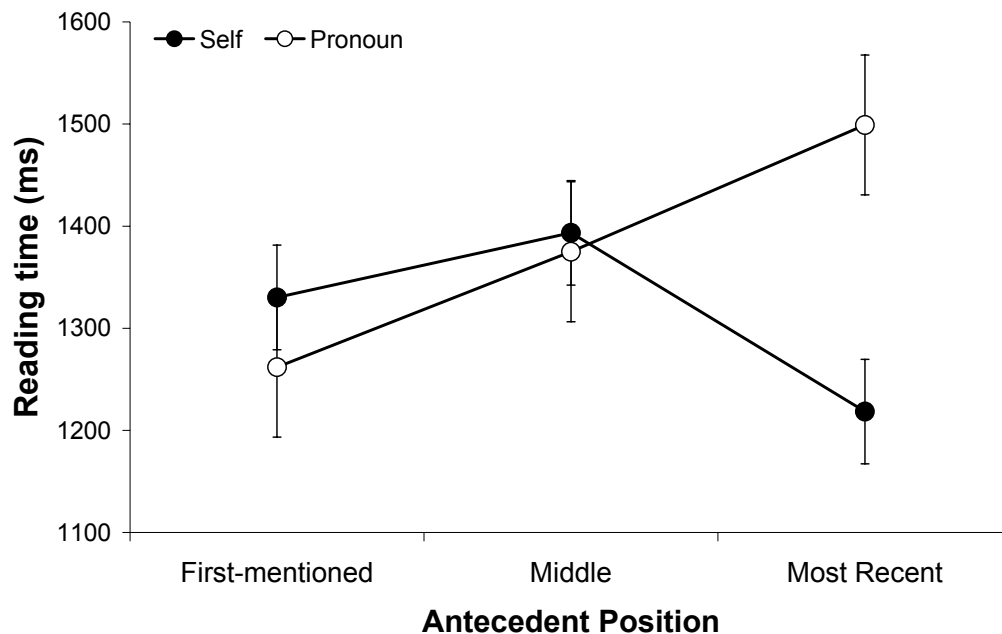
Overall, there were no differences due to referent type alone (Ss: $F(1, 48) = 1.64, p = .21$; Items: $F < 1$) or antecedent position alone (Ss and Items: $Fs < 1$), but there was an interaction between the two for the Subjects analysis ($F(2, 96) = 3.93, p = .02$), although not for the Items¹ analysis ($F(2, 36) = 1.98, p = .15$). Planned contrasts comparing conditions with the most recent antecedent position to conditions with the two other positions were significant for Subjects analyses ($F(1, 48) = 6.51, p = .01$) but not for Items analyses ($F(1, 18) = 2.95, p = .10$). Figure 1 shows the data when Subjects is treated as a random factor, and although the Items-based planned contrasts did not reach significance, the same interaction pattern was evident. When an antecedent was in either a first-mentioned or middle position, logophor and pronoun conditions did not differ regarding ease of coreference. However, when an antecedent was in the most recent, clause-

¹ Overall, Items analyses tend to only approach significance, which is likely due to the small number of sentence items, consistent with less power to detect an effect.

bounded position, logophor conditions were read more quickly than (a) the two other logophor conditions (Ss: $F(1, 48) = 5.01, p = .03$; Items: $F(1,9) = 1.29, p = .09$) and (b) the pronoun condition containing an antecedent in the most recent position (Ss: $t(50) = 2.69, p = .01$; Items: $t(9) = 1.75, p = .11$).

Figure 1. Reading times for the spillover phrase

Logophoric reflexives were processed no differently than pronouns for first-mentioned or intermediate antecedents, but when the antecedent was in the same clause as the logophor (most recent), reading times were significantly shorter than those for the corresponding pronoun condition, and significantly shorter than those for the two other logophor conditions. Logophor (“self”) conditions are represented with filled circles and pronoun conditions with open circles. Error bars indicate standard error.



2.2.6 Discussion

The resolution of logophors appears to use the same type of pragmatic and discourse information as that for pronoun coreference. Sentences containing logophors and pronouns showed the same pattern of processing, particularly when the antecedent was in a first-mentioned or intermediate position in the sentence.

Analyses of the reading times for the phrase containing the logophor/pronoun suggested that both a first-mentioned strategy and a recency bias affected the ease of resolution for both logophors and pronouns, to an equal extent. On the following spillover phrase, there was evidence that when a logophor referred to an

antecedent that was in the same clause, processing took less time than all other conditions.

When linking a logophor with its antecedent and forming an interpretation, this shortest reading time could indicate either sensitivity to clause-boundedness or an effect of recency in memory, either of which is consistent with the pattern of reading times on the previous conjoined noun phrase. It is difficult to decide between these two alternatives by comparison with the pronoun condition, as the inflated reading time for a pronoun coreferring with an antecedent in the most recent position is in the opposite direction predicted by a recency account. The longest reading time for that particular pronoun condition is likely due to both (a) the pronoun having more than one possible referent, producing ambiguity between a sentence-internal and sentence-external (no explicit antecedent) interpretation, and (b) a sentence-internal interpretation being less acceptable, likely producing reanalysis and reinterpretation on some trials.

In order to discern whether the shortest reading time for a logophor coreferring with a recent, local antecedent is due solely to the recency of the antecedent or whether it reflects the use of different types of information for clause-bounded versus non-clause-bounded antecedent coreference, a measure which de-emphasizes the role of memory is needed. That is, if the difference in logophor condition reading times is due to only an effect of recency in memory, the reading time results would remain consistent with a semantic-marking account of logophor reflexivity (Reinhart & Reuland, 1993). However, if a recency bias accounts for very little of the difference in reading times, the role of clause-boundedness and the use of syntactic information would be implicated. If the role of working memory operations is reduced and yet a similar pattern for the most recent conditions occurs, this would imply the use of information which is sensitive to clause-boundedness.

2.3.1 Experiment 2: Acceptability judgments

Experiment 2 used the method of acceptability judgments, which reduces the role of working memory. Since the whole sentence is viewed at once, with unlimited time, any effects of memory on processing are minimized. If the locality effect found in Experiment 1 was due in large part to the deployment of a recency bias when interpreting logophors, the pattern of acceptability judgments should not show a difference between conditions with an antecedent in the most recent position as compared to conditions with either a first-mentioned or middle antecedent. On the other hand, if the locality effect was due primarily to incorporating a different type of information for resolution of local versus non-local coreference, a pattern similar to Experiment 1 would be expected. That is, consistent with a shorter reading time for a logophor coreferring with a local antecedent, a higher acceptability rating for that condition would be expected.

2.3.2 Participants

Thirty undergraduate students (9 male, 21 female, mean age = 18.9) from New York University consented to participate in exchange for course credit. None of them had participated in Experiment 1.

2.3.3 Procedure

The stimulus materials from Experiment 1, including filler items, were employed. Each full sentence was presented for an unlimited amount of time on a computer monitor. Participants judged how acceptable each sentence was to them, along a 7-point scale, where 1 meant “nonsense/unacceptable” and 7 meant “makes perfect sense/fully acceptable.” Six practice trials preceded the experimental trials to ensure understanding of the task.

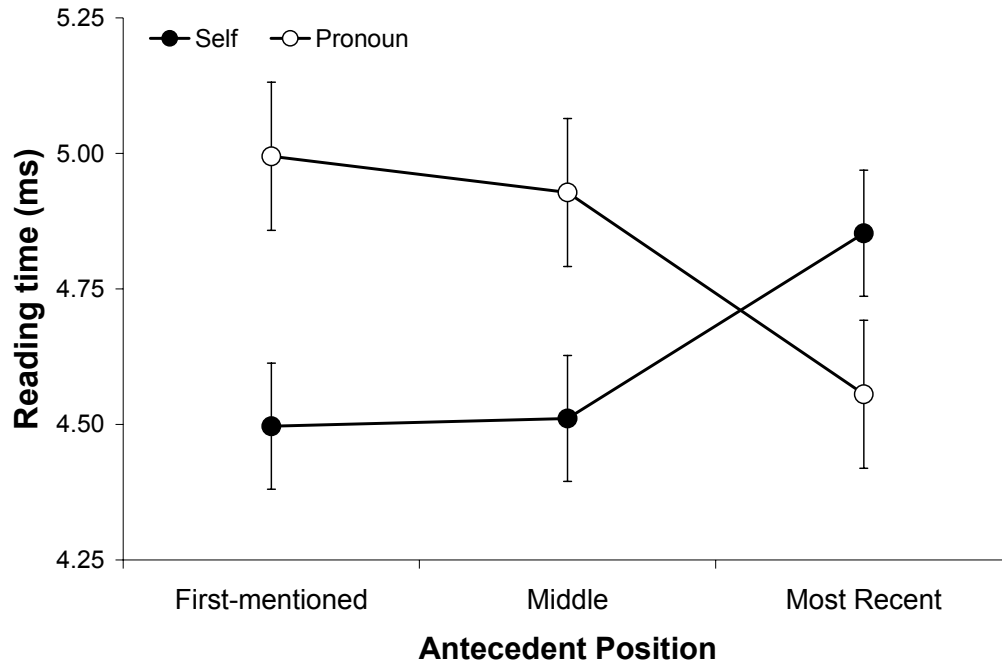
2.3.4 Results and Discussion

Ratings for the experimental stimuli ranged from 2 – 7, with a mean of 4.61. Figure 2 illustrates the mean ratings for each of the six conditions (with Subjects as a random factor). There was no main effect of antecedent position (Ss and Items: $F < 1$), and mixed evidence for an effect of referent type (Ss: $F(1, 27) = 4.44, p = .04$, Items: $F < 1$), but a clear interaction was apparent (Ss: $F(2, 54) = 4.60, p = .01$; Items: $F(2, 36) = 3.37, p = .05$). Planned contrasts also revealed that ratings for conditions with the antecedent in the most recent position differed from those for conditions with antecedents in either the first-mentioned or most recent position, and that the first-mentioned and most recent conditions did not differ from each other, within referent type (Ss: $F(1, 27) = 6.12, p = .02$; Items: $F(1, 18) = 8.49, p = .01$). Post hoc paired comparisons produced mixed evidence for the first-mentioned and middle position conditions varying depending on referent type, with pronoun conditions being more acceptable than logophor ones (first-mention, Ss: $t(29) = 3.03, p = .01$; Items: $t(9) = 1.75, p = .11$; middle, Ss: $t(29) = 2.04, p = .05$; Items: $t(9) = 0.93, p = .37$).

The pattern of logophor and pronoun conditions mirrored each other when comparing first-mentioned and middle conditions to those with the antecedent in the most recent position. When the logophor coreferred with an antecedent in the most recent position, it was more acceptable than the two other logophor conditions. Because a recency account was minimized with this task, it is suggested that syntactic constraints are being used for the linking of the “self” form with its antecedent, contained in the same clause. For the same reason, the lower rating of a pronoun coreferring with a most recent antecedent was likely due to ambiguity of interpretation between a sentence-internal or sentence-external antecedent. For logophors and pronouns respectively, the ratings for first-mentioned and middle antecedent conditions were the same, with pronoun conditions being rated as more acceptable than the logophor ones.

Figure 2. Acceptability ratings for the whole sentence

Logophoric reflexives were most acceptable when the antecedent occurred in the most recent, clause-bounded position, while comparatively, a pronoun was least acceptable. Logophor conditions are denoted with filled circles, and pronoun ones with open circles. Error bars indicate standard error.



3.1.1 General Discussion

Experiment 1 showed that the interpretation of logophoric reflexives was similar to that of pronoun coreference. For the phrase containing the logophor/pronoun, reading times did not differ as a function of coreferent form. The same was true for the following spillover phrase when the antecedent was in a first-mentioned or middle position. However, both the reading times and acceptability judgments produced a distinct difference between most recent, clause-bounded antecedent versus first-mentioned and intermediately positioned antecedents. The confluence of a short reading time and a high acceptability rating for the clause-bounded “self” form indicates that participants were accessing the same knowledge both on-line and off-line. This suggests that these “self” forms were being treated as true reflexives, subject to a syntactic binding operation, inconsistent with a Reflexivity explanation of these constructions (Reinhart & Reuland, 1993).

The reading times and acceptability ratings also differed for pronouns corefering with a most recently positioned antecedent. This was likely due to both the ambiguity between an interpretation of the antecedent as sentence-internal or as sentence-external, and that a sentence-internal interpretation is less acceptable or perhaps considered ungrammatical on occasion.

Reading times on the conjoined noun phrase itself showed a recency bias (for both pronouns and logophors), but on the following spillover area logophors were more quickly read and pronouns were more slowly read. The interpretation given here, that syntax-based information was more important for clause-bounded situations, fits well with a model of coreference resolution which involves two stages (e.g. Garnham, 2001; Garrod & Terras, 2000). The first stage involves a relatively automatic linking of pronoun and antecedent, in this case, affected by recency, and the second stage involves assessment of the resulting interpretation, including reanalysis of the initial linking and reinterpretation when necessary. For instances when the antecedent and pronoun/logophor were in the same clause, these experiments suggest that information based on syntactic constraints was used during the second stage, both because of a shorter reading time for the “self” form and because of an inflated reading time for the pronoun form on the spillover area.

Given the above findings, it seems that perhaps the conjoined noun phrase construction does not follow the same distribution as the other logophoric constructions introduced earlier. Although the “self” form is not a direct coargument with its antecedent, even in cases like (10), these two experiments suggest that it is treated as being within the binding domain of its antecedent, like a true reflexive.

It remains to be seen whether other logophoric constructions are similarly sensitive to the clause-boundedness of a logophor or pronoun to its antecedent. For example, a construction with an adjunct prepositional phrase containing a logophor or pronoun may show no differences in processing due to referring form across all three antecedent positions, unlike the pattern found for conjoined noun phrase logophoric reflexives. At any rate, these experimental results make a case for including processing evidence to fully account for the distribution and nature of coreferring devices.

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