Available online at www.sciencedirect.com

ScienceDirect

Lingua 169 (2016) 70–94

Lingua

www.elsevier.com/locate/lingua

Processing *let alone* coordination in silent reading

Jesse A. Harris *

University of California, Los Angeles, Department of Linguistics, 3125 Campbell Hall, Los Angeles, CA 90095, USA

Received 12 September 2014; received in revised form 14 October 2015; accepted 20 October 2015
Available online 29 November 2015

Abstract

Processing research on coordination indicates that simpler conjuncts are preferred over more complex ones, and that positing ellipsis structure in the second conjunct is taxing to process when a simpler non-ellipsis structure exists. The present study investigates *let alone* coordination, which is argued to require clausal ellipsis in the second conjunct. It is proposed that the processor always projects a clausal structure for the second conjunct for the ellipsis, obviating a general preference for a less complex conjunct. Experiment 1 consists of several sentence-completion questionnaires testing whether a DP or VP conjunct is preferred in *let alone* structures as in *John doesn't like Mary, let alone* (*Sue* | *love her*). The results found a bias towards VP remnants that was weakly affected by syntactic placement of the focus particle *even*, as well as by prior context. Experiment 2 examined the effect of remnant type on eye movements during silent reading, revealing only distinct processing patterns, rather than major processing penalties, for different remnant types, and a general facilitation when *even* was present to signal upcoming scalar contrast.

Keywords: Sentence processing; Ellipsis; Coordination; Eye movements; Focus particles

1. Introduction

There is much evidence that as an utterance unfolds the sentence processor actively seeks to assign an appropriate structural analysis as quickly as possible to meet real-time constraints on computation. In the case of (temporary) ambiguity involving coordination, previous research has shown that less complex structures are typically preferred over more complex ones, at least out of context – although this preference may be encoded within models of the processing system in multiple ways (e.g., as a syntactic economy constraint on structure building, as in Frazier's 1979 garden path model, or as a pressure to minimize discourse topics, as in Hoeks et al., 2002, to take just two possibilities among many).

Further, preferences that guide the processing of ambiguous sentences implicitly reveal which underlying structures are considered possible or likely by the processor at various junctures within the sentence. Such preferences are especially important when the processor must infer covert structure on the basis of overt form as in the case of ellipsis; here, I take *mandatory ellipsis* after focus-sensitive coordination as a novel case study, investigating whether the more complex clause structure required for ellipsis necessarily obviates a preference for simpler alternatives.

Focus-sensitive coordination refers to a unique class of coordinators that include *let alone*, as in (1a), *much less*, and possibly others, such as *never mind*. In line with Hulsey (2008) and Toosarvandani (2010), I will argue that such structures always elide material from the second conjunct, so that (1a) may be roughly spelled out as (1b), a view to be

* Tel.: +1 310 825 0634.
E-mail address: jharris@humnet.ucla.edu.

http://dx.doi.org/10.1016/j.lingua.2015.10.008
0024-3841/

defended later. The <> symbols demarcate an elided string, and CAPS indicates linguistic focus, though explicit pitch accent is not manipulated or specified in the experiments that follow.

(1) a. John can't run a MILE, let alone a MARATHON.
b. John can't run a MILE, let alone [a MARATHON]$_1$ <John run t_1 >.

Ellipsis is licensed primarily in coordination environments (Ross, 1967; Sag, 1976; Hardt, 1993), and common coordinators like *and*, *or*, *but*, and so forth have already been well explored. However, it remains open whether all coordination types stand in fundamentally the same relationship with respect to the licensing of ellipsis. For example, certain coordinators, like *but*, might prohibit forms of ellipsis (as suggested for gapping by Sag, 1976). Conversely, coordinators like *let alone* might *require* an elided constituent. It is this possibility that we explore here.

Necessitating ellipsis after coordination might seem to be an unusual requirement for a coordinator; coordination is typically thought to merely permit ellipsis structures like sluicing, stripping, and arguably gapping, without requiring it (e.g., Ross, 1967, 1970).[1] For instance, on the basis of examples like (2) from Siegel (1984), gapping is usually described as an *optional* syntactic process that omits material from the surface syntax which is identical to a correlate in the previous clause. In (2), the gap site includes a verb identical to the matrix clause <*eat*>, leaving the discontinuous constituents *Mary* and *beans* behind.

(2) a. John won't eat CAVIAR and Mary eat beans.
b. John won't eat CAVIAR and MARY <eat> BEANS.

Yet, parallel cases involving coordinate structures with *let alone* (called *let alone coordination* here) show that ellipsis in this case is required:

(3) a. * John won't eat CAVIAR, let alone Mary eat beans.
b. John won't eat CAVIAR, let alone MARY BEANS.

Let alone coordination is unique in several additional respects (Fillmore et al., 1988). First, *let alone* is licensed under negation and other downward entailing environments, much like negative polarity items like *any* or *ever* (Ladusaw, 1979).[2,3]

(4) a. John can't drink TEA, let alone COFFEE.
b. John never drinks TEA, let alone COFFEE.
c. * John drinks TEA, let alone COFFEE.

Second, *let alone* coordination marks the items in comparison with contrastive focus, so that the first item is ranked on a salient scale as more informative than (Fillmore et al., 1988) or contextually entailing (Toosarvandani, 2010) the second. Example (4a), for instance, is understood as presupposing a ranking in which *John's drinking tea* is a less expected or less informative activity than *John's drinking coffee*. This type of scalar reasoning is familiar from scalar implicatures in which a language user draws the (defeasible) inference that a stronger element on a scale cannot be used, given the fact that a weaker one was used instead (Horn, 1972, 1989).

As with scalar implicatures generally, the scalar relations in *let alone* coordination can be extremely variable (Hirschberg, 1985). For example, the scale may be retrieved more or less directly from logical relations holding between the elements in contrast. Examples in (5) illustrate such a scale with numerals (5a) and quantificational expressions (5b). Logically, if John can run ten miles, then he must also be able to run one, and if John drank all of the coffee, then he also drank some of it.

(5) a. John can't run ONE mile, let alone TEN miles.
b. John didn't drink SOME of the coffee, let alone ALL of it.

[1] Many approaches to gapping do not involve ellipsis *per se*, but rather Across-the-board movement with scrambling (Johnson, 1996, among others). However, the precise analysis of gapping will not concern us here, as what matters is ultimately the *size* of the second conjunct, which nearly all approaches treat as larger than what is visible at the surface.

[2] So-called 'positive' instance of *let alone* coordination (3c) are attested in which the *let alone* phrase provides an afterthought, rather than a scalar comparison (Cappelle et al., 2015). Such instances might be limited to specific dialects (Fillmore et al., 1988; Toosarvandani, 2009), and are relatively rare in recorded speech (see Harris and Carlson, in press, for some distributional properties of *let alone* coordination in corpora).

[3] A function F is *downward entailing* iff for all X, Y in the domain of F, such that $X \subseteq Y$: $F(Y) \subseteq F(X)$.

In addition, the scale could be entirely contextual or ad hoc, as already illustrated in (4a-b). In this case, the intended scalar relation could be formed from any dimension along which the proposition recovered from the second conjunct, here that *John drinks coffee*, is somehow more informative in the context than the matrix proposition that *John drinks tea*. One natural relation for (4a-b) compares caffeine content: If John can handle the caffeine content in coffee, he can also handle the lower caffeine content in tea.

As with such scales generally, the negation of a weaker element on the scale entails the negation of a stronger one (except when the use of negation is metalinguistic). Thus, from denying *John can drink tea*, the negation of *John can drink coffee* ultimately follows, at least on an ordering of drinks by their caffeine strength. There is much more to say regarding the semantic and pragmatic effects of *let alone* coordination (Fillmore et al., 1988; Hulsey, 2008; Toosarvandani, 2010). However, recovering the scale defining the ranking of elements in comparison is just one problem the processor must solve in order to properly interpret these structures; another is determining the appropriate syntax for the second conjunct, the central topic of this paper.

1.1. Syntax of let alone coordination

There are multiple possible syntactic analyses for *let alone* structures, the simplest of which reduces to straightforward conjunction. Such an approach is intuitively appealing, for *let alone* coordination appears to be possible with multiple syntactic types of conjunct, as shown in (6), modeled after examples in Fillmore et al. (1988).

(6) a. *V coordination*
Clinton won't reduce, let alone withdraw, the troops.
b. *VP coordination*
Clinton won't reduce the troops, let alone withdraw them.
c. *DP coordination*
Clinton won't withdraw the generals, let alone the lieutenants.
d. *Determiner coordination*
Clinton won't withdraw some, let alone all, of the soldiers.
e. *Preposition coordination*
Clinton won't let the troops march near, let alone over, the border.

Given the diversity of syntactic categories following *let alone* coordination in (6), it would seem natural and intuitive to treat *let alone* coordination as a syntactically flexible coordinator, on par with ordinary coordination (7).

(7) **Ordinary coordination hypothesis.**
Let alone is a flexible coordinator, like *and*, able to combine with multiple syntactic types. The second conjunct only involves ellipsis when a simpler analysis of the conjunct is unavailable.

In contrast to the simplest account in (7), we might propose that the second conjunct is more complex than it would seem from the surface syntax. One account in this vein is Hulsey (2008), who proposes that conjuncts in *let alone* coordination are always conjoined at the vP level in a low analysis of gapping, following Johnson (1996) and others.

(8) a. John won't eat CAVIAR, let alone <John eat> VEAL.
b. JOHN won't eat CAVIAR, let alone MARY <eat> VEAL.

Similarly, Toosarvandani (2010) proposes that *let alone* coordination involves gapping when it appears in clause-final position,[4] but offers a different account of gapping in general, which is conceptually akin to the move and delete approach suggested here. For present purposes, the precise syntactic analysis of focus-sensitive coordination is less important than the broader hypothesis that it coordinates a larger, more complex conjunct than shown on the surface.[5]

[4] Toosarvandani (2010) proposes that only clause-final instances of *let alone* coordination involve gapping of clausal constituents, whereas clause-medial ones, e.g., (6a-b), are derived by coordinating subclausal constituents directly. In contrast, Hulsey (2008) treats clause-medial cases in terms of Right Node Raising (Postal, 1974) from clause-final position. Since I will only consider clause-final cases in the experiments below, I will avoid committing to a specific stance on this issue here.

[5] I take the size of constituents in *let alone* coordination to be *at least* vP or higher on the basis of examples in which a *wh*-element is placed in contrast, such as *John doesn't know whether Mary came home last night, let alone when (she did)*, indicative of a CP remnant. Such cases might instead be argued to involve some variant of sluicing (Ross, 1967), which can also be incorporated into a move and delete style account (Merchant, 2001).

Therefore, we present (9) as an alternative to the null hypothesis (7), compatible with multiple syntactic derivations in the literature.

(9) **Clausal ellipsis hypothesis.**
The second constituent in *let alone* coordination always contains an elided vP or CP with a remnant topicalized into a focus position.

An ellipsis approach has several empirical advantages, the first two of which were presented by Hulsey (2008) in favor of her gapping analysis. First, it straightforwardly incorporates the requirement that the second conjunct omits the verb (10). If *let alone* structures were simply an instance of cross-categorical coordination, then the repeated verb should be optional, cf. the unacceptability of (10b, d).

(10) a. JOHN can't eat CAVIAR, or MARY (eat) VEAL
b. JOHN can't eat CAVIAR, let alone MARY (*eat) VEAL
c. John can't eat CAVIAR, and he can't eat VEAL
d. John can't eat CAVIAR, let alone (*he can't eat) VEAL

Second, *let alone* coordination shows many of the telltale syntactic hallmarks gapping ellipsis. As demonstrated by the pair in (11), a gapped constituent cannot be embedded (Hankamer, 1971; Sag, 1976); the same restriction holds for *let alone* coordination (12).

(11) *Gapping with ordinary coordination*
a. Peter ate his apple slices, and SALLY ___ her green BEANS.
b. * Peter has eaten his apple slices, and the babysitter said that SALLY ___ her green BEANS.

(12) *Let alone coordination*
a. Peter hasn't eaten his apple slices, let alone SALLY ___ her green BEANS.
b. * Peter hasn't eaten his apple slices, let alone the babysitter said that SALLY ___ her green BEANS.

Additionally, Hulsey reports that most speakers strongly prefer non-finite tense (*eat*) in the second conjunct to the inflected variant (*eats*) for both gapping with ordinary coordination (13b) and the *let alone* construction (13c), as opposed to ordinary coordination without negation (13a).

(13) a. John drinks milk or Mary eats veal.
b. John doesn't drink milk, or Mary eat / ??eats veal.
c. John doesn't drink milk, let alone Mary eat / ??eats veal.

Nevertheless, there are several ways in which *let alone* coordination does not pattern with gapping, two of which are discussed here. First, *let alone* coordination permits 'sprouting', in which the second conjunct contains an argument that contrasts with an implicit argument in the correlate (see Chung et al., 1995, who introduced the term for sluicing ellipsis). *Let alone* coordination (14a) behaves more like stripping (14b) than gapping (14c) in this respect.[6] All of the cases in (14) are perfectly acceptable when there is an explicit corresponding argument in the correlate (15).[7]

[6] Thanks to Masaya Yoshida for raising related contrasts and arguments, and to David Potter for additional discussion of these points. An anonymous reviewer suggests several other observations in favor of a move-and-delete analysis, such as the fact that both TP fronting (Abels, 2003) and particle fronting appear to be banned, e.g., **John can't push me over, let alone down.* Detailed discussion of these observations is omitted for reasons of space.

[7] Interestingly in the case of multiple remnants below, only the *let alone* coordination improves when there are implicit referents made salient in the matrix clause, e.g., *nobody from accounts*, suggesting that (i.a) is awkward for discourse reasons, and that (i.b) and (ii.b) are simply ungrammatical.

(i) a. ?? John didn't talk, let alone Bill to Sue.
b. * John didn't talk, or Bill to Sue.
(ii) a. Nobody from accounts ever talked, let alone Bill to Sue.
b. * Nobody from accounts ever talked, or Bill to Sue.

Following Johnson (2014) and others, I assume that the single remnant case in (15c) below also constitutes a gapping structure.

(14) a. John didn't talk, let alone to Sue.
b. John talked, but not to Sue.
c. * John didn't talk, or to Sue.

(15) a. John didn't talk to Mary, let alone to Sue.
b. John talked to Mary, but not to Sue.
c. John didn't talk to Mary, or to Sue.

Second, *let alone* coordination (16a) and stripping (16b) both allow topicalization of an adjunct *about linguistics* in the second conjunct, whereas gapping (16c) does not (Frazier et al., 2012).

(16) a. John didn't talk to Mary about philosophy, let alone about linguistics to Sue.
b. John talked to Mary about philosophy, but not about linguistics to Sue.
c. * John didn't talk to Mary about philosophy, about linguistics, Sue.
cf. John didn't talk about philosophy, and Sue <talk> about linguistics.

In light of the data above, a gapping analysis of *let alone* coordination seems less plausible than one involving (multiple) stripping. I follow a family of move and delete accounts of stripping (Frazier et al., 2012) and related phenomena (Sailor and Thoms, 2014 for non-constituent ellipsis, Merchant, 2001, for sluicing, and Merchant, 2004, for fragment answers) in which the remnant is moved to a focus position in the clause (the movement step), as an adjunction to vP or within 'extended CP layer' (Rizzi, 1997; Grimshaw, 2000, among many others), which allows it to escape the ellipsis site (the deletion step). On this account, the sole difference between a DP remnant (17a) and VP remnant (17b) is which element is fronted to the focus position, not the size of the conjunct or the complexity of the derivation.[8]

(17) a. I can't drink tea, let alone coffee

$[_{\&P}\ [_{\&^0}\ \text{let alone}]\ [_{DP}\ \text{coffee}_1]\ [_{TP}\ \cancel{\text{I can drink}}\ t_1\ ]]]$

b. I can't drink tea, let alone make it

$[_{\&P}\ [_{\&^0}\ \text{let alone}]\ [_{VP}\ \text{make it}_1\ ]\ [_{TP}\ \cancel{\text{I can}}\ t_1\ ]]]$

The above arguments for mandatory ellipsis following *let alone* do not necessarily make the ordinary coordination hypothesis into a straw man position. Not only is the coordination approach the simplest hypothesis in terms of derivational complexity, it would avoid positing a connective that demands ellipsis, a requirement which is, to the best of my knowledge, unattested elsewhere (though there may be other structures that require ellipsis, as pointed out by an anonymous reviewer; see Boone, 2014; Weir, 2014; Thoms, 2014). The assumption in (18) explicitly links the phrase structure mandated by the clausal ellipsis hypothesis with the phrase structure entertained by the processor at the earliest stages of processing, in accordance with (9).

(18) **Project remnant and ellipsis structure for focus-sensitive coordination.**
Immediately project an entire clausal structure for the remnant and ellipsis upon encountering a focus-sensitive coordinator.

[8] Derivations for more complex examples with sprouting or multiple remnants (12) and (14–16) are omitted here for ease of presentation. For instance, (16) would be derived in essentially the same way as (17) except that the argument PP *to Sue* and the adjunct *about linguistics* could escape the ellipsis site either by multiple focus fronting (Sailor and Thoms, 2014) or additional rightward movement of one of the PPs (Frazier et al., 2012).

Specifically, we would expect that the processor generates a vP or CP conjunct when processing *let alone*, given that there are no other analyses to entertain, according to the clausal ellipsis hypothesis. As a consequence, material that follows *let alone* would only ever be interpreted as a focus-fronted remnant that originated within an elided constituent.

Our two hypotheses make different processing predictions, by permitting a different range of syntactic analyses of *let alone* coordination. Only in the ordinary conjunct hypothesis are radically different conjunct sizes structures permissible. In the next section, I state what I will assume about the language processor, and briefly review what is known about processing coordination and related ellipsis constructions, before turning to the processing predictions of the respective accounts in depth.

Before then, however, I briefly clarify why the *let alone* construction would be of interest to linguists and psycholinguists. First, not enough is known about coordination in general, despite being very common in text and speech (occurring in over 50% of sentences in written text, according to Sturt and Lombardo, 2005). Literature on discourse connectives show that many coordination and subordination structures specify intricate and somewhat idiosyncratic discourse relations between clauses; for example, concessives like *although* impose markedly different relationships than causatives like *because*. Understanding how the processor interprets specific constraints from an connective like *let alone* provides an important counterpoint against the backdrop of coordination structures in general, and allows us to determine what kind of grammatical knowledge the processor deploys during real-time processing.

Second, the requirement of ellipsis after a coordinator appears to be a unique phenomenon. It has not been studied previously in a processing context, to the best of my knowledge, outside of Harris and Carlson (in press), who argue that the processing of *let alone* employs strategies familiar from ellipsis, in support of the findings discussed here.

Finally, the unique semantic and discourse properties of *let alone*, such as focus sensitivity and scalar contrast, must be solved alongside the structural properties of the construction. A conflict between structural and discourse information provides insight into how such information is prioritized by the processor, and in turn informs important general architectural issues, such as whether discourse can overturn syntactic biases, and, if so, at what point in online comprehension.

1.2. Processing coordination

Along with current sentence processing literature, I will assume that the language comprehension system as a whole is (i) highly incremental and (ii) at least partially predicative (e.g., Tanenhaus and Trueswell, 1995; Staub, 2014, for review). That the language processor builds structure incrementally means that a linguistic element is added to a relevant representation in the order it is encountered, typically on a word-by-word basis (though listeners can shadow speech at much faster rates, as noted by Marslen-Wilson, 1973). There is a range of positions regarding how *eager* incremental processing is, i.e., how much of a delay between encountering a new constituent and updating the current representation is permissible (Kimball, 1975; Shieber and Johnson, 1993; Sturt and Lombardo, 2005). For concreteness, I adopt a strongly incremental approach here, in which there is little to no delay when computing basic grammatical dependencies (e.g., Crocker, 1996; Konieczny, 1996; Schneider, 1999), though such relationships many be only partially represented in the syntax (e.g., Frazier and Clifton, 1996a,b; Ferreira et al., 2002; Swets et al., 2008) and the semantics (e.g., Frazier and Rayner, 1990; Frazier, 1979; Frisson, 2009; Fishbein and Harris, 2014).

Evidence for structural incrementality is supported by a rich literature on processing temporary ambiguity, in which the processor seems to rapidly select or favor one analysis over another, instead of waiting for disambiguating information (e.g., Frazier and Rayner, 1982; Altmann and Steedman, 1988; Trueswell et al., 1994, among many others). To take a classic example, (19) is temporarily ambiguous between a main clause analysis (where *played the tape* is the matrix verb phrase with *the editor* as its subject) and a reduced relative clause analysis (where *played the tape* is the predicate of a relative clause with *the editor* as its object).

(19) The editor played the tape agreed the story was a big one.

Although (19) is disambiguated towards a reduced relative clause structure at the main predicate *agreed*, readers usually have already incrementally assigned *the editor played the tape* a main clause structure before reaching that point, as evidenced by increased reading times over unambiguous overt relative clause controls like *The editor <u>who was</u> played the tape agreed the story was a big one* (e.g., Ferreira and Clifton, 1986, among many others). Sentences with these kinds of temporary structural ambiguities, for which the ultimately incorrect analysis is the initially most tempting, are often called *garden path* sentences (Bever, 1970), though the reasons for selecting a main clause analysis in structures like (19) continue to be hotly debated.

That the language processor actively predicts upcoming material has garnered much recent support (e.g., Kamide, 2008; DeLong et al., 2014; Staub, 2015, for review). Prediction appears to be an important part of language processing at a variety of levels: at the lexical level, in terms of predicting the syntactic category of an upcoming word (Wright and

Garrett, 1984), at the phrasal level (Staub and Clifton, 2006), and at the discourse level (Altmann et al., 1998; Altmann, 1999; Altmann and Kamide, 1999; Rohde et al., 2011). While there is still some debate about what *grain size* is relevant to prediction – i.e., whether the processor predicts specific word forms or particular syntactic parses, it is clear that it engages in a great deal of top-down processing, drawing from multiple sources of information when forming a representation, even if doing so occasionally comes at a cost (e.g., Chen et al., 2005; Van Petten and Luka, 2012).

The processing of coordination structures is highly relevant to both incremental and predictive processing, issues which we will now treat in turn. Much of what we know about how the language processing system handles coordination comes from processing temporarily ambiguous structures – e.g., garden path fragments like (20) which allow both a DP coordination continuation (20a) and an S (or IP) coordination continuation (20b).

(20) Jacob kissed Miriam and her sister . . .
   a. Jacob kissed [$_{DP}$ Miriam [$_{\&P}$ and [$_{DP}$ her sister . . .]]]
   b. [$_{S}$ [$_{S}$ Jacob kissed Miriam] [$_{\&P}$ and [$_{S}$ her sister . . .]]]

The essential finding is that continuations supporting S level coordination (20b) elicit an increased processing cost over DP level coordination (20a), a result which has replicated several times (e.g., Frazier, 1987; Hoeks et al., 2002; Engelhardt and Ferreira, 2010). However, the preference for DP conjuncts has been interpreted in multiple ways. In an influential account, Frazier (1987) proposed that the preference for DP over S coordination is a result of Minimal Attachment, *Do not postulate any potentially unnecessary nodes*, a general structural economy principle that allows the sentence parser to take the least complex structure available (a general architectural principle in Frazier's 1979 garden-path model). In essence, when the processor (or syntactic parser) is confronted with two or more available options in an ambiguous fragment, it must immediately choose between them. Assuming that the parser is generally motivated to avoid potentially taxing analyses unless necessary, it selects the simplest one, revising the analysis if required.

However, others have noted that the DP preference observed in reading is possibly confounded by the fact that DP coordination is more frequent in corpora than S coordination is (Desmet and Gibson, 2003; Gibson et al., 1996), though decisions in reading times appear not to follow corpus frequencies (Gibson and Schütze, 1999). In a corpus study of a Dutch newspaper, Hoeks et al. (2002) find a majority of DP coordinations in a coarse-grained analysis, where only category information is considered (61% DP coordination; 10% S coordination; 16% VP coordination). However, in a more fine-grained analysis, where the grammatical function was also considered, coordinated DPs appeared as grammatical objects only 6% of cases (7% S coordination; 16% VP coordination). Thus, depending on what types of frequency information are relevant, we would predict a preference for DP or VP coordination, if lexical and structural frequencies guide early processing decisions, as in constraint-based approaches (e.g., MacDonald et al., 1994; McRae et al., 1998), in which processing decisions are determined by satisfying a diverse set of weighted constraints in parallel.

Coordination has also been important, though less thoroughly explored, in establishing the role of prediction in syntactic processing. Staub and Clifton (2006) manipulated the presence of the word *either*, which strongly indicates that the disjunction *or* will soon follow (Frazier and Fodor, 1978). In addition to replicating the DP coordination preference for disjunctions without a preceding *either*, Staub and Clifton found that readers were faster to process the disjunct after *either*, which removed the penalty for the more complex S coordination when it took scope over an entire clause, as in *Either Linda bought the red car or her husband leased the green one*. On their account, *either* triggers the top-down expectation that a disjunction will follow, and readers use the location of *either* to form a hypothesis regarding the size of the disjunct (also Yoshida et al., 2014).

Finally, many studies have observed that processing coordination is facilitated if the two clauses share syntactic, semantic, or prosodic features (e.g., Henstra, 1996; Frazier et al., 1984, 2000; Carlson, 2002). Such parallelism, i.e., the shared syntactic, prosodic, or semantic properties between clauses, strongly influences how the processor interprets a coordinated constituent with a possible ellipsis analysis. Carlson (2001, 2002) found that ambiguous sentences like *Bill took chips to the party and Susan to the game* were preferentially resolved towards the non-gapping analysis (*Bill took Susan to the game*) instead of the larger and more complex gapping analysis (*Susan took chips to the game*). Carlson also found that the online bias towards simpler, non-gapped, structure was influenced, but not entirely overturned by semantic or prosodic similarity (see also Carlson et al., 2005, for related findings with PP preposing, and Yoshida et al., 2013, who show that the parallelism advantage for ellipsis is limited to environments in which an elided clause is licensed syntactically). In an ERP study, Kaan et al. (2004) compared gapping structures with an initially plausible coordination analysis, *Ron took the planks for the bookcase, and Bill the hammer with the big head*, against those with implausible ones, *Ron sanded the planks for the bookcase, and Bill the hammer with the big head*. They observed an N400 and P600 penalty for nouns, e.g., *hammer*, that were implausible with gapped verbs, e.g., *sanded*. The immediate penalty for implausible noun-verb combinations over controls suggests that gapped verbs are reconstructed from the previous clause as soon as possible. Overall, these studies support a model in which the processor posits an ellipsis analysis when required, though it prefers a simpler, non-elided structure when one is available, so that the structural preference is impacted by indicators of prosodic and pragmatic parallelism, as with coordination structures generally (Frazier et al., 2000).

The primary aim of the experiments below is to test the predictions of the two proposals for the syntax of *let alone* coordination introduced above: the ordinary coordination hypothesis (7) and the clausal ellipsis hypothesis (9). If the ordinary coordination hypothesis is correct, the research reviewed above would support an expectation for non-elided conjuncts over elided ones, and, further a DP continuation over a VP one, as the former represents the structurally simpler alternative. It therefore predicts that cases like (21) should exhibit a strong bias towards DP continuations (21a) over VP ones (21b). Alternatively, if the clausal ellipsis hypothesis is correct, the processor should not delay positing a clausal structure for ellipsis, and would thereby fail to show a structural preference for DPs and may well permit a bias towards VP continuation, as other, possibly pragmatic, factors may determine what type of constituent is expected (discussed further in Section 4).

(21) John doesn't like Mary, let alone ...
a. Sue.
b. love her.

A secondary manipulation was included in the studies below in order to test whether the presence of the focus sensitive operator *even* facilitates the computation of the scalar contrast implied by *let alone* coordination. The manipulation is especially important in the online reading study, as it will establish that the method was sufficiently sensitive to capture differences in the text. It also allows us to test whether readers use *even* to assign a focus structure to text in silent reading (as shown for *only* by Filik et al., 2009; Carlson, 2013). Specifically, if readers take *even* to mark narrow focus on the constituent it immediately dominates, as in Büring and Hartmann's (2001) Closeness Principle: *Focus particles adjoin as close to the focus as possible*, we expect that VP continuations would be more tempting. If, in contrast, readers preferentially use discourse and prosodic information to determine the scope of *even* (Harris and Carlson, 2014), it should facilitate processing of scalar contrast without affecting remnant preferences after *let alone*.

To foreshadow the central conclusions, the results show a bias towards VP, not NP, remnants, a pattern which broadly supports the clausal ellipsis hypothesis over the ordinary coordination hypothesis. However, the clausal ellipsis hypothesis does not itself predict a bias towards either NP or VP remnants, only that one is not more structurally complex than another. This naturally invites an explanation for why VP remnants should be preferred. While a detailed discussion is deferred until the conclusion, I will briefly note that the existing evidence indicates that discourse structure might be responsible. If *let alone* coordination is sensitive to the discourse, perhaps in the form of the Question Under Discussion (Roberts, 1996; Toosarvandani, 2010), language users might default to a global discourse strategy that minimizes unlikely or potentially unnecessary discourse commitments, at least without prior context. Ultimately, this means that, in the absence of supporting contexts, readers might avoid positing additional discourse referents, choose a remnant on the basis of a focus structure that corresponds to broadest implicit question, or use the surface form to infer what a specific discourse question might be, relying on indicators of implicit focus among other things. This general direction is supported by ongoing research (Harris and Carlson, 2014, 2015, in press). However, the central point of the present paper is to establish that the very tempting view of an ordinary coordination for *let* alone is unlikely in light of results from the experiments reported below.

2. Experiment 1

Three Internet questionnaires were conducted to test the preferences associated with *let alone* coordination, each involving a slightly different method or manipulation.

2.1. Experiment 1A: Sentence completion

The essential prediction distinguishing the ordinary coordination hypothesis from the clausal ellipsis hypothesis for *let alone* coordination was tested in a sentence completion task. Specifically, the ordinary coordination hypothesis predicts an overall preference for DP continuations whereas the clausal ellipsis hypothesis does not.

2.1.1. Methods

2.1.1.1. Items. Sixteen pairs of items like (21) were presented to subjects on Ibex Farm (Drummond, 2012), an Internet based presentation tool, and interspersed with 42 items from unrelated experiments, 16 non-experimental fillers, and 5 highly constraining catch items to identify inattentive subjects. Two conditions, varying the presence of preverbal *even*, were counterbalanced and presented in individually randomized order, so that each subject saw one and only one item (22a or 22b, but not both) from each pair. Items are presented in Appendix A (see Supplementary data).

2.1.1.2. Participants and procedure. Thirty-three subjects were recruited through Amazon Mechanical Turk (AMT), a web-based service that pays Internet users to complete short tasks online. Subjects were asked to self-identify their native language; only one subject was removed from analysis for identifying as a non-native English speaker. Prior to testing, subjects were required to interpret three semantically complex sentences designed to identify non-proficient speakers; no such individuals were observed. Further, no individuals were removed on the basis of their answers to highly constrained catch items randomly interspersed throughout the experimental items. However, 10 subjects were removed for counterbalancing purposes due to a coding error. Subjects were given $4 as compensation for participation, which lasted approximately 25 minutes on average.

Through a guided practice of 3 items, subjects were instructed to complete the sentence with the first natural sounding completion that came to mind, but were not otherwise constrained in their responses.

2.1.2. Results

Completions were annotated according to VP, DP, or Other categories. Responses were overwhelmingly of the VP or DP type. The Other responses accounted for less than 1% of the data and were removed from analysis. The prevalence of DP and VP remnants mirrors the distribution found in text (Harris and Carlson, in press). Means for Experiments 1A-C are presented in Table 1.

In contrast to the predictions of the ordinary coordination analysis, there was an overall bias towards VP completions (M = 64%, SE = 3), and conditions with preverbal *even* failed to elicit more VP continuations than conditions without *even* (d = 2%). A binomial test conducted in R (R Development Core Team, 2014) revealed that VP responses appeared more often than predicted by chance set at 50%, $p < 0.001$. In a by-items analysis, only 4 items from the set of 16 showed a reversal of VP-bias: 3 such fragments (items 2, 3, and 9 in the Appendix, see Supplementary data) showed an even 50% split between DP and VP responses, whereas a single fragment (item 13) displayed a 59% bias towards DP continuations. The remaining items were given a VP continuation more than half of the time.

The completion data permit a more fine-grained analysis of the responses by further categorizing their lexical content. In addition to the syntactic category of the continuation, responses may be categorized by the element in the matrix clause they contrasted with. Various patterns to VP responses to (22) were found: in 33% of cases, there was only a matrix verb contrast, as in *look at it*; in 42% of cases, only the matrix object contrasted, as in *read the footnotes*; in 24% of cases, there was both a verb and the an object contrast, as in *recall the title*. The predominance of the verb plus pronoun cases motivated the construction of the VP remnants in the experiments that follow, despite containing an additional pronoun, which may have added complexity to VP remnants. (This pattern is again supported by corpus studies, reported in Harris and Carlson, in press). The presence of *even* had no effect on whether the remnant contrasted with the verb, the object, or both. In all, subjects favored VP remnants that involved contrasting the remnant with the object (a combined 66% of total cases). As all DP remnant responses also contrasted the matrix object, there was a general preference for contrasting the

Table 1
Experiment 1: Mean percent DP and VP responses by condition.

Remnant	No operator	Even	Mean
Experiment 1A: Sentence completion			
DP	37%	35%	36%
VP	63%	65%	64%

Remnant	No operator	VP scope	DP scope	Mean
Experiment 1B: Forced choice completion				
DP	38%	39%	48%	42%
VP	62%	61%	52%	58%

Remnant	Neutral	Biased VP	Biased DP	Mean
Experiment 1C: Completion in context				
DP	34%	14%	58%	35%
VP	66%	86%	42%	65%

let alone remnant with the object, consistent with a default object focus of the matrix clause (Selkirk, 1984; Cinque, 1993), that was independent of syntactic preferences.[9] In addition, the presence of *even* did not affect implied contrasts.

2.1.3. Discussion

The bias towards VP continuations does not support the central prediction of the ordinary coordination hypothesis. Instead, the evidence is consistent with the clausal ellipsis hypothesis, in which *let alone* always signals a structure larger than DP in underlying syntax. Further, the presence of *even*, which was predicted to increase the proportion of VP continuations, had little to no effect on responses given, suggesting that the processor may not assign focus to the immediate right of *even*, at least in silent reading without additional contextual support.

2.2. Experiment 1B: Forced choice completion

It is possible that the results in Experiment 1A were driven by an independent preference to avoid introducing new referents unless required, opting to stay with discourse given entities (e.g., Arnold, 2008, and references therein). That is, DP continuations could have been penalized for reasons entirely orthogonal to the syntax of *let alone* coordination. Further, the presumed penalty for new referents could have been exaggerated by the nature of the task: subjects may have avoided DP continuations in order to avoid thinking up new nouns for themselves that would fit the limited discourse context, opting instead to construct an alternative for the verb along an ad hoc scale. The next experiment addresses this methodological concern by presenting the same sentences in a two-alternative forced choice task, where DP and VP continuations were given in sentence frames, so that subjects only had to choose between them. The manipulation used the most common type for VP remnant (verb followed by pronoun) and DP remnant (definite noun phrase, indefinite noun phrase, or proper name) observed in the completion study above.

We also test the influence of *even* further: if the specific placement of *even* does little to guide focus placement in silent reading, then *even* with narrow scope under the VP should have fail to determine which continuation subjects prefer as the second conjunct of *let alone* coordination.

2.2.1. Methods

2.2.1.1. Items. Experimental items were created from the 16 pairs in the previous experiment by adding another condition in which *even* appears directly before the matrix object (*the article*) for a total of 3 conditions: *No operator*, *VP scope*, and *DP scope.* In anticipation of Experiment 2, continuations (*before his class last week*) were added.

(23) Pat didn't ...
a. skim the article, let alone _______ before his class last week. (*No operator*)
b. even skim the article, let alone _______ before his class last week. (*VP scope*)
c. skim even the article, let alone _______ before his class last week. (*DP scope*)

(24) *Forced-choice options:*
i. the book
ii. read it

Items were presented with 60 other items from unrelated experiments, 20 non-experimental fillers, and 4 high probability fillers to identify uncooperative subjects as before. The forced-choice options in (24) were presented in individually randomized order, so that the answers appeared one above the other, as in the example above.

2.2.1.2. Participants and procedure. In a procedure nearly identical to Experiment 1A, 45 subjects were recruited through AMT. Twelve subjects were removed for either failing to answer each of the semantically complex questions correctly (3 subjects), or for giving incoherent responses to high probability catch items (9 subjects). An additional nine participants were removed for counterbalancing purposes, so that each item was presented an equal number of times, for a total of 24 subjects.

2.2.2. Results

As before, there was a bias towards VP continuations (M = 58%, SE = 3), which was significantly greater than chance set at 50% in a binomial test, $p < 0.001$. There was no difference between the percentage of VP continuations elicited in

[9] Thanks to Katy Carlson for categorizing the responses in the post hoc analysis, and for insightful comments regarding contrast in the remnant.

Table 2
Experiment 1: Logistic mixed effects regression models for Experiments 1B and 1C.

	Estimate	Std. error	Wald *Z*	*p*-estimate
Experiment 1B				
(Intercept)	−0.646	0.55	−1.176	0.24
DP scope	0.528	0.28	1.887	0.059
VP scope	−0.291	0.268	−1.084	0.278
Experiment 1C				
(Intercept)	1.179	0.611	1.928	0.054
DP-Biased	−1.867	0.486	−3.845	<0.001
VP-Biased	1.574	0.587	2.682	<0.01

the *No operator* ($M = 61\%$, $SE = 4$) and *VP scope* ($M = 62\%$, $SD = 4$) condition. The *DP scope* condition elicited numerically fewer VP responses ($M = 52\%$, $SD = 4$).

To determine whether the *DP scope* condition elicited significantly more DP continuations in comparison to the other two conditions, the data were subjected to a logistic linear mixed effects regression model (Jaeger, 2008) in R using the lme4 package (Bates and Maechler, 2009). The conditions were treated as fixed effect predictors with sum (also known as deviation) contrast coding, so that the deviation of each level was compared against the deviation of the *No operator* baseline from the grand mean. The model was given by-subject and by-item slopes and intercepts so that random effect structures were maximally specified for predictor variables (Barr et al., 2013). As shown in Table 2, there were no differences between the *No operator* and *VP scope* conditions, $z = 1.08$, but there were marginally fewer VP responses for the *DP scope* condition than the baseline, $z = -1.89$, $p = 0.06$, even though the narrow scope of *even* failed to overturn the bias generally.

2.2.3. Discussion

The results address the methodological concerns of the previous study in several ways. First, the findings confirm that *let alone* coordination shows no preference for, but instead a mild aversion to, DP continuations.[10] Second, the results reconfirm the limited impact of *even* observed in the previous experiment: although *even* appeared in a syntactically unambiguous position with respect to focus, it did not unambiguously determine a remnant preference in *let alone* coordination (even though a low scope position did reduce the bias).

2.3. Experiment 1C: Completion in context

In the final offline study, items from Experiment 1A were placed in contexts to determine whether the VP preference could be overridden by contextual cues, and, if so, to what extent. It further addresses the methodological question raised with respect to Experiment 1A: subjects may have hesitated to complete sentences with unmentioned DPs, thereby giving preference to VP continuations.

2.3.1. Methods

2.3.1.1. Items. Three types of contexts were created for each of the items in Experiment 1A: *Neutral*, *VP-Biasing*, and *DP-Biasing* (see Appendix B, see Supplementary data). The *DP-Biasing* contexts explicitly introduced nouns standing in natural contrast, as in *book* and *article*. Since the previous two studies failed to find a strong effect of *even* in completion preferences, all sentences contained *even* in *VP scope* position, as those were judged to be the most natural by the author. When a context introduced an individual, the name or description of the individual was referred to via a pronominal form in the target sentence to increase naturalness.

(25) *Context*
a. Patrick isn't a very good student. (*Neutral*)
b. Patrick is supposed to read the book for class ahead of time. (*VP-Bias*)
c. Patrick is supposed to look over the article and the book. (*DP-Bias*)

[10] Harris and Carlson (2014) report a follow up forced choice study using different materials tested the influence of the pronoun in fragments like *Simon couldn't remember the attack, let alone ...* Subjects again preferred VP remnants with pronouns *describe it* (47%) over DP remnants *the mugger* (36%). VP remnants with a full DP object *describe the mugger* were selected the least often (17%).

(26) *Target*
He didn't even skim the article, let alone _________________.

Items were randomly interspersed with 48 experimental items from two unrelated experiments and 24 non-experimental fillers, and 5 highly constrained catch items. Additionally, items were rated for naturalness with respect to their preceding contexts on a 7-point scale (7 = totally natural) in a separate norming experiment. Another thirty-six self-identified native speakers of English participated on AMT. Overall, naturalness was judged relatively high ($M = 5.86$), and there were no differences between the different contexts and the targets (the mean for each condition was within ± 0.02 points of the grand mean).

2.3.1.2. Participants and procedure. The procedure was the same as the Experiment 1A above, and was conducted with different subjects recruited on AMT. Of the forty subjects who participated, four were excluded for failing to provide coherent responses to any one of the highly constrained fillers, for a total of thirty-six subjects evenly distributed across lists of experimental conditions.

2.3.2. Results

As in Experiment 1A, responses were again coded for continuation type: DP, VP, or Other. The Other responses were very rare (<1%) and were discarded. As before, there was a general bias towards VP continuations ($M = 65\%$, $SE = 2$). The Neutral contexts replicated the previous findings in showing a similar bias towards VP continuations ($M = 66\%$, $SE = 3$). To determine whether the context influenced continuation preference, the data was modeled as a logistic linear mixed effect regression model with sum coding as described above, treating the *Neutral* condition as the baseline. The two biased conditions each showed an effect of context away from the baseline: *VP-Biasing* contexts elicited more VP continuations ($M = 86\%$, $SE = 3$), $z = 3.99$, $p < 0.001$, while *DP-Biasing* contexts elicited fewer VP continuations ($M = 42\%$, $SE = 4$), $z = -3.13$, $p < 0.001$, compared to *Neutral* contexts. Apparently, mentioning an additional object for contrast facilitated overturning the general VP bias, although the effects for *DP-Biasing* contexts are somewhat weaker than the *VP-Biasing* ones.

Examining the data by items revealed that one item (item 12) received all VP continuations in both of the biasing contexts. The *DP-Biasing* context for this item described an action (*carry the firearms*) that formed a highly salient contrast with the matrix verb *(hold a gun*) in the target, and, unlike the other contexts in this condition, did not mention objects for comparisons explicitly. The percentage of DP continuations after *DP-Biasing* contexts was increased to 62% when it was removed, again showing significantly fewer VP responses than the Neutral condition, $z = 3.85$, $p < 0.001$. The statistical model is provided in Table 2.

2.3.3. Discussion

The results suggest that remnant preference is sensitive to context generally, and that mentioning the objects explicitly facilitated the DP remnant continuation. However, the size of the effect was greater by approximately 20% for *VP-Biasing* contexts compared to *DP-Biasing* contexts. The difference could be attributed to a difference in quality of contexts, rather than an independent bias towards VP continuations, although it is unclear at this point precisely what property of the context could account for the difference. At any rate, there was a considerable bias towards VP continuations, a bias which would not be expected if *let alone* coordination was a flexible coordination operator. Rather, it seems that the results are most compatible with an account that coordinates syntactically more complex conjuncts, precluding the expectation for a simpler structure seen elsewhere with coordinate structures. It remains open whether the VP bias is based in syntactic or discourse preferences, as discussed in Section 4.

Each of the experimental tasks above involved some kind of choice – either sentence completion or selecting between alternatives – in order to establish a preference for remnant type. We now turn to an eye movement study of *let alone* coordination in silent reading to determine whether remnant type affected online sentence interpretation.

3. Experiment 2: Eye tracking study

The previous studies found a general bias favoring VP over DP continuations. The following experiment probed for a cost for remnant type in real-time sentence processing. If the preference for VP remnants represents processes specific to sentence completion or production, subjects might show different processing preferences in reading. On the one hand, if the focus particle *even* plays a role in anticipating upcoming structure through focus placement, its influence might be more readily apparent when examined online in eye movements (as was the case for *only* in Paterson et al., 2007). On other hand, if *even* generally facilitates processing a scalar contrast, without influencing the focus structure, its presence should result in a general facilitation after encountering the remnant region, without affecting remnant types differently.

3.1. Methods

3.1.1. Items

The sixteen items from Experiment 1A above were completed with one of the two alternatives provided in Experiment 1B, e.g., *the book* or *read it*, corresponding to a DP or a VP remnant, respectively, whose forms were selected on the basis of occurring the most frequently in the completion studies. As in Experiment 1A, the presence of a preverbal *even* was manipulated, making for a crossed 2 × 2 design between Remnant type (DP vs. VP) and Presence of *even* (Even vs. No-Even), as in (27) below. By-character length of DP remnants (M = 11.06 characters, SE = 0.51) and VP remnants (M = 10.25 characters, SE = 0.27) were matched prior to testing in a paired t-test, $t(15)$ = 1.54. Simple comprehension questions (28) were presented immediately following half of the items to encourage careful reading, but were not examined in later data analysis. Items were interspersed with 70 items from unrelated experiments, 20 non-experimental fillers, and 7 practice items. Items were presented in an individually randomized order, counterbalanced in Latin Square design.

(27) $|_1$ Pat didn't $|_2$ (even) skim the article, $|_3$ let alone (Presence of *even*)
a. the book, $|_4$ before his class $|_5$ last week. (DP remnant)
b. read it, $|_4$ before his class $|_5$ last week. (VP remnant)

(28) Was Pat completely prepared for class?
a. Yes
b. No

As an observed by an anonymous reviewer, there were important differences between the remnant types besides the factor of syntactic category. The VP remnant always contained a pronoun, whereas the DP remnant did not. Although these forms were common in completion, they do present additional variables, such as establishing a referential dependency between the pronoun and its antecedent. Such factors must be considered in future studies as much as possible. How the differences between conditions may have affected online processing in terms of eye movements is discussed extensively below. Nevertheless, these differences had no discernable effect on ease of interpretation offline. In a separate norming study, twenty-eight subjects recruited from AMT rated the sentences for ease of comprehension on a 7-point Likert scale (*How easy is this sentence to understand?* with 1 marked as *very easy*). On the whole, items were rated as easily comprehensible (M = 2.37), with less than ±0.2 difference for any condition, and no significant differences in comprehensibility for any condition (DP No-Even: M = 2.24, SE = 0.18; DP Even: M = 2.13, SE = 0.16; VP No-Even: M = 2.44, SE = 0.18, VP Even: M = 2.29, SE = 0.16).

3.1.2. Participants and procedure

Thirty-six native speakers of English who were associated with the Claremont Colleges participated. The experiment took approximately 40 minutes, for which subjects were compensated $10. Items were presented with EyeTrack, the UMass Amherst presentation software (http://www.psych.umass.edu/eyelab/) on a 19'' Mitsubishi Diamond Pro 900u flat-screen CRT monitor with a refresh rate set to 170 Hz. The computer was a Dell Optiplex tower running Windows 7, with the Internet and peripheral programs closed. Eye movements were recorded using an SR Research Eyelink 1000 eye tracker mounted on the table approximately 50 cm away from the monitor in a sound isolated room. Text was presented in black 11pt monospaced font against a white background, so that 3 characters subtended approximately 1 degree of visual angle. Sampling rate was set to 1000 Hz. Subjects were encouraged to take a break between trials; a drift correct was performed between each trial.

3.2. Results

Using the UMass software EyeDoctor, long (over 800 ms) and short (under 80 ms) fixations were removed, as were blinks and track losses, prior to analysis. Trials in which a blink or a long fixation appeared on first entering the remnant region were removed (Rayner, 1998). Standard measures in eye movement studies were collected for each region using the UMass EyeDry software. Measures included *first fixation duration*, the time of the fixation upon first entering a region; *first pass time* (also known as *gaze duration*), the sum of all first fixation durations within a region; *go past time*, the time spent after first entering a region to first moving past the region to the right; *percentage of regressions out* of and *percentage of regressions into* a region; *second pass time*, the time spent re-reading a region once the region has been exited to the right including zero times indicating failure to re-read; and *total time*, the sum of all fixation times in a region during any point in reading (see, e.g., Staub and Rayner, 2007, for a concise review of these measures). Means and standard errors for these measures are presented in Table 3. Note that even though the remnant region was matched

Table 3
Experiment 2. Mean and standard errors for all regions.

	Region 1 Subject	Region 2 Verb	Region 3 Let alone and remnant	Region 4 Spill over	Region 5 Final
First fixation durations					
DP No-Even	180 (5)	214 (6)	248 (8)	230 (8)	229 (7)
DP Even	199 (5)	222 (6)	228 (6)	220 (6)	232 (6)
VP No-Even	201 (7)	206 (6)	223 (6)	220 (7)	237 (7)
VP Even	196 (7)	230 (7)	235 (6)	216 (6)	239 (9)
First pass times					
DP No-Even	331 (15)	388 (21)	561 (20)	380 (19)	504 (27)
DP Even	331 (14)	545 (25)	511 (16)	382 (20)	449 (24)
VP No-Even	372 (20)	349 (17)	580 (19)	353 (14)	478 (24)
VP Even	370 (19)	552 (23)	533 (18)	351 (17)	486 (25)
Go past times					
DP No-Even	351 (25)	556 (28)	610 (25)	404 (22)	1281 (84)
DP Even	348 (22)	747 (26)	542 (19)	405 (23)	1094 (71)
VP No-Even	372 (20)	579 (32)	619 (24)	410 (21)	1184 (87)
VP Even	370 (19)	733 (31)	563 (20)	381 (24)	1173 (77)
Regressions out					
DP No-Even	NA	29% (4)	7% (2)	3% (2)	61% (4)
DP Even	NA	33% (4)	5% (2)	3% (2)	54% (4)
VP No-Even	NA	39% (4)	6% (2)	7% (2)	50% (4)
VP Even	NA	23% (4)	4% (2)	4% (2)	54% (4)
Regressions in					
DP No-Even	63% (5)	25% (4)	13% (3)	46% (4)	NA
DP Even	63% (5)	23% (4)	11% (3)	41% (4)	NA
VP No-Even	69% (4)	18% (3)	17% (3)	38% (4)	NA
VP Even	51% (5)	20% (3)	9% (2)	45% (4)	NA
Second pass times					
DP No-Even	195 (23)	169 (25)	183 (29)	190 (21)	NA
DP Even	159 (20)	167 (26)	117 (19)	165 (19)	NA
VP No-Even	256 (27)	149 (24)	173 (27)	192 (24)	NA
VP Even	183 (27)	188 (28)	151 (27)	173 (20)	NA
Total times					
DP No-Even	489 (32)	633 (35)	766 (35)	548 (26)	716 (30)
DP Even	461 (31)	833 (36)	642 (25)	538 (23)	639 (29)
VP No-Even	552 (30)	592 (34)	763 (36)	554 (26)	714 (33)
VP Even	497 (33)	831 (36)	703 (34)	512 (27)	722 (32)

for length across conditions, the DP and VP remnants present different words that may well vary in terms of complexity in that region.

All measures were modeled as linear mixed effects regressions with Remnant type, the Presence of *even*, and their interaction as fixed effect predictors. All models, except for regression in and out measures, were given maximal random effect structures. As the logistic regression models with maximal random effect terms typically failed to converge for the analysis of regressive eye movements, simpler random intercept models were used instead. Predictors in all models were given sum (deviation) contrast coding. As there is currently no consensus on how to best compute *p*-values in such models for continuous distributions, *t*-values whose absolute value is above 2 are considered statistically significant, although estimates of the *p*-value computed by the *memisc* package in R (Elff, 2013) are provided in the statistical tables for linear regression models. The logistic regression models of the categorical regression data are shown with *p*-values from lme4. Only the target region, which contained the *let alone* coordinator and the remnant, and the regions that followed it are presented for first fixation, first pass, and go past measures, as earlier regions are not of theoretical interest for these measures.

First fixation durations showed no effects on regions of interest and are omitted here. First pass times showed a main effect of the focus particle on the target remnant region: items following *even* (M = 522 ms, SE = 12) elicited shorter first pass times than those which did not follow *even* (M = 577 ms, SE = 14), t = 2.94. The spillover region showed a weak trend for a 29 ms penalty for DP remnants, t = 1.70. No other effects for first pass times were observed.

Table 4
Experiment 2: Linear mixed effects regression models for first pass and go past times fit with maximal random error structures.

		Estimate	Std. Error	*t*-value	*p*-value
First pass times					
Region 3 (Remnant)	(Intercept)	546.572	22.671	24.108	<0.001
	Remnant type	12.127	12.087	1.003	0.316
	Particle	24.119	8.194	2.943	<0.01
	Remnant type × Particle	0.247	8.222	0.03	0.976
Region 4 (Spill over)	(Intercept)	358.963	26.592	13.499	<0.001
	Remnant type	−14.183	8.339	−1.701	0.089
	Particle	9.572	8.029	1.192	0.233
	Remnant type × Particle	−2.952	9.151	−0.323	0.747
Region 5 (Final)	(Intercept)	477.217	27.364	17.439	<0.001
	Remnant type	6.277	11.24	0.558	0.577
	Particle	11.545	13.266	0.87	0.384
	Remnant type × Particle	−14.626	15.009	−0.974	0.33
Go past times					
Region 3 (Remnant)	(Intercept)	583.838	25.319	23.059	<0.001
	Remnant type	8.417	13.764	0.612	0.541
	Particle	32.507	10.91	2.979	<0.01
	Remnant type × Particle	−1.051	10.847	−0.097	0.923
Region 4 (Spill over)	(Intercept)	393.478	32.961	11.938	<0.001
	Remnant type	−1.466	14.162	−0.104	0.918
	Particle	18.03	10.257	1.758	0.079
	Remnant type × Particle	3.438	14.531	0.237	0.813
Region 5 (Final)	(Intercept)	1192.409	90.656	13.153	<0.001
	Remnant type	−14.946	36.586	−0.409	0.683
	Particle	55.352	41.474	1.335	0.182
	Remnant type × Particle	−46.355	44.299	−1.046	0.295

The advantage imparted by *even* on the target remnant region appeared in the go past measure, as well. Items following *even* were associated with shorter go past times (M = 553 ms, SE = 14) than those without the focus particle (M = 615 ms, SE = 18), t = 2.98, an advantage which manifested as a trend in the spillover region favoring *even* (M = 393, SE = 17) compared to items without *even* (M = 407 ms, SE = 15), t = 1.76. See Table 4 for models of first pass and go past data.

Further evidence for facilitation from *even* can be observed in measures involving re-reading. In second pass times, subjects spent less time in Region 1 when *even* was present in the following region (M = 174 ms, SE = 17) than when it was not (M = 226 ms, SE = 18), t = 2.58, manifesting as a non-significant 40 ms advantage on the remnant, t = 1.73. In total times, items with *even* (M = 673 ms, SE = 21) were read faster than those without it (M = 765 ms, SE = 25) on the remnant, t = 3.07, an effect which appeared again as a 34 ms trend in the following spillover region, t = 1.92 (Table 5).

Although no significant effects were observed for regressions out of any region of interest, the presence of *even* was associated with marginally fewer regressions into the sentence initial region, Region 1 (M = 57%, SE = 4), than without (M = 66%, SE = 3), z = 1.81, p = 0.07. Additionally, *even* reduced the percentage of regressions into the region for VP remnants (d = 18%), but not DP remnants (d = 0%), $t = -2.11$, $p < 0.05$. No other effects for regressions were observed (Table 6).

It would seem that the sole consistent effect observed was a general facilitation conferred by *even* throughout the sentence. However, when we further subdivide the target region, splitting apart the *let alone* coordinator from the remnant, we see evidence for an interesting tradeoff in processing, which may be due in part to the presence of a pronoun in the VP remnant. Means and standard errors for the coordination and the remnant in all measures are presented in Table 7; statistical models, with the same parameters above except with length as an additional covariate in the remnant region, are presented in Tables 8 and 9 for durational and regression data, respectively.

Analysis of first fixation measures reveals an interaction between remnant type and the presence of *even* on both the coordinator and the remnant. On the coordinator, the presence of *even* reduced first fixation durations for the DP remnant by 21 ms, but increased first fixation times for VP remnants by 13 ms, $t = -2.21$. Given that there are no linguistic differences between conditions in the coordinator region, as it consisted simply of the coordinator *let alone*, the interaction suggests that readers were able to identify the remnant type in parafoveal preview, i.e., the area outside of foveal vision in which visual information is available at degraded acuity (see Rayner et al., 2012, for review). This interpretation is

Table 5
Experiment 2: Linear mixed effects regression models for second pass and total reading times fit with maximal random error structures.

		Estimate	Std. Error	*t*-value	*p*-estimate
Second pass					
Region 1 (Subject)	(Intercept)	200.407	22.915	8.746	<0.001
	Remnant type	19.71	11.665	1.69	0.091
	Particle	28.654	11.099	2.582	<0.05
	Remnant type × Particle	6.703	14.5	0.462	0.644
Region 2 (Verb)	(Intercept)	168.25	26.796	6.279	<0.001
	Remnant type	−1.424	13.277	−0.107	0.915
	Particle	−7.363	12.499	−0.589	0.556
	Remnant type × Particle	−11.448	11.712	−0.977	0.328
Region 3 (Remnant)	(Intercept)	156.587	26.39	5.934	<0.001
	Remnant type	3.805	15.049	0.253	0.8
	Particle	23.818	13.795	1.727	0.084
	Remnant type × Particle	−13.784	11.965	−1.152	0.249
Region 4 (Spill over)	(Intercept)	184.52	19.972	9.239	<0.001
	Remnant type	0.054	13.398	0.004	0.997
	Particle	12.704	10.835	1.172	0.241
	Remnant type × Particle	3.285	14.041	0.234	0.815
Total times					
Region 1 (Subject)	(Intercept)	505.073	37.669	13.408	<0.001
	Remnant type	23.652	13.67	1.73	0.084
	Particle	18.009	16.65	1.082	0.279
	Remnant type × Particle	3.867	17.576	0.22	0.826
Region 2 (Verb)	(Intercept)	723.092	42.851	16.875	<0.001
	Remnant type	−10.602	16.58	−0.639	0.523
	Particle	−108.312	17.285	−6.266	<0.001
	Remnant type × Particle	−7.083	16.46	−0.43	0.667
Region 3 (Remnant)	(Intercept)	720.081	37.192	19.361	<0.001
	Remnant type	13.492	18.756	0.719	0.472
	Particle	49.175	16.001	3.073	<0.01
	Remnant type × Particle	−18.286	17.327	−1.055	0.291
Region 4 (Spill over)	(Intercept)	537.569	34.66	15.51	<0.001
	Remnant type	−8.108	12.754	−0.636	0.525
	Particle	22.203	11.59	1.916	0.055
	Remnant type × Particle	7.561	13.139	0.575	0.565
Region 5 (Final)	(Intercept)	697.543	42.133	16.556	<0.001
	Remnant type	19.951	14.712	1.356	0.175
	Particle	12.768	15.201	0.84	0.401
	Remnant type × Particle	−18.924	15.009	−1.261	0.207

supported by the fact that DP remnants were initiated by short, and highly frequent function words like *a* and *the*, which are known to be readily identified within preview (e.g., Koriat and Greenberg, 1994; Rayner et al., 2011), and might even be skipped over automatically (Angele and Rayner, 2013). First fixation times on the remnant, however, revealed the opposite interaction: there was a 29 ms penalty for VP remnants over DP ones, which was reduced to 1 ms in the presence of *even*, $t = 2.14$. There was also a non-significant general cost for VP remnants ($M = 227$ ms, SE = 5) compared to DP remnants ($M = 213$ ms, $SE = 4$), $t = 1.71$, in this region. A similar pattern holds in first pass measures on the remnant: VP remnants ($M = 280$ ms, $SE = 8$) elicited non-significantly longer first pass times than DP remnants ($M = 251$ ms, $SE = 7$) did, $t = 1.98$. There was an additional non-significant trend towards an interaction, as before: whereas *even* facilitated processing for VP remnants ($d = 20$ ms), it had no effect on DP remnants ($d = 0$ ms), $t = 1.80$.

While VP remnants seemed to elicit increased fixation times, they showed a benefit in terms of the percentage of regressions. Indeed, there were nearly twice as many regressions out of DP remnants ($M = 23\%$, $SE = 2$) as VP remnants ($M = 12\%$, $SE = 3$), $z = 2.78$, $p < 0.01$, as well as more regressions into the *let alone* region when preceding DP remnants ($M = 27\%$, $SE = 1$) than when preceding VP remnants ($M = 24\%$, $SE = 1$), $z = 2.56$, $p < 0.05$.

We find an interesting and complex pattern once we further divide the first pass data into trials in which readers made regressions from those in which they did not (see Altmann et al., 1992, for an introduction to regression contingent

Table 6
Experiment 2: Logistic linear mixed effects regressions models fit with random intercepts for regression data.

		Estimate	Std. Error	Wald Z	p-estimate
Regressions out					
Region 2 (Verb)	(Intercept)	−0.957	0.177	−5.404	<0.001
	Remnant type	−0.016	0.101	−0.157	0.875
	Particle	0.195	0.103	1.883	0.06
	Remnant type × Particle	0.267	0.111	2.417	<0.05
Region 3 (Remnant)	(Intercept)	−3.778	0.31	−12.186	<0.001
	Remnant type	0.07	0.318	0.222	0.825
	Particle	−0.064	0.282	−0.228	0.82
	Remnant type × Particle	−0.276	0.25	−1.105	0.269
Region 4 (Spill over)	(Intercept)	−3.968	0.401	−9.907	<0.001
	Remnant type	0.298	0.257	1.16	0.246
	Particle	0.244	0.262	0.93	0.352
	Remnant type × Particle	0.168	0.257	0.654	0.513
Region 5 (Final)	(Intercept)	0.266	0.252	1.059	0.29
	Remnant type	−0.148	0.103	−1.43	0.153
	Particle	0.003	0.124	0.024	0.981
	Remnant type × Particle	−0.077	0.12	−0.64	0.522
Regressions in					
Region 1 (Subject)	(Intercept)	0.666	0.237	2.809	<0.01
	Remnant type	−0.103	0.122	−0.839	0.401
	Particle	0.182	0.128	1.42	0.155
	Remnant type × Particle	0.244	0.116	2.106	<0.05
Region 2 (Verb)	(Intercept)	−1.704	0.242	−7.031	<0.001
	Remnant type	−0.16	0.116	−1.371	0.17
	Particle	−0.107	0.13	−0.829	0.407
	Remnant type × Particle	−0.212	0.125	−1.689	0.091
Region 3 (Remnant)	(Intercept)	−2.533	0.268	−9.47	<0.001
	Remnant type	0.09	0.198	0.455	0.649
	Particle	0.604	0.173	3.494	<0.001
	Remnant type × Particle	−0.003	0.19	−0.015	0.988
Region 4 (Spill over)	(Intercept)	−0.394	0.26	−1.515	0.13
	Remnant type	−0.072	0.098	−0.735	0.463
	Particle	−0.061	0.103	−0.587	0.557
	Remnant type × Particle	−0.179	0.14	−1.285	0.199

analysis, and Rayner and Sereno, 1994, for questions regarding its interpretation). In trials in which the reader regressed out of the region, eye movements elicited the opposite pattern to simple first pass times. On the *let alone* region, first pass times were reduced following *even* for DP remnants (d = 82) but were increased for VP remnants (d = 99), t = −3.37. On the following region, VP remnants (M = 243, SE = 19) elicited longer first pass times than DP remnants (M = 202 ms, SE = 9), t = 2.02. However, on trials with regressions out of the region, we see the reverse pattern on the coordinator: there was a non-significant advantage for conditions with VP remnants (M = 294 ms, SE = 8) over those with DP remnants (M = 317 ms, SE = 9), t = 1.79, but no effects on the actual remnant.

Taking the regression contingent analysis of first pass times together with the pattern of regressions for these two regions, it seems likely that the different processing patterns associated with the different remnant types can be attributed to two factors. First, readers were able to better identify, or at least begin to process, the DP remnant from the preceding region, thereby eliciting longer reading times for DP remnants on the coordinator. Beginning processing of DP remnants earlier may have permitted shorter reading times on the remnant region itself, such that earlier identification of the remnant type could have prompted more regressions out of the region. In contrast, pre-processing the VP remnant from the coordinator region would be perhaps less successful, given that such remnants began with a content word, requiring readers to spend more time in this region. Second, readers may have dwelled longer on VP remnants to resolve the referent for the anaphoric element, consistent with the finding that pronouns sometimes inflate reading times at first encounter, subject to distance (e.g., Ehrlich and Rayner, 1983), lexical frequency (e.g., Van Gompel and Majid, 2004), and semantic compatibility of the antecedent (Albrecht and Clifton, 1998; Moxey et al., 2004).

Table 7
Experiment 2: Means and standard errors for the coordinator and remnant separated out from Region 3.

	First fixation durations		First pass times		Go past times	
	Let alone	Remnant	Let alone	Remnant	Let alone	Remnant
DP No-Even	253 (8)	202 (5)	319 (12)	237 (10)	350 (21)	333 (19)
DP Even	232 (7)	224 (6)	294 (11)	265 (10)	306 (12)	335 (20)
VP No-Even	223 (6)	231 (7)	290 (12)	289 (12)	305 (14)	359 (24)
VP Even	236 (7)	223 (6)	296 (10)	271 (10)	309 (12)	307 (14)
	First pass with regressions		First pass times without regressions		Second pass times	
	Let alone	Remnant	Let alone	Remnant	Let alone	Remnant
DP No-Even	262 (23)	197 (12)	332 (13)	252 (13)	151 (22)	82 (14)
DP Even	180 (10)	208 (13)	303 (11)	279 (12)	108 (15)	48 (9)
VP No-Even	229 (24)	215 (35)	396 (12)	293 (12)	126 (21)	81 (13)
VP Even	297 (37)	231 (18)	381 (10)	277 (11)	103 (18)	68 (12)
	Percent regressions out		Percent regressions in		Total times	
	Let alone	Remnant	Let alone	Remnant	Let alone	Remnant
DP No-Even	20% (2)	44% (4)	31% (4)	8% (2)	455 (26)	312 (18)
DP Even	21% (2)	40% (4)	27% (4)	4% (2)	356 (17)	286 (17)
VP No-Even	17% (1)	32% (3)	20% (3)	10% (3)	403 (23)	360 (20)
VP Even	17% (2)	34% (3)	20% (4)	6% (2)	383 (22)	320 (18)

Turning to later processing measures on the coordinator region, we find a total time benefit for items with *even* (M = 369 ms, SE = 17) compared to their counterparts (M = 428 ms, SE = 14), t = 2.65, and a marginal interaction in which *even* reduced reading times for DP remnant conditions (d = 99 ms) more than VP remnant conditions (d = 20 ms), t = −1.99. On the remnant itself, there was also a marginal benefit for items with *even* (M = 303 ms, SE = 14) compared to items without (M = 337 ms, SE = 13), t = 1.93. No effects were observed in any other measure.

3.3. Discussion

The results indicate that VP and DP remnants each elicited a different sort of processing cost in the eye movements record, suggestive of a processing tradeoff rather than a categorical penalty for a particular remnant type. One possible explanation would attribute the different processing patterns to the unique demands imposed by the two structures. VP remnants always contained a pronominal element referring back to the matrix object, whereas DP remnants provided a noun that contrasted with the matrix object. The tendency to linger on VP remnants may indicate a cost for encoding the referential dependency, whereas the inclination to regress out of a DP remnant into the matrix VP region may indicate that the processor needs to recover the elided verb to establish the appropriate scalar relation, e.g., *skim* above, prompting more regressions to the matrix verb. As a reviewer notes, differences between remnant types could be obscured by the fact that the DP remnant introduced a novel noun into the discourse. This is indeed a concern, given the results of Experiment 1C, which showed that DP remnants were selected more often in contexts where both the correlate and remnant were introduced. Yet it is unclear whether DP remnants were necessarily more taxing on the discourse, as VP remnants also introduced a new action or state, along with a referential dependency with the preceding clause. Given the apparent tradeoffs between remnant types observed for different eye movement measures, it is crucial to dissociate the effects of remnant type on processing from the independent demands of the elements contained therein. Notably, the tradeoff does not support the predictions made by the ordinary coordination hypothesis, in that VP remnants were not categorically harder to process than DP ones, though it is admittedly difficult to assess the role of structural complexity without controlling for additional factors related to information structure, including, as in our case, the impact of establishing referential dependencies.

In addition, it seems that the general effect of *even* was to facilitate processing scalar contrast, particularly in measures of re-reading, rather than to guide initial expectations of upcoming contrast through focus placement. Such an effect is consistent with previous findings that the processor may differentiate between different types of focus sensitive particles in terms of focus placement during silent reading (Filik et al., 2009).

An anonymous reviewer raised the important concern that the differences in the DP and VP remnant conditions would sufficiently confound the conclusions. As mentioned, the content of the remnant structures was selected on the basis of

Table 8
Experiment 2. Linear mixed effect regression models with maximal random effect structures on the coordinator and remnant regions. The model for the remnant region had an additional covariate of region length to adjust for differences between conditions.

		Estimate	Std. Error	*t*-value	*p*-estimate
First fixation					
Let alone	(Intercept)	236.406	4.994	47.342	<0.001
	Remnant type	−6.513	4.707	−1.384	0.166
	Particle	2.511	4.271	0.588	0.557
	Remnant type × Particle	−9.218	4.164	−2.214	<0.05
Remnant	(Intercept)	219.924	24.346	9.033	<0.001
	Remnant type	6.314	3.692	1.71	0.087
	Particle	−3.861	3.078	−1.254	0.21
	Length	−0.005	2.238	−0.002	0.998
	Remnant type × Particle	7.16	3.352	2.136	<0.05
First pass time					
Let alone	(Intercept)	298.844	10.568	28.277	<0.001
	Remnant type	−7.358	6.038	−1.219	0.223
	Particle	6.525	5.574	1.171	0.242
	Remnant type × Particle	−7.993	6.805	−1.175	0.24
Remnant	(Intercept)	226.412	49.983	4.53	<0.001
	Remnant type	15.057	7.596	1.982	<0.05
	Particle	−2.754	5.273	−0.522	0.601
	Length	3.386	4.596	0.737	0.461
	Remnant type × Particle	10.143	5.641	1.798	0.072
First pass time in trials with regressions					
Let alone	(Intercept)	244.388	17.932	13.628	<0.001
	Remnant type	24.324	14.517	1.676	0.094
	Particle	−7.581	14.758	−0.514	0.607
	Remnant type × Particle	−47.41	14.065	−3.371	<0.01
Remnant	(Intercept)	244.111	44.352	5.504	<0.001
	Remnant type	20.365	10.067	2.023	0.043
	Particle	4.124	11.146	0.37	0.711
	Length	−2.002	3.967	−0.505	0.614
	Remnant type × Particle	12.433	14.235	0.873	0.382
First pass time in trials without regressions					
Let alone	(Intercept)	307.422	11.699	26.278	<0.001
	Remnant type	−11.976	6.697	−1.788	0.074
	Particle	9.572	6.39	1.498	0.134
	Remnant type × Particle	−6.915	7.316	−0.945	0.345
Remnant	(Intercept)	196.948	56.108	3.51	<0.001
	Remnant type	10.189	8.688	1.173	0.241
	Particle	−3.001	5.6	−0.536	0.592
	Length	7.143	5.187	1.377	0.169
	Remnant type × Particle	9.862	7.092	1.39	0.164
Total times					
Let alone	(Intercept)	402.432	26.361	15.266	<0.001
	Remnant type	−7.719	10.553	−0.731	0.465
	Particle	34.621	13.055	2.652	<0.01
	Remnant type × Particle	−22.476	11.321	−1.985	<0.05
Remnant	(Intercept)	218.631	84.062	2.601	<0.01
	Remnant type	24.414	13.699	1.782	0.075
	Particle	16.472	8.525	1.932	0.053
	Length	9.456	7.675	1.232	0.218
	Remnant type × Particle	2.626	9.235	0.284	0.776

Table 9
Logistic linear mixed effect regression models with maximal random effect structures on the coordinator and remnant regions. The model for the remnant region had an additional covariate of region length to adjust for differences between conditions.

		Estimate	Std. Error	*t*-value	*p*-estimate
Regressions out					
Let alone	(Intercept)	−3.686	0.329	−11.19	<0.001
	Remnant type	−0.17	0.267	−0.639	0.523
	Particle	−0.02	0.266	−0.074	0.941
	Remnant type × Particle	0.01	0.266	0.039	0.969
Remnant	(Intercept)	−3.313	1.158	−2.862	<0.01
	Remnant type	−0.411	0.148	−2.783	<0.01
	Particle	0.074	0.139	0.529	0.597
	Length	0.116	0.104	1.115	0.265
	Remnant type × Particle	−0.151	0.14	−1.08	0.28
Regressions in					
Let alone	(Intercept)	−1.411	0.229	−6.153	<0.001
	Remnant type	−0.278	0.109	−2.559	<0.05
	Particle	0.091	0.111	0.823	0.41
	Remnant type × Particle	−0.058	0.111	−0.519	0.604
Remnant	(Intercept)	−1.865	1.402	−1.33	0.184
	Remnant type	0.13	0.197	0.661	0.509
	Particle	0.31	0.192	1.616	0.106
	Length	−0.091	0.131	−0.692	0.489
	Remnant type × Particle	−0.022	0.193	−0.113	0.91

the results from previous sentence completion and forced-choice tasks. Ideally, the remnants would contain the same number and type of anaphoric elements, as in *The professor won't read a long essay, let alone write one/a short one*. While it is important to match properties of the remnant as much as possible, the presence of a contrastive adjective like *long* might well introduce a bias towards a DP remnant with another contrastive adjective. Harris and Carlson (in press) find that which noun is understood as correlate to the remnant can be modulated by contrasts established by the presence of an adjective, e.g., *The (nicest) nurse didn't like the (nicest) patient, let alone the meanest one*, as well by questions in previous context. Yet, in the experiment above, a processing tradeoff, rather than a categorical penalty, was found for remnants of different types. Although the patterns were entirely consistent with existing literature, how differences within the remnant affect the processing of *let alone* can certainly be explored much further.

As suggested by a reviewer, it might be fruitful to compare processing of the *let alone* construction to ordinary coordination as a control. However, it is challenging to find cases that truly match: *John didn't like Mary and love her*, seems, at best, pragmatically odd, if not outright infelicitous. One possibility would be to use a scalar element with disjunction, as in *or even*, to paraphrase the scalar effects of *let alone.* And yet, the order of conjuncts would have to be reversed to keep the scalar relation the same, as in *John didn't love Mary, or even like her*, precluding it as an appropriate control. What's more, I've argued that clause-final *let alone* always elides its second conjunct. If the argument is correct, providing a true non-elided control after *let alone* is simply not possible.

Finally, it is important to acknowledge that the items in the above eye tracking experiment were presented without the benefit of preceding context. The lack of context is especially important as Experiment 1C suggests that the offline bias against DP remnants could be manipulated by preceding discourse. A pilot self-paced reading study using materials from Experiment 1C showed no different between VP and DP remnants in supporting contexts, and ongoing studies have confirmed that context has a powerful impact on remnant preferences in *let alone* coordination. Nevertheless, this very important issue must be left as an avenue for future research.

4. Conclusions

Two sets of experiments, consisting of three related sentence completion questionnaires and an experiment recording eye movements in silent reading, tested for a preference for conjunct type in *let alone* coordination. Two hypotheses regarding the structure of *let alone* coordination were considered: the ordinary coordination hypothesis and the clausal ellipsis hypothesis. No evidence was found in support of the former, which would favor a DP remnant as the simplest structure. Instead, a VP conjunct was found to be preferred, a finding entirely compatible with the clausal ellipsis hypothesis, which assigns a more complex ellipsis structure following a *let alone* coordinator (Hulsey, 2008; Toosarvandani, 2010). Provided that the processor fails to entertain a simpler non-ellipsis structure following *let alone* (19), the lack of a penalty for VP continuations may be straightforwardly explained by an ellipsis analysis: structures with a VP remnant are, in fact, not more complex than those with a DP remnant. Further, the VP bias was not modulated by the presence of pre-verbal *even*, in either offline or online measures, suggesting that the processor does not use *even* to generate expectations regarding focus placement in silent reading, in contrast to *only* (e.g., Paterson et al., 2007; Carlson, 2013).

It should be noted, however, that the clausal ellipsis hypothesis does not, by itself, predict a preference for VP over DP remnants. There are multiple post hoc explanations that might account for the bias we observed. First, the processor might simply prefer elided structures that share as little as possible with their correlate. Such an account, however, is clearly a non-starter for our data, as it would predict a preponderance of conjuncts with multiple remnants, as in *Pat didn't read the book, let alone Phil the article.* Instead, a bias towards simple VPs was observed in free completion paradigms, with almost no examples of multiple remnants.

Second, we might imagine that *let alone* is, in some important respects, a unique construction (Fillmore et al., 1988), whose default conjunct preference is determined by frequency, not by general principles of sentence parsing. While constructional frequency has been argued to impact disambiguation of, for example, attachment ambiguities (as in the *tuning hypothesis* of Mitchell and Cuetos, 1991; Mitchell, 1994; see also Hoeks et al., 2006, for discussion), a categorical preference for VP conjuncts would be expected to have uniform effects in production and comprehension. However, the preference for VP remnants in offline studies contrasts with the eye movement results: there was no evidence that DP or VP continuations elicited a categorical processing difficulty over the other type. Worse, Harris and Carlson (in press) find a bias towards DP remnants in speech and text in both British and American English corpora.

Another possibility rests on the idea that the determination of remnant type involves a conflict between default cues that indicate syntactic scope from those that indicate semantic contrast. The syntactic scope of the remnant is in principle distinct from the semantic contrast that feeds the scalar relation between the correlate and remnant. For example, we have a VP remnant with a DP contrast in *John doesn't read articles, let alone read books.* The analysis of responses by contrast and remnant type in Experiment 1A supports a general preference for object contrast within VP remnants. To speculate, the syntactic type of the remnant might be influenced primarily by scope bearing elements like negation and focus particles. With the exception of Experiment 1B, the experiments above confounded the two factors: both negation and the focus particle were placed in pre-verbal position, potentially biasing the processor towards a VP syntax for the remnant. This preference might be understood in terms of a default interpretation of the scope of negation to deny the maximal possible event consistent with its syntactic position, unless the discourse suggests otherwise. Further, this proposal could be tested by manipulating the placement of negation within the sentence, perhaps utilizing negative quantifiers, as in *No boy in the advanced class skimmed the article, let alone ...*

The contrast that forms the scale might be determined by somewhat different factors than those that determine scope. As noted, the correlate and remnant in *let alone* coordination are typically marked with contrastive accent. In cases of silent reading, the processor might therefore follow default prosody for sentence-final accent (e.g., Carlson et al., 2009). The bias towards DP contrast could be attributed to the fact that the matrix clause in the materials above was always of the canonical SVO type, implicitly giving the DP object sentence accent. This explanation would predict a preference for a contrast with the most deeply embedded antecedent, which in the case of *let alone* coordination after SVO matrix clauses is also the nearest antecedent. Indeed, Harris and Carlson (in press) find evidence for a local contrast preference in both corpora and online processing.

Despite potentially conflicting cues, scope and contrast must converge on a remnant that provides a scale related to the correlate in an accessible way. The accessibility of the scale is also perhaps impacted by several factors, including the extent to which there are lexical contrasts that permit a scalar relation, as in the case of lexicalized scales discussed in the introduction, and general discourse coherence. To illustrate the first point, including a scalar adjective like *long* in our case sentence *Pat didn't skim the long article, let alone ...* might well entice the reader to expect, or at least accommodate, a remnant which contrasts with *long*, regardless of the syntactic type of the remnant.

A final possibility is that remnant preferences are guided by discourse expectations, rather than syntactic economy. Toosarvandani (2010) proposes that *let alone* coordination is sensitive to the discourse topic or the Question Under Discussion (QUD), an explicit or implicit question which guides the conversation and provides the essential background against which utterances are interpreted (Roberts, 1996, 2011). As a consequence, readers would need to infer the QUD in order to compute the relationship presupposed or implicated by the *let alone* conjuncts in the absence of a richer discourse context. Without knowing what the discourse was about, subjects might have opted for the QUD that addresses the most general discourse topic. The strategy of inferring the least specific QUD warranted by the utterance is supported by Beaver and Clark's (2008) *Discourse Principle*, in which utterances are to be maximally relevant to the current QUD. Subjects in the above experiments may thus have accommodated the QUD that required them to make as few assumptions as possible regarding what the discourse was about in order to maximize discourse coherence. This interpretation is compatible with the findings of Birch and Clifton (1995), who observed a preference for broad focus when possible (see also Stolterfoht et al., 2007), and with recent findings that sentence processing is sensitive to the QUD, including in particular ellipsis structures (see Roberts, 2011 for review, as well as Clifton and Frazier, 2012).

Additionally, an explanation appealing to presumed QUDs permits a better understanding of the influence of the different experimental paradigms on the results, as the extent to which subjects were tempted to infer a QUD might have varied with task demands. Specifically, a strategy to minimize discourse commitments might have been more pressing in completion or forced choice tasks than in silent reading. Ongoing research tentatively supports this conclusion (e.g., Harris and Carlson, 2014, 2015), but these explanations remain mere possibilities at this point.

Perhaps one of the more surprising results above is that the focus sensitive operator *even* had such little impact regarding which type of conjunct following *let alone* was preferred. The results contrast with a null hypothesis that treats all focus sensitive operators like the canonical case of *only* with respect to focus assignment. Instead, *even* appeared to facilitate sentence processing across the board, by signaling an upcoming scalar relationship. The results are compatible with multiple analyses, but notably do not support the Closeness Principle, which assigns focus to the rightmost constituent to which the particle is adjoined (Büring and Hartmann, 2001). As such, the present results differ from those found for the exclusive particle *only*, which seems to drive expectations regarding upcoming contrast during online sentence processing (Paterson et al., 2007; Carlson, 2013). Furthermore, the results broadly support previous findings in which the effects of *even* are delayed compared to *only* in reading times (e.g., Filik et al., 2009; though see Gotzner et al., 2013, and Spalek et al., 2014, for evidence that different focus particles induce a similar encoding of focus alternatives in spoken stimuli).

To the best of my knowledge, this paper presents the first experimental study on *let alone* coordination besides the related studies presented in Harris and Carlson (in press), or any other type of focus sensitive coordination, and, as such, the general results might raise more questions than can be answered by a single suite of manipulations. Yet, the findings, on the whole, cohere with our current understanding of ellipsis structures overall, and hopefully have contributed some plausible general principles to be investigated further.

Acknowledgements

I thank Katy Carlson for discussion and for suggesting additional analyses of the completion studies, Chuck Clifton and Lyn Frazier for discussion of the eye movement data and extensive feedback on a previous draft, and Maziar Toosarvandani, Masaya Yoshida and David Potter for comments on the syntax of the *let alone* structure. Detailed comments from two anonymous reviewers improved the paper substantially. Thanks also go to Joel Fishbein for assistance running subjects in the reading study at Pomona College, and to Zoe Zarkades for carefully copy-editing the penultimate version of the paper. Previous versions of this work were presented as a poster at the 26th Annual CUNY Human Sentence Processing Conference in 2013, and as invited talks at the University of Southern California in 2013 and the University of California, Los Angeles in 2014, where I greatly benefited from feedback and comments. The research received financial support from Pomona College.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.lingua.2015.10.008.

References

Abels, K., 2003. Successive Cyclicity, Anti-Locality, and Adposition Stranding (PhD thesis). University of Connecticut, Storrs, CT.
Albrecht, J.E., Clifton Jr., C., 1998. Accessing singular antecedents in conjoined phrases. Mem. Cognit. 26, 599–610.
Altmann, G.T.M., 1999. Thematic role assignment in context. J. Mem. Lang. 41, 124–145.
Altmann, G.T.M., Kamide, Y., 1999. Incremental interpretation at verbs: restricting the domain of subsequent reference. Cognition 73, 247–264.
Altmann, G., Steedman, M., 1988. Interaction with context during human sentence processing. Cognition 30, 191–238.
Altmann, G., Garnham, A., Dennis, Y., 1992. Avoiding the garden path: eye movements in context. J. Mem. Lang. 31, 685–712.
Altmann, G.T.M., van Nice, K.Y., Garnham, A., Henstra, J.A., 1998. Late closure in context. J. Mem. Lang. 38, 459–484.
Angele, B., Rayner, K., 2013. Processing *the* in the parafovea: are articles skipped automatically? J. Exp. Psychol. Learn. Mem. Cogn. 39, 649–662.
Arnold, J.E., 2008. Reference production: production-internal and addressee-oriented processes. Lang. Cognit. Process. 23, 495–527.
Barr, D., Levy, R., Scheepers, C., Tily, H.J., 2013. Random effects structure in mixed-effects models: keep it maximal. J. Mem. Lang. 68, 255–278.
Bates, D., Maechler, M., 2009. lme4: Linear mixed-effects models using S4 classes. R package version 0.999375-31.
Beaver, D., Clark, B.Z., 2008. Sense and Sensitivity: How Focus Determines Meaning. Wiley-Blackwell, Malden, MA.

Bever, T.G., 1970. The cognitive basis for linguistic structures. In: Hayes, R. (Ed.), Cognition and Language Development. Wiley & Sons Inc., New York, pp. 279–362.

Birch, S., Clifton Jr., C., 1995. Focus, accent, and argument structure: effects on language comprehension. Lang. Speech 33, 365–391.

Boone, E., 2014. Exceptional movement is unexceptionally local. In: Iyer, J., Kusmer, L. (Eds.), Proceedings of North Eastern Linguistics Society, vol. 44. GLSA, Amherst, MA, pp. 5–68.

Büring, D., Hartmann, K., 2001. The syntax and semantics of focus-sensitive particles in German. Nat. Lang. Linguist. Theory 19, 229–281.

Cappelle, B., Dugas, E., Tobin, V., 2015. An afterthought on let alone. J. Pragmat. 80, 70–85.

Carlson, K., 2001. The effects of parallelism and prosody in the processing of gapping structures. Lang. Speech 44, 1–26.

Carlson, K., 2002. Parallelism and Prosody in the Processing of Ellipsis Sentences. Routledge.

Carlson, K., 2013. The role of only in contrasts in and out of context. Discourse Process. 50, 249–275.

Carlson, K., Dickey, M.W., Kennedy, C., 2005. Structural economy in the processing and representation of gapping sentences. Syntax 8, 208–228.

Carlson, K., Dickey, M.W., Frazier, L., Clifton Jr., C., 2009. Information structure expectations in sentence comprehension. Q. J. Exp. Psychol. 62, 114–139.

Chen, E., Gibson, E., Wolf, F., 2005. Online syntactic storage costs in sentence comprehension. J. Mem. Lang. 52, 144–169.

Chung, S., Ladusaw, W.A., McCloskey, J., 1995. Sluicing and logical form. Nat. Lang. Semant. 3, 239–282.

Cinque, G., 1993. A null theory of phrase and compound stress. Linguist. Inq. 24, 239–297.

Clifton Jr., C., Frazier, L., 2012. Discourse integration guided by the 'question under discussion'. Cognit. Psychol. 65, 352–379.

Crocker, M.W., 1996. Computational Psycholinguistics: An Interdisciplinary Approach to the Study of Language. Kluwer Academic, Dordrecht, The Netherlands.

DeLong, K.A., Troyer, M., Kutas, M., 2014. Pre-processing in sentence comprehension: sensitivity to likely upcoming meaning and structure. Lang. Linguist. Compass 8, 631–645.

Desmet, T., Gibson, E., 2003. Disambiguation preferences and corpus frequencies in noun phrase conjunction. J. Mem. Lang. 49, 353–374.

Drummond, A., 2012. Ibex Farm. Available from: http://spellout.net/ibexfarm

Ehrlich, K., Rayner, K., 1983. Pronoun assignment and semantic integration during reading: eye movements and immediacy of processing. J. Verbal Learn. Verbal Behav. 22, 75–87.

Elff, M., 2013. memisc: Tools for Management of Survey Data, Graphics, Programming, Statistics, and Simulation. R package version 0.96-9.

Engelhardt, P.E., Ferreira, F., 2010. Processing coordination ambiguity. Lang. Speech 53, 494–509.

Ferreira, F., Clifton Jr., C., 1986. The independence of syntactic processing. J. Mem. Lang. 25, 348–368.

Ferreira, F., Bailey, K.G., Ferraro, V., 2002. Good-enough representations in language comprehension. Curr. Direct. Psycholog. Sci. 11, 11–15.

Filik, R., Paterson, K.B., Liversedge, S.P., 2009. The influence of *only* and *even* on online semantic interpretation. Psychon. Bull. Rev. 16, 678–683.

Fillmore, C.J., Kay, P., O'Connor, M.C., 1988. Regularity and idiomaticity in grammatical constructions: the case of let alone. Language 64, 501–538.

Fishbein, J., Harris, J.A., 2014. Making sense of Kafka: structural biases induce early sense commitment for metonyms. J. Mem. Lang. 76, 94–112.

Frazier, L., 1979. On Comprehending Sentences: Syntactic Parsing Strategies (PhD thesis). Reproduced by the Indiana University Linguistics Club.

Frazier, L., 1987. Syntactic processing: evidence from Dutch. Nat. Lang. Linguist. Theory 5, 519–559.

Frazier, L., Clifton Jr., C., 1996a. Construal. MIT Press.

Frazier, L., Clifton Jr., C., 1996b. Construal.. The MIT Press, Cambridge, MA.

Frazier, L., Fodor, J.D., 1978. The sausage machine: a new two-stage parsing model. Cognition 6, 291–326.

Frazier, L., Rayner, K., 1982. Making and correcting errors during sentence comprehension: eye movements in the analysis of structurally ambiguous sentences. Cognit. Psychol. 14, 178–210.

Frazier, L., Rayner, K., 1990. Taking on semantic commitments: processing multiple meanings vs. multiple senses. J. Mem. Lang. 29, 181–200.

Frazier, L., Taft, L., Roeper, T., Clifton, C., Ehrlich, K., 1984. Parallel structure: a source of facilitation in sentence comprehension. Mem. Cognit. 12, 421–430.

Frazier, L., Munn, A., Clifton Jr., C., 2000. Processing coordinate structures. J. Psycholinguist. Res. 4, 345–370.

Frazier, M., Potter, D., Yoshida, M., 2012. Pseudo noun phrase coordination. In: Arnett, N., Bennett, R. (Eds.), Proceedings of the 30th West Coast Conference on Formal Linguistics. Cascadilla Proceedings Project, Somerville, MA, pp. 142–152.

Frisson, S., 2009. Semantic underspecification in language processing. Lang. Linguist. Compass 3, 111–127.

Gibson, E., Schütze, C.T., 1999. Disambiguation preferences in noun phrase conjunction do not mirror corpus frequency. J. Mem. Lang. 40, 263–279.

Gibson, E., Schütze, C.T., Salomon, A., 1996. The relationship between the frequency and the complexity of linguistic structure. J. Psycholinguist. Res. 25, 59–92.

Van Gompel, R.P., Majid, A., 2004. Antecedent frequency effects during the processing of pronouns. Cognition 90, 255–264.

Gotzner, N., Spalek, K., Wartenburger, I., 2013. How pitch accents and focus particles affect the recognition of contextual alternatives. In: Proceedings of the 35th Annual Conference of the Cognitive Science Society. Cognitive Science Society, Austin, TX, pp. 2434–2439.

Grimshaw, J., 2000. Locality and extended projection. In: Coopmans, P., Everaert, M., Grimshaw, J. (Eds.), Lexical Specification and Insertion. John Benjamin, Amsterdam, pp. 115–133.

Hankamer, J., 1971. Constraints on Deletion in Syntax (PhD thesis). Yale University.

Hardt, D., 1993. Verb Phrase Ellipsis: Form, Meaning, and Processing (PhD thesis). University of Pennsylvania.

Harris, J.A., Carlson, K., 2014. What was the question? Broad focus in focus-sensitive coordination. In: Poster Presented at the 20th Architectures and Mechanisms for Language Processing, University of Edinburgh, Scotland.

Harris, J.A., Carlson, K., 2015. Focus particles in context: support for the broadest focus principle. In: Poster Presented at the 28th Annual CUNY Human Sentence Processing Conference. University of Southern California.

Harris, J.A., Carlson, K., 2015. Keep it local (and final): remnant preferences for ''let alone'' ellipsis. Q. J. Exp. Psychol. (in press).

Henstra, J.A., 1996. On the Parsing of Syntactically Ambiguous Sentences: Coordination and Relative Clause Attachment (Unpublished doctoral dissertation). University of Sussex.

Hirschberg, J.L.B., 1985. A Theory of Scalar Implicature (PhD thesis). University of Pennsylvania, Philadelphia, PA.

Hoeks, J.C.J., Vonk, W., Schriefers, H., 2002. Processing coordinated structures in context: the effect of topic-structure on ambiguity resolution. J. Mem. Lang. 46, 99–119.

Hoeks, J.C., Hendriks, P., Vonk, W., Brown, C.M., Hagoort, P., 2006. Processing the noun phrase versus sentence coordination ambiguity: thematic information does not completely eliminate processing difficulty. Q. J. Exp. Psychol. 59, 1581–1599.

Horn, L., 1972. On the Semantic Properties of Logical Operators in English (PhD thesis). UCLA, Los Angeles, CA.

Horn, L., 1989. A Natural History of Negation. University of Chicago Press, Chicago, IL.

Hulsey, S., 2008. Focus Sensitive Coordination (PhD thesis). MIT, Cambridge, MA.

Jaeger, T.F., 2008. Categorical data analysis: away from ANOVAs transformation (or not) and towards logit mixed models. J. Mem. Lang. 59, 447–456.

Johnson, K., 1996. In Search of the English Middle Field (Ms.). University of Massachusetts, Amherst.

Johnson, K., 2014. Gapping (Ms.). University of Massachusetts, Amherst.

Kaan, E., Wijnen, F., Swaab, T.Y., 2004. Gapping: electrophysiological evidence for immediate processing of ''missing'' verbs in sentence comprehension. Brain Lang. 89, 584–592.

Kamide, Y., 2008. Anticipatory processes in sentence processing. Lang. Linguist. Compass 2, 647–670.

Kimball, J., 1975. Predictive analysis and over-the-top parsing. In: Kimball, J. (Ed.), Syntax and Semantics, vol. 4. Academic Press, New York, pp. 155–179.

Konieczny, L., 1996. Human Sentence Processing: A Semantics-Oriented Approach (Unpublished doctoral dissertation). University of Freiburg, Germany.

Koriat, A., Greenberg, S.N., 1994. The extraction of phrase structure during reading: evidence from letter detection errors. Psychon. Bull. Rev. 1, 345–356.

Ladusaw, W.A., 1979. Polarity Sensitivity as Inherent Scope Relations (PhD thesis). University of Texas, Austin.

MacDonald, M.C., Perlmutter, N.J., Seidenberg, M.S., 1994. The lexical nature of syntactic ambiguity resolution. Psychol. Rev. 101, 676–703.

Marslen-Wilson, W., 1973. Linguistic structure and speech shadowing at very short latencies. Nature 244, 522–533.

McRae, K., Spivey-Knowlton, M.J., Tanenhaus, M.K., 1998. Modeling the influence of thematic fit (and other constraints) in on-line sentence comprehension. J. Mem. Lang. 38, 283–312.

Merchant, J., 2001. The Syntax of Silence: Sluicing, Islands, and the Theory of Ellipsis. Oxford University Press, Oxford.

Merchant, J., 2004. Fragments and ellipsis. Linguist. Philos. 27, 661–738.

Mitchell, D.C., 1994. Sentence parsing. In: Gersnbacher, M.A. (Ed.), Handbook of Psycholinguistics. Academic Press, NY, pp. 375–409.

Mitchell, D.C., Cuetos, F., 1991. The origins of parsing strategies. In: Conference Proceedings of Current Issues in Natural Language Processing. University of Texas at Austin, Austin, TX, pp. 1–12.

Moxey, L.M., Sanford, A.J., Sturt, P., Morrow, L.I., 2004. Constraints on the formation of plural reference objects: the influence of role, conjunction, and type of description. J. Mem. Lang. 51, 346–364.

Paterson, K.B., Liversedge, S.P., Filik, R., Juhasz, B.J., White, S.J., Rayner, K., 2007. Focus identification during sentence comprehension: evidence from eye movements. Q. J. Exp. Psychol. 60, 1423–1445.

Postal, P., 1974. On Raising. MIT Press, Cambridge, MA.

R Development Core Team, 2014. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria.

Rayner, K., 1998. Eye movements in reading and information processing: 20 years of research. Psychol. Bull. 124, 372–422.

Rayner, K., Sereno, S.C., 1994. Regressive eye movements and sentence parsing: on the use of regression-contingent analyses. Mem. Cognit. 22, 281–285.

Rayner, K., Slattery, T.J., Drieghe, D., Liversedge, S.P., 2011. Eye movements and word skipping during reading: effects of word length and predictability. J. Exp. Psychol. Hum. Percept. Perform. 37, 514–528.

Rayner, K., Pollatsek, A., Ashby, J., Clifton Jr., C., 2012. Psychology of Reading. Psychology Press, New York.

Rizzi, L., 1997. The fine structure of the left periphery. In: Haegeman, L. (Ed.), Elements of Grammar. Springer, Netherlands, pp. 281–337.

Roberts, C., 1996. Information structure: towards an integrated formal theory of pragmatics. In: Yoon, J.H., Kathol, A. (Eds.), OSUWPL Volume 49: Papers in Semantics. The Ohio State University, Department of Linguistics.

Roberts, C., 2011. Solving for interpretation. In: Paper Given at the Workshop on Meaning and Understanding at the Centre for Advanced Study, Oslo.

Rohde, H., Levy, R., Kehler, A., 2011. Anticipating explanations in relative clause processing. Cognition 118, 339–358.

Ross, J.R., 1967. Constraints on Variables in Syntax (PhD thesis). MIT, Cambridge, MA.

Ross, J.R., 1970. Gapping and the order of constituents. In: Bierwisch, M., Heidolph, K.E. (Eds.), Progress in Linguistics. Mouton, The Hague, pp. 249–259.

Sag, I.A., 1976. Deletion and Logical Form (PhD thesis). Massachusetts Institute of Technology.

Sailor, C., Thoms, G., 2014. On the non-existence of non-constituent coordination and non-constituent ellipsis. In: Santana-LaBarge, R.E. (Ed.), Proceedings of the 31st West Coast Conference on Formal Linguistics Cascadilla. Proceedings Project, Somerville, MA, pp. 361–370.

Schneider, D., 1999. Parsing and Incrementality (Unpublished doctoral dissertation). University of Delaware, Newark.

Selkirk, E.O., 1984. Phonology and Syntax: The Relation between Sound and Structure. MIT Press, Cambridge.

Shieber, S., Johnson, M., 1993. Variations on incremental interpretation. J. Psycholinguist. Res. 22, 287–318.

Siegel, M.E.A., 1984. Gapping and interpretation. Linguist. Inq. 15, 523–530.

Spalek, K., Gotzner, N., Wartenburger, I., 2014. Not only the apples: focus particles influence memory for information-structural alternatives. J. Mem. Lang. 70, 68–84.

Staub, A., 2014. Reading sentences: syntactic parsing and semantic interpretation. In: Pollatsek, A., Treiman, R. (Eds.), The Oxford Handbook of Reading. Oxford University Press, Oxford, UK.

Staub, A., 2015. The effect of lexical predictability on eye movements in reading: critical review and theoretical interpretation. Lang. Linguist. Compass 9, 311–327.

Staub, A., Clifton Jr., C., 2006. Syntactic prediction in language comprehension: evidence from either.. or. J. Exp. Psychol. Learn. Mem. Cogn. 32, 425–436.
Staub, A., Rayner, K., 2007. Eye movements and on-line comprehension processes. In: Gaskell, G. (Ed.), The Oxford Handbook of Psycholinguistics. Oxford University Press, Oxford, UK, pp. 327–342.
Stolterfoht, B., Friederici, A.D., Alter, K., Steube, A., 2007. Processing focus structure and implicit prosody during reading: differential ERP effects. Cognition 104, 565–590.
Sturt, P., Lombardo, V., 2005. Processing coordinated structures: incrementality and connectedness. Cognit. Sci. 29, 291–305.
Swets, B., Desmet, T., Clifton, C., Ferreira, F., 2008. Underspecification of syntactic ambiguities: evidence from self-paced reading. Mem. Cognit. 36, 201–216.
Tanenhaus, M.K., Trueswell, J., 1995. Sentence comprehension. In: Miller, J., Eimas, P. (Eds.), Handbook of Perception and Cognition. Volume 11: Speech, Language, and Communication. 2nd ed. Academic Press, San Diego, CA, pp. 217–262.
Thoms, G., 2014. Constraints on exceptional ellipsis are only parallelism effects. In: Huang, H.-L., Rysling, A., Poole, E. (Eds.), Proceedings of NELS, vol. 43. GLSA, Amherst, MA, pp. 235–248.
Toosarvandani, M., 2009. Letting negative polarity alone for let alone. In: Friedmann, T., Ito, S. (Eds.), Semantics and Linguistic Theory, vol. 18. pp. 729–746.
Toosarvandani, M., 2010. Association with Foci (PhD thesis). University of California, Berkeley.
Trueswell, J.C., Tanenhaus, M.K., Garnsey, S.M., 1994. Semantic influences on parsing: use of thematic role information in syntactic ambiguity resolution. J. Mem. Lang. 33, 285–318.
Van Petten, C., Luka, B.J., 2012. Prediction during language comprehension: benefits, costs, and ERP components. Int. J. Psychophysiol. 83, 176–190.
Weir, A., 2014. Why-stripping targets voice phrase. In: Huang, H-L., Rysling, A., Poole, E. (Eds.), Proceedings of NELS, vol. 43. GLSA, Amherst, MA, pp. 235–248.
Wright, B., Garrett, M., 1984. Lexical decision in sentences: effects of syntactic structure. Mem. Cognit. 12, 31–45.
Yoshida, M., Carlson, K., Dickey, M.W., 2013. Incremental parsing, gapping, and connectives. In: Paper Presented at The 26th Annual CUNY Conference on Human Sentence Processing, University of South Carolina, Columbia, SC.
Yoshida, M., Dickey, M.W., Sturt, P., 2014. The Effect of *either* on the Processing of Disjunctive Coordination (Ms.). Northwestern University, The University of Pittsburg, and The University of Edinburgh.