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Keep it local (and final): Remnant preferences in 'let alone' ellipsis

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Abstract

The *let alone* construction (*John can't run a mile, let alone a marathon*) differs from standard coordination structures (with *and* or *but*) by requiring ellipsis of the second conjunct, e.g., *a marathon* is the remnant of an elided clause [*John run a marathon*]. In support of an ellipsis account, a corpus study of British and American English finds that *let alone* exhibits a Locality bias, as the second conjunct preferentially contrasts with the nearest lexical item of the same syntactic type. Two self-paced reading studies show that the Locality bias is active during online processing, but must be reconciled with indicators of semantic contrast and discourse information. Further, a sentence-rating study shows that the Locality bias interacts with a Finality bias that favors placing the *let alone* phrase at the end of a clause, which sometimes necessitates a non-local contrast. Together, the results show how a general bias in ellipsis for local contrasts is affected by discourse demands, such as the need for scalar contrast imposed by *let alone*, thereby offering a window into how possibly divergent syntactic and discourse constraints impact sentence processing.

Keywords

Ellipsis; sentence comprehension; scalar contrast; corpora; self-paced reading

Introduction

Much research in language processing has shown that syntactic and discourse expectations are tightly linked, even if not all researchers agree on their relative importance or the best way to model their interaction. To this literature we add an intriguing, and experimentally understudied, class of coordinate structures which depend on discourse more than ordinary coordinators like *and*, *or*, and *but* do. Focus-sensitive coordination refers to a class of coordinators including *let alone*, *much less*, and possibly *never mind* (Fillmore, Kay, & O'Connor, 1988; Hulsey, 2008; Toosarvandani, 2009, 2010), which place diverse demands on the sentence processor, offering a window into how the processor might treat multiple conflicting pressures from syntax and discourse.

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We believe that the structures studied here are important to sentence processing for a variety of reasons. First, they impose a unique set of syntactic and semantic constraints (discussed below) on the rest of the structure – e.g., focus contrast, scalar comparison, and ellipsis. The sentence processor must recruit a great deal of grammatical and contextual knowledge to interpret them in real time. Therefore, these structures provide the opportunity to investigate which types of knowledge are recruited at particular junctures in the processing record. Second, since similar constraints are observed in other structures, particularly other ellipsis structures, we are not simply studying the idiosyncratic properties of the *let alone* construction. Indeed, we propose that the strategies used to process *let alone* and related coordinators can be generalized to other structures; the uniqueness of *let alone* is that it forces the processor to confront a range of restrictions in concert. Determining which sources of information are prioritized by the processor helps delineate the roles of such information in the processing system generally, thereby revealing the internal organization of the processor. We hope to show that *let alone* displays a strong structural bias that is modulated, but not eliminated, by prior sentential and discourse context.

The remainder of the paper is organized as follows: we introduce the major properties of *let alone* coordination, before continuing on to what those properties require of the language processor, and what is already known about the processing of *let alone*. We then present a corpus study of British and American English to determine the distribution of such constructions in speech and text, followed by three experiments that probe whether, and in what manner, the biases we observe in the corpora are also active during sentence interpretation.

The *let alone* construction

Semantically, *let alone* coordination places two elements on a contextually salient scale. In the case below, *tea* and *coffee* are understood to be in a scalar relation, such that *drinking tea* is somehow less expected, appropriate, beneficial, etc. than *drinking coffee*. As such, the denial *John shouldn't drink tea* then contextually entails that *John shouldn't drink coffee* (Toosarvandani, 2010).[1]

    (1) John won't drink tea, let alone coffee.

The constituents placed in opposition need not be inherently scalar (see Constant 2012 for a similar point with respect to a rise-fall-rise prosodic contour). We could easily reverse the relationship above, provided that the context supports it. For example, in (1), imagine that John has a severe heart condition that prevents him from imbibing caffeine: the context fits the given order of elements, *tea* followed by *coffee*, since coffee has more caffeine than tea. In the next example (2), we reverse the appropriate order of (1) by imagining that John drinks nothing but Coke. In this case, there is the additional inference that the Speaker believes it is common ground that tea is less likely or less expected than coffee.[2] This inference would be supported by world knowledge, as coffee is certainly a more common beverage than tea in America.

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[1]According to Toosarvandani (2010), *let alone* conveys a presupposition placing two propositions in a *contextual entailment* relation, P $>_C$ Q, which holds just when Q follows as a reasonable inference from P via world knowledge.

(2) John won't drink coffee, let alone tea.

Relatedly, the *let alone* phrase addresses the immediate topic of the discourse. Note that (1) would be an appropriate reply to the question: *Would John like some coffee?* In response to the same question, however, (2) would seem a non sequitur, in the sense that *tea* has not even been mentioned as a possible alternative, and is certainly not inferable from the discourse.[3]

In addition, the elements under comparison in the *let alone* construction typically receive contrastive focus, as in (3) below; incompatible pairings yield awkward utterances (3b).

(3) a. John won't drink tea in the EVENING, let alone at NIGHT.

b. ??John won't drink TEA in the evening, let alone at NIGHT.

In case multiple elements are to be compared, they must all receive contrastive accent (4), even if comparing more than two elements seems somewhat forced without supportive context (4b).

(4) a. John won't drink TEA in the EVENING, let alone COFFEE at NIGHT.

b. JOHN won't drink TEA in the EVENING, let alone MARY COFFEE at NIGHT.

The examples above already indicate that *let alone* may be followed by NPs (1-2), and PPs (3), as well as larger, phrasal constituents (4). The *let alone* phrase is in fact quite flexible syntactically, appearing in a variety of positions and with many different syntactic categories, as in (5).

(5) a. *Subject DP coordination*

[DP Clinton, let alone McCain,] won't withdraw the troops.

b. *V coordination*

Clinton won't [V reduce, let alone withdraw], the troops.

c. *VP coordination*

Clinton won't [VP reduce the troops, let alone withdraw them].

d. *Object DP coordination*

Clinton won't withdraw [DP the generals, let alone the lieutenants].

e. *Determiner coordination*

Clinton won't withdraw [DET some, let alone all], of the soldiers.

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[2]The intended inference may be more precisely categorized as a conventional implicature, following Toosarvandani 2009), as illustrated by the fact that, once uttered, it is difficult for the Speaker to deny (Potts, 2007), as shown in (i). Note that the scalar inference is absent from a coordination with an ordinary coordinator, like *or* (ii).
i. Sally wouldn't date John, let alone Bill, *# not that Bill is less dateable than John*.
ii. Sally wouldn't date John or Bill, not that Bill is less dateable than John.
[3]Semantically, the sentence without the *let alone* phrase, i.e., *John won't drink tea* in (1), should contextually entail the answer to the question (in a question-answer relation sometimes called *over answering* in the pragmatics literature; see, e.g., Groenendijk & Stokhof, 1997; Roberts, 1998; Beaver & Clark, 2008; Coppock, & Brochhagen, 2013). We defer addressing why this should be a legitimate discourse move.

At first glance, the range of elements that are compatible with *let alone* might seem to put it on par with better-studied coordinators, like *and*, which also are syntactically flexible. However, the next section briefly covers arguments that *let alone* coordination requires ellipsis, followed by potential consequences for the processor.

An ellipsis analysis of *let alone*

Fillmore et al. (1988), in a seminal paper which established the complexities of the *let alone* coordination, propose that constructional properties of *let alone* are stored in the 'Appendix to the Grammar', a rather large repository responsible for associating idiosyntactic semantic and pragmatic properties to 'formal idioms'. On their account, a relatively simple structure involving phrasal conjunction is associated with a set of idiomatic, yet highly structured, semantic and pragmatic constraints.

More recent approaches have argued that the syntax of *let alone* involves coordination of clauses plus mandatory ellipsis of the second conjunct. Ellipsis is usually considered to be an optional process following conjunction, as illustrated by the availability of the stripping ellipsis (6b) variant of the sentence conjunction (6a). A similar pair in (7) shows that with *let alone*, the non-elided variant is not grammatical.

(6) a. John will drink tea, but he will not drink coffee.

b. John will drink tea, but not coffee.

(7) a. * John won't drink tea, let alone he will / won't drink coffee.

b. John won't drink tea, let alone coffee.

Although rare and perhaps somewhat awkward, examples with what appears to be a full SVO clause in the second conjunct, like (8a), are easy enough to construct. However, *let alone* sentences are restricted in two important ways (Hulsey, 2008). First, they usually do not repeat material already given in the previous clause (8b).[4] Second, the verb cannot be finite, i.e., show tense marking (8c).

(8) a. John won't drink tea, let alone Mary sip on coffee.

b. * John won't drink tea, let alone he drink coffee.

c. * John won't drink tea, let alone Mary sips on coffee.

Whether the verb appears in finite form in the second conjunct of (8) is thought to reveal the size of the conjuncts in coordination. If finite (8c), the structure is sentence coordination in which the modal *won't* is limited to the first conjunct, and the sentence is ungrammatical; if non-finite (8a), the coordination must be smaller, so that semantic operators like *won't* take scope over both conjuncts (Oehrle, 1987; Oirsouw, 1987; Siegel, 1984, 1987; McCawley, 1993; Johnson, 2009, for gapping). Thus, the material following *let alone* must be smaller than an entire clause.

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[4]We can approximate the intended reading of (8b) with Subject-Auxiliary inversion, as in the marginally acceptable *John wouldn't drink tea, let alone would he drink coffee*. Examples with some repeated material like (i) were observed in corpora, as discussed below. However, no examples comparable to (8b) were observed.
(i) Americans do not like to think of themselves as predictable, let alone predictable on a regular basis. (COCA)

Of course, there is the remaining possible syntactic analysis in which *let alone* simply coordinates all constituent types (NPs, PPs, etc.) except tensed clauses, as opposed to one in which a clause has undergone ellipsis. However, not only does such a solution essentially reduce to a stipulation, there is clear evidence against it: unlike simple coordination with *and*, coordination with *let alone* can contrast with a non-adjacent phrase. In example (9), the embedded subject *women* contrasts with *men*.

(9) I don't think women would even fancy Mr. X., let alone men. (BNC)

Given their respective locations, however, these two NPs are clearly not directly coordinated with each other. The possibility of this configuration supports the contention that the second conjunct is the remnant to clausal ellipsis.

These facts are just a few of many that support an analysis of *let alone* coordination as coordination plus mandatory ellipsis (for additional arguments, see Hulsey, 2008, or Harris, submitted). We will assume that the phrase following *let alone* is a remnant of ellipsis which has been raised to a position adjoining to a vP or CP clause, as in syntactic accounts of various forms of ellipsis (e.g., Merchant, 2001, 2004; Frazier, Potter, & Yoshida, 2012; Sailor & Thoms, 2013; Toosarvandani, 2013). We now turn to previous experimental evidence providing initial support for this claim.

Processing let alone *coordination*

Harris (submitted) provides experimental evidence for obligatory ellipsis with *let alone*. If *let alone* were an instance of ordinary coordination, it should exhibit the same processing bias towards smaller structures as other coordinators like *and*. For example, the coordination in (10; item appeared in Dutch) from Frazier (1987b) is temporarily ambiguous, consistent with a low, NP coordination (10a) or a high, sentence coordination (10b). There is a consistent preference to take the low coordination analysis, as evidenced by longer reading times on the sentence coordination parse. We assume that this effect could be due to structural economy preferences (Frazier, 1979; Frazier, 1987) in combination with thematic fit preferences and/or frequency (Hoeks et al., 2006).

(10) Pete kissed Marie and her sister …

a. too.

b. laughed.

In contrast, if *let alone* coordination requires ellipsis, then the second conjunct will involve a larger phrase structure than would be expected from the surface syntax. In this case, the processor might automatically project an ellipsis structure replete with covert clausal structure along the lines of (11) upon encountering *let alone*.

(11) Phrase structure projected by *let alone* coordination

Accordingly, the processor could project the clausal structure required for ellipsis, either vP or CP, as stated in Harris' (submitted) processing hypothesis below:

(12) **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.

If the processor necessarily projects a complex phrase structure (11) regardless of the category of the remnant, then there might be no preference for a simpler conjunct (an NP over a VP, say) on the grounds of structural economy, i.e. no bias towards NP (13a) over VP (13b) coordination.

(13) John didn't like Mary, let alone …

a. Sue.

b. love her.

Harris (submitted) tested these predictions in several offline questionnaires, finding neither a preference for putatively simpler NP variants, nor a categorical processing penalty for one type of structure over another in an eye tracking study. Instead, subjects preferred VP over NP answers at a rate of about 60-65% in offline studies, unless biased away from VPs through prior context. Thus, there was no evidence for a bias towards simpler constructions, and a syntactic analysis treating *let alone* coordination as a type of ordinary phrasal coordination is not supported by theoretical or experimental evidence. As such, we will now call the phrase introduced by *let alone*, e.g., *Sue* or *love her* in (13), the *remnant*, and the element in the preceding clause with which the remnant contrasts the *correlate* (e.g., *Mary* or *like Mary*).

However, an ellipsis account of *let alone* coordination does not predict a bias towards VP remnants; it only fails to predict an (incorrect) bias towards NP remnants. There are several possible hypotheses that might capture the VP bias. For example, the processor might be guided by exposure-based preferences, as in a broad construal of Mitchell and colleague's *tuning hypothesis* (Mitchell & Cuetos, 1991; Cuetos, Mitchell, & Corley, 1996; Mitchell, 1994; Mitchell, Cuetos, Corley, & Byrsbaert, 1995; though see, for instance, Gibson & Schütze, 1999, or Pickering, Traxler, & Crocker, 2000, for counterevidence). On this approach, we would expect that processing preferences should match completion and corpus preferences.

A second possible explanation of the VP bias, as well as the lack of a processing cost for VP remnants, derives from general principles favoring broad over narrow focus in impoverished discourse settings, so as to avoid potentially unnecessary discourse commitments (see also Harris & Carlson, 2013, 2014a). Under this approach, we would expect that the VP bias could be overturned by contexts that specify discourse topics, in addition to prosodic indicators of discourse topic, including focus prominence. This second, discourse-based, explanation makes no predictions regarding the distribution of *let alone* remnants in naturally occurring speech and text, except that they should vary along with the presumed topic of the discourse.

Therefore, the first aim of the corpus study below is to test whether there is a VP bias in text and speech. If so, an exposure-based account would be supported over a discourse-based one. A second, but equally important, aim of the corpus work is to determine whether *let alone* coordination patterns with other types of ellipsis in additional ways. Although

different types of ellipsis – such as VP ellipsis, NP ellipsis, sluicing, gapping, replacives, etc. –have very different properties, there is widespread evidence that they are biased to associate with the most local constituent, possibly due to default focus placement on the most embedded constituent (Carlson et al., 2009). In the case of sluicing in (14a), there is a bias to associate the *wh*-element *who* with the object correlate, *someone*, which is the nearest possible candidate, instead of the subject *somebody* (Frazier & Clifton, 1998; Poirier, Wolfinger, Spellman, & Shapiro, 2010). Although this bias can be partly counteracted by focal stress on non-local correlates (Carlson et al., 2009), as well as other indicators of discourse prominence, there is a processing cost associated with retrieving a structurally dispreferred correlate (Carlson, 2001, 2002, 2013; Stolterfoht et al., 2007; Harris, 2014).

(14) a. Somebody claimed that the president fired someone but nobody knows who.

b. (Only) the curator embarrassed (only) the gallery owner in public, not the artist.

Similarly, the remnant phrase *the artist* in the replace ellipsis in (14b) preferentially contrasts with the object *the gallery owner* over the subject *the curator* (Paterson et al., 2007; Carlson, 2013). As before, the object bias can be mitigated by placing a focus marker like *only* on the subject, although this again incurs a processing cost (Carlson, 2013).

Accordingly, an additional aim of the corpus study that follows is to determine whether *let alone* coordinations show a similar locality bias to other forms of ellipsis. We state the prediction that it will as the processing constraint in (15).

(15) **Locality bias:** Contrast the remnant with the nearest constituent in the preceding clause.

In other words, we expect a general preference for contrasts between remnant and correlate to be as local as possible, with no intervening constituent of the same type. To illustrate, Locality predicts that local contrasts like (16a) should be preferred over non-local contrasts (16b).

(16) John didn't take the poodle to the park, let alone …

a. the zoo. (Local contrast with *the park*)

b. the pug. (Non-Local contrast with *the poodle*)

As an alternate strategy, *let alone* coordination might instead adjoin next to the item with which it contrasts; (17) is a variation of (16b) in which the Locality bias is respected.

(17) John didn't take the poodle, let alone the pug, to the park.

However, we do not expect that (17) will necessarily be preferred over (16b). This intuition is supported by extant syntactic accounts which give non-clause-final instances of *let alone* alternate, and arguably more complex, derivations from the clause-final case (e.g., Hulsey, 2008). We posit (18) as an intuitive generalization about the position of *let alone* coordination to be explored in the corpora, as well as experimentally.

(18) **Finality bias:** Don't interrupt a clause with *let alone* coordination.

In the next section, we present the distribution of *let alone* coordination within two corpora, with special attention paid to the syntactic type of the remnant and the extent to which *let*

alone conforms to the Locality and Finality biases. Then, we test the effect of Locality in two online phrase-by-phrase reading studies. Finally, we conclude with a sentence rating study that probes the tradeoff between Locality and Finality.

Corpus studies

In this section, we focus most centrally on three questions. First, is there a bias for VPs in corpora, corresponding to the VP bias observed in Harris' (submitted) experiments? Second, is there a tendency for *let alone* remnants to contrast with the most local correlate possible, as predicted by the Locality constraint? And, third, does *let alone* coordination appear most frequently in clause-final position, as predicted by Finality?

To address these questions, examples of *let alone* were annotated for (i) syntactic category of the remnant,(ii) syntactic category of the contrastive part of the remnant, (iii) position of the *let alone* coordination (clause-final or not), and (iv) locality of correlate-remnant pairs.

Annotation procedure

We extracted 1232 instances of *let alone* coordination from the British National Corpus (BNC), which contains 100 million words sampled from written (90% of the corpus) and spoken (10% of the corpus) sources with a variety of registers.[5] To ensure that the distribution was not unique to British English, we also extracted the first 804 instances of *let alone* coordination from the Corpus of Contemporary American English (COCA), a dynamic 450 million word corpus sampled from 190,000 texts obtained from 1990 through 2012. Texts in COCA are sampled from spoken language, including unscripted conversations, radio interviews, etc., as well as written sources including fiction, magazines, newspapers and academic journals (see Davies 2010 for description). We removed repetitions and speech errors from the dataset. A total of 8 cases were classified as errors or uninterpretable, and were eliminated from the BNC data. Twenty-eight such cases were eliminated from the COCA data.

Syntactic category

The data were coded for the syntactic category of the remnant. For ease of presentation, we present a simplified dataset omitting 21 low-frequency syntactic categories, including possessives, *wh*-words, and relative clauses, from the BNC data – these categories were not observed in COCA. In addition, instances which we could not code for Locality or Finality were eliminated from each dataset, for a total of 1196 remaining cases of *let alone* coordination in the BNC and 776 in COCA.

The syntactic categories we present here are adjective (Adj), adverb (Adv), determiner (Det), noun (N), noun phrase (NP), preposition (P), prepositional phrase (PP), sentence complement (SC), verb (V), and verb phrase (VP). The categories with both phrase and head labels are ones where some examples clearly involved only the head (X) and others involved entire phrases (XP). For example, only the verb is involved in this example from the BNC:

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[5]Data cited herein has been extracted from the British National Corpus Online service, managed by Oxford University Computing Services on behalf of the BNC Consortium. All rights in the texts cited are reserved.

But do not expect me to [understand], let alone [share], your views. The two contrasting verbs even share the following NP object. But a full VP is clearly at issue in this BNC example: *He barely had time to [pay his dues], let alone [think up new material].*

By far, the most common syntactic categories for *let alone* remnants were VPs and NPs, which collectively accounted for about 80% of all cases in both the BNC and COCA (see Table 1 for the BNC, and Table 2 for COCA). Nouns and noun phrases constituted 47% and 51% of the total data in the BNC and COCA, respectively; verbs and verb phrases made up 37% of the total data in the BNC, and 33% in COCA. This distribution clearly does not pattern with the VP bias observed in Harris' (submitted) offline questionnaires, nor does it support an exposure-based explanation of that data. The next highest category was PP. All other categories accounted for 4% of the data or less.

The syntactic category of the contrasting part of the remnant followed essentially the same pattern: nouns and noun phrases, along with verbs and verb phrases were the most dominant at 83% in the BNC and 82% in COCA of the data, followed by Adjs and PPs. In the majority of cases (75% in the BNC and 79% in COCA), the remnant was the same syntactic category as the contrastive unit. That is, noun remnants were directly contrasted with nouns, adjectives with adjectives, and so forth. The most common type of exception (60% of non-agreeing cases in the BNC, and 62% in COCA) was when remnants were syntactically entire phrases, but only sub-parts of the phrases were actually contrastive. So NPs might contrast fully with other NPs, or only on a Det, Adj, Noun, or other sub-unit. In (19a), although the remnant is an entire VP, the actual contrast is between the verbs alone. Similarly, the semantic contrast in the NP remnant in (19b) is actually between the numerical modifiers.

(19) a. I ask myself whether Chaillot ever *glanced at* his libretto, let alone *read* it. (COCA)

b. I was impressed by her self-confidence; I 'd never had *one* boyfriend, let alone *as many as* she'd had. (COCA)

In addition, we found 20 instances in the BNC and 14 instances in COCA, or approximately 2% of the data in both datasets, in which the *let alone* remnant had no overt correlate in the matrix. We call such cases "sprouting" on analogy with the literature on sluicing, in which a *wh*-element in the IP ellipsis corresponding to an implicit argument in the matrix is said to "sprout" from the ellipsis remnant, e.g., *John ate, but I don't know __what__* (Chung, Ladusaw, & McCloskey, 1995). Most of the sprouting cases involved "adjective sprouting" (20a), in which the *let alone* remnant added an adjective to contrast with an unmodified NP correlate, or the addition of an adjunct modifier (20b).

(20) a. Counselling is not *a "chat"* let alone *a quick chat*. (BNC)

b. That only perhaps left him one alternative – an ultimate alternative which no-one, not even Carnelian, could reasonably expect him to invoke, let alone *soon*… (BNC)

Locality

The second reason for exploring the corpora was to determine whether *let alone* coordination exhibited a bias towards local contrasts between the remnant and correlate. We

coded a contrast as local if no phrase or head of the same syntactic type in the correlate clause intervened before the *let alone* remnant, though material from other categories could intervene. One exception involved contrasts with NPs in subject position, where we took the intervening VP to make the contrast non-local. We made this decision because it would be possible to put the remnant inside the clause and before the verb in order to make the contrast truly local. A number of subject contrasts do just that, with the *let alone* phrase preceding the verb, as in the COCA example *Common sense, let alone basic human compassion, would dictate that*…. Example (21a) is non-local because the NP *political life* is structurally closer to the *let alone* phrase than the contrasting head of the higher NP, *major figure*; (21b) is local; and (21c) is non-local because the contrasting NP *anyone* is the subject of an intervening verb.

> (21) a. She was not brought up to be *a major figure* in <u>political life</u>, let alone *a ruler*. (BNC)
>
> b. It isn't fit for *a latrine*, let alone *a resting place for the dead*. (BNC)
>
> c. That's a hell of a feeling for *anyone* to have, let alone *a five-year-old*. (COCA)

In addition, we did not count non-restrictive appositives or parentheticals as intervening, given arguments that they are independent from their host clause (e.g., McCawley, 1998).

Overall, 84% of cases in the BNC and 82% of cases in COCA had local contrasts. As shown in Table 1, the Locality bias was evident across all types of remnant categories. NP and PP categories showed a less robust bias at 74% and 79% local contrasts, respectively, in the BNC, and 72% and 80% in COCA. In a number of remnant types, there seemed to be a categorical preference for local contrasts, although in most of these cases the total counts are relatively low so it is difficult to assess whether the sample is truly generalizable.

However, one set of cases worth considering further is V remnants, in which local contrasts were observed in all cases in both the BNC and COCA. These may be subdivided into two main types. In the first type, the remnant and correlate seemed to share an argument, e.g., *by our desires* in (22a), and *her magnificent record* in (22b).

> (22) a. It does not seem that we necessarily are always simply *taken*, let alone *overtaken*, by our desires… (BNC)
>
> b. Doubtless very few will manage to *come near to*, let alone *equal*, her magnificent record. (BNC)

The second type of case involved ellipsis of an argument. In (23) below, for example, although the remnant consists solely of the verb *passed*, it is understood as an elided variant of *passed them*.

> (23) Although Indians had been allowed to join the ICS since 1858, only a handful had actually *sat its fiercely competitive examinations*, let alone *passed*. (BNC)

These cases are particularly interesting as they implicitly show the tradeoff between preferences for Locality and Finality. In (22) and (23), the contrast is as local as possible, but violates the preference for Finality, with argument sharing or ellipsis as a consequence.

Finality

Another consideration was the position of the *let alone* phrase itself. As shown above (5), the coordination may appear in a variety of positions within a clause, although Finality predicts that the preferred position is at the end. We observed a general preference (82% for BNC, 85% for COCA) for *let alone* in clause-final position, as predicted. However, there was considerable variation between types of remnants, as displayed in Tables 1 and 2. The rough generalization appears to be that the Finality preference is stronger for remnants whose correlates are likely to be at the end of a clause already, as in NPs, VPs, PPs, and sentence complements. Remnants of the categories Adj, Adv, Det, and V show much more variation with respect to Finality, and some, like Det and V, show a strong preference against Finality. This variation suggests the possibility that, depending on the category, Finality is sometimes deemed less important than Locality, in that the production mechanism prefers Local contrasts over positioning the *let alone* coordination after the end of a clause. We address the connection explicitly in Experiment 3 below.

In cases where Finality is satisfied to the detriment of Locality, the remnant often employs an anaphoric element like ellipsis or an overt pronominal. The tradeoff between the two strategies can be seen if we minimally alter example (22b) above by including the pronominal element *it*:

> (24) Doubtless very few will manage to *come near to* her magnificent record, let alone *equal* it. (BNC)

In the majority of instances, both Locality and Finality were satisfied (BNC: S = 798, 66%; COCA: S = 531, 68%).[6] When one was violated, there was a very slight preference to violate Finality for the sake of Locality (BNC: S = 202, 17%; COCA: S = 125, 16%), over the other way around (BNC: S = 182, 15%, COCA: S = 108, 14%). The 15 instances in the BNC (1%) where neither Locality nor Finality was obeyed were all NP remnants, usually ones in which the *let alone* remnant contrasted with the subject of a transitive matrix clause. The same pattern was observed in all 12 instances in COCA.

Discussion

To summarize, we found no evidence for a VP preference in corpora, contrary to the predictions of an exposure-based explanation of the VP bias in Harris' (submitted) study of *let alone* coordination. Instead, we observed a bias towards NPs over all other categories, although both NPs and VPs were very frequent and clearly dominated the other categories in both the BNC and COCA. While an exposure-based account is not supported by the conflicting patterns in the corpus distributions and the experimental results, a discourse explanation is still viable.

However, the frequency of NP remnants in the corpora may also be explained, at least in part, by the structural constraints discussed above. Canonical sentences in English are of the SVO type. If both Finality and Locality are obeyed, the preferred position for the *let alone* coordination is at the end of the clause, where the most local contrast is often the object of

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[6]We use the symbol 'S' to denote the sum total of cases found in the corpus.

the verb. Indeed, we found a considerable preference for Locality and Finality in the corpora. Given that *let alone* coordination involves contrast, it may also be relevant that the default position of focus in an English sentence is at the end of a clause (Selkirk, 1984; Cinque, 1999; a.o.). The Finality and Locality constraints together predict that remnants will be found at the end of the clause and tend to contrast with the nearest relevant constituent, which means they likely pick out an already focused item. In other work, we have found that the location of contrastive accent influences the interpretation of ambiguous *let alone* coordination by over 20% (Harris & Carlson, 2014b), so the focus status of a phrase could well influence the likelihood and ease with which it is taken as the correlate to a *let alone* remnant. We now turn to whether the processor obeys Locality during online sentence processing.

Experiment 1

This self-paced moving window experiment, as well as the following, tests the basic prediction of Locality in real-time processing: plausible local contrasts are to be preferred over non-local ones. Assuming that the remnant and the correlate of *let alone* ellipsis must contrast within the discourse, we manipulated where the most plausible location for the correlate was through the placement of superlative or ordinal adjectives with contrastive scalar counterparts, e.g., *nicest-meanest*, *first-second*, or *richest-poorest*. Such adjectives were intended to provide the processor with cues regarding which noun was the correlate by providing an indicator of discourse contrast, thereby putting the structural Locality bias in potential conflict with the discourse cue. For example, (25b) violates the Locality bias if the adjective indicates the position of a contrastive correlate for the *let alone* remnant. But the processor should favor an analysis in which the remnant *meanest one* contrasts with whichever correlate bears a term like *nicest*, in order to have semantically similar contrast.[7]

(25) a. The nurse couldn't stand the *nicest* patient, let alone the *meanest* one.

b. The *nicest* nurse couldn't stand the patient, let alone the *meanest* one.

Participants

Forty-eight native speakers of English from the Claremont Colleges participated for $10 per testing session, which lasted no more than 40 minutes.

Materials and method

The experiment consisted of 16 pairs of sentences manipulating the syntactic placement of an adjective like *nicest*, which modified the object (*Local contrast*) or subject (*Non-local contrast)* noun in the matrix clause. The remainder of the sentence, i.e., Region 4 and following segments, was the same across sentence pairs, all of which are listed in Appendix A.

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[7]Although only the location of the adjective was manipulated, this may have had unintended consequences on discourse structure and complexity, as pointed out by an anonymous reviewer. For example, the presence of an adjective might affect implicit accent placement, rendering one noun more salient or contrastive than another. Also, the subject and object nouns varied in order to create natural-sounding sentences, meaning that the contrast sets were different: other nurses vs. other patients. But unless all items had reversible meanings, it would be difficult to use the same nouns in subject and object positions of different conditions.

(26) a. |$_1$ The nurse |$_2$ couldn't stand |$_3$ the nicest patient, … (Local contrast)

b. |$_1$ The nicest nurse |$_2$ couldn't stand |$_3$ the patient, … (Non-Local contrast)

|$_4$ let alone |$_5$ the meanest one, |$_6$ and no one at the hospital |$_7$ was happy at all.

Items were presented in a self-paced moving window by the Linger program (Rohde, 2003) on a Dell Optiplex Tower on a 17inch Dell LCD screen using Windows 7, so that readers revealed one region at a time at their own pace by pressing the space bar (see (26) for example of segmentation). Non-essential programs and the Internet connection were turned off, so as to limit interference from peripheral programs (Plant & Turner, 2009). Subjects were instructed to rest their fingers on a Logitech PS/2 keyboard and to read naturally for comprehension. Experimental items were presented in individually randomized counterbalanced orders, interspersed with an additional 46 items from unrelated experiments, and 28 non-experimental fillers. Participants were presented with comprehension questions, as in (27), after half of all items, in order to ensure that they were paying attention to the sentences. As shown in Appendix A, half of the comprehension questions were polar Y/N questions, while the other half were *wh*-questions, such as *Where were the kids?* Answers were displayed on the left and right sides of the screen; the side was selected at random for each trial.

(27) Was the nurse on good terms with the patients?

i. Yes

ii. No

Results

Subjects performed well on the comprehension questions, yielding a success rate of 97% with just a 1% difference between conditions. No subject answered more than two of the eight comprehension questions after the critical items incorrectly. The comprehension data were not examined further.

Reading times over 3 standard deviations from the mean for each region were considered outliers and eliminated from the data prior to analysis of reading times. Outlier removal resulted in approximately 2% data loss overall and no more than 2.5% for any one region.[8] Means and standard errors for Experiments 1 and 2 are presented in Table 3, presented visually in Figure 1. Response time data for Regions 5 - 7 were subjected to a linear mixed effects regression model (Baayen, Davidson, & Bates, 2008) in R (R Development Core Team, 2008) using the lme4 package (Bates & Maechler, 2009), with sum-coded (ANOVA-style) fixed effects contrasts, and maximal random effects structures (Barr et al., 2013). We computed three models of increasing complexity for each region of interest: the first used the planned effect of Contrast (Local vs. Non-Local contrast) as the sole predictor, the second included Order of presentation as an additive predictor, and the third included Order as an interactive predictor, so that Contrast, Order and their interaction were all predictors in the model. The random effects of all models were specified as by-subjects and by-items

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[8]Qualitatively similar results were observed with outliers retained for Experiments 1 and 2.

random slopes and intercepts for Contrast only, regardless of the fixed effect structure. Models were compared using the *anova* function in the R base package, so that the simplest model, here the first, was compared against the more complex models. We report the results of the best-fitting model, defined as the model whose increased complexity was justified by a significantly lower AIC value (Akaike Information Criterion, Akaike, 1974). If the increased complexity generated by the additional predictor was not warranted, we report the simpler model; see Table 4 for details. As there is no general consensus regarding the computation of *p*-values in linear mixed effects models, we follow the convention of considering an absolute value of the *t*-statistic over 2 as significant.

In Region 5, the region containing the remnant, the best-fitting model was of the second type, with Contrast and Order as additive predictors, and there was a 62ms penalty for Non-Local contrast over Local contrast conditions, $t = 3.34$. In addition, subjects read this region more quickly as they progressed through the experiment, $t = -9.72$, but not differentially so for different Contrast types.

In Region 6, the spillover region, the best-fitting model was the most complex model tested, with Contrast, Order, and their interaction as predictors. Again, we found the predicted cost for Non-Local contrast in a 30ms reading time penalty, $t = 3.78$. As in the previous region, subjects sped up over the course of the experiment, $t = 8.19$, but interestingly, the effect of Order was greater for Non-Local contrast conditions over their Local contrast counterparts, $t = -2.71$. In a post-hoc correlation test, reading time was negatively correlated with Order for both Non-Local ($t(370) = -4.82$, $p < 0.001$, $r = -0.24$) and Local ($t(378) = -3.43$, $p < 0.001$, $r = -0.17$) contrast conditions. This interaction suggests that subjects may have habituated slightly to violations of the Locality bias over the course of the experiment. Notably, the reduction was present only in the spillover region. As such, the subjects may have simply *recovered* faster as the experiment progressed, rather than tuned their expectations on the basis of the placement of the contrasting adjective in the preceding clause.

In Region 7, the final region, the only effect observed was an overall decrease in reading times in later trials, $t = -7.61$. No other significant effects were observed.

Discussion

The results above support the claim that the Locality bias is operative during online comprehension, in that reading times on the remnant and following region were inflated when the correlate bearing the contrastive adjective was not in the preferred structural position, i.e., object position for SVO sentences. The results are consistent with not only the general distribution of *let alone* coordination observed in the corpus study above, but also with an ellipsis analysis of *let alone* coordination. The nearest potential correlate for the remnant, the object NP, is both closer to the remnant and likely to be focused. In addition, choosing a correlate for the remnant which contained a clear scalar adjective allows the correlate and remnant to be maximally parallel (or similar) in form, which is common in ellipsis (see e.g. Carlson, 2001, 2002).

In sum, the processing and corpus patterns suggest that the object is the preferred correlate for an NP contrast, and that this preference may be overturned if the lexical semantics of an

element in another position provide a better or more accessible scale, but that deviation from the preferred position comes at a cost.

Experiment 2

When discussing the NP bias in the corpus results, we proposed that the size of the preferred remnant type in focus-sensitive coordination is highly dependent on context. However, we also found a very strong bias against non-local correlates, both in the corpus study and the experiment above. In the previous manipulation, adjectives standing in natural scalar contrasts favored different correlate-remnant pairs – that is, the remnant contrasted with a noun in either subject or object position. These effects could be attributed solely to the ease of identifying the contrastive unit when overtly scalar adjectives were present, without requiring a strong relation to prior discourse. We now test the Locality bias in another self-paced reading study, in which the processor must consult previous context to determine the best correlate-remnant pair.

Participants

Thirty-two native speakers of English from the Claremont Colleges participated for $10 per testing session, which lasted approximately 45 minutes on average.

Materials and methods

We presented subjects with 16 pairs of context-target pairs. Instead of varying the placement of an adjective in the matrix clause, we created Local and Non-Local contrasts through a polar question presented immediately above the target sentence. In the Local contrast condition, the object of the question was the conjoined phrase *Paul and Susan* (28a); in the Non Local contrast condition, the subject was the conjoined phrase *Gina and Susan* (28b). Essentially, the sub-phrase *and Susan* appeared in one of two positions in the question, but its effect was to make either the object or the subject a set of two individuals rather than a single individual. The manipulation set up a natural contrast between two individuals while minimally varying the context. Target sentences were identical for each condition. All items contained distinct proper names. See Appendix B for a complete list of items.

> (28) *Context questions:*
>
> a. Did Gina remember Paul and Susan? (Local contrast)
>
> b. Did Gina and Susan remember Paul? (Non-Local contrast)
>
> *Target sentence:*
>
> |$_1$ Gina didn't remember Paul, |$_2$ let alone Susan, |$_3$ even though they met|$_4$ last year.

The expectation was that the contrast between the remnant *let alone Susan* and either the subject or object in the preceding clause would depend on whether *Susan* had been mentioned as one of two individuals in that NP position.

Items were presented with 60 items from unrelated experiments and 38 non-experimental fillers. There were no comprehension questions after these items, although subjects did answer comprehension questions after some other items throughout the experiment. The

self-paced reading procedure was the same as Experiment 1, and was conducted on the same equipment, with essentially the same instructions.

Results

Prior to analysis, we removed outliers, defined as above, with approximately 2% data loss and no more than 3% of the data removed from any one region. Means and standard errors are presented in Table 3, along with those in Experiment 1, and are depicted graphically in Figure 2. A series of linear mixed effects regression models of increasing complexity, whose effect structures are the same as those specified as in Experiment 1, was computed for each region; we report the effects of the best-fitting model.

The sole effect was observed in Region 2, which contained the *let alone* coordination and the remnant. The best-fitting model consisted of two independent predictors of Contrast and Order. As predicted, there was a significant cost for remnants contrasting with the subject noun, which manifested as a 76ms cost for Non-Local contrast conditions, $t = 2.90$. In addition, reading times decreased over the course of the experiment, $t = -11.72$, but this effect did not interact with Contrast type.

Discussion

The predicted penalty for a non-local correlate was observed in Experiment 2, a pattern that is clearly consistent with the Locality bias. A remnant following *let alone* that ultimately contrasted with the object NP was processed faster than one contrasting with the subject NP. Further, merely manipulating the placement of conjoined NPs in the preceding context questions produced an immediate penalty on the remnant region in the target sentences. This suggests that readers immediately utilize a representation of the discourse when interpreting focus-sensitive coordination, lending further evidence to the dependence between *let alone* coordination and the discourse topic (Toosarvandani, 2010; Harris & Carlson, 2014b).

Experiment 3

In our final experiment, we examine the tradeoff between Locality and Finality. As mentioned in connection with examples (16) and (18), the sentence production mechanism might elect to obey either Locality or Finality at the expense of the other. To take an example from the BNC (29), the *let alone* remnant *a burglary* contrasts with the complex NP phrase *a piss-up in a brewery*, rather than with the most local constituent, *a brewery*.

> (29) *Non-local, clause-final*
>
> I couldn't organise *a piss-up in a brewery*, let alone *a burglary*.
>
> (30) *Local Alternatives, neither satisfactory*
>
> a. Local, clause-final: I couldn't organise a piss-up in a brewery, let alone a bakery.
>
> b. Local, not clause-final: I couldn't organise a piss-up, let alone a burglary, in a brewery.

In such cases, the processor has no choice but to violate Locality, for salient alternative constructions with a Local contrast either require a remnant like *a bakery* comparable with *a*

brewery and yield a very different meaning (30a), or else (30b) imply that the PP *in a brewery* applies to the remnant, as well. In addition, the penalty for a non-local contrast can be reduced by appropriate pitch accents on contrastive items, as in *a PISS up in brewery, let alone a BURGlary*, discussed further below. Nevertheless, there are cases where Locality and Finality might genuinely compete. We turn to such cases below.

Participants

Twenty-two subjects were recruited using Amazon's Mechanical Turk, a web-based service for paying subjects to perform small tasks over the Internet. In a pre-experiment questionnaire, all subjects self-reported as native speakers of English. A pre-test consisting of three semantically complex sentences tested the subjects' command of the language. Subjects who answered any one of these three questions incorrectly were to be excluded from the final data set. However, no subjects answered any of these questions incorrectly. An anonymous version of the subject's IP address was recorded to identify subjects who tried to complete the experiment more than once, but no such individuals were found. The experiment also contained four ungrammatical catch items to identify inattentive or uncooperative subjects. Two subjects were excluded for having errors on one or more of these items, resulting in a dataset consisting of responses from a total of twenty subjects. Subjects were paid $4 for the experiment, which lasted approximately 20 minutes on average.

Materials and methods

Sixteen quartets of conditions were constructed based on the items in Experiment 1, so that the *Local Final* (31a) and *Non-Local Final* (31b) conditions correspond to the Local and Non-Local conditions in that experiment, respectively. Two further conditions varied whether subject remnants appeared closer to their correlate, either at the end of the noun phrase, Local Medial (31c), or interrupting it, Local Initial (31d). Subjects rated sentences for naturalness on a 1-7 Likert scale (where 7 = "Completely natural"), as in (32) below.

(31) a. *Local Final*

The nurse couldn't stand the nicest patient, let alone the meanest one.

b. *Non-Local Final*

The nicest nurse couldn't stand the patient, let alone the meanest one.

c. *Local Medial*

The nicest nurse, let alone the meanest one, couldn't stand the patient.

d. *Local Initial*

The nicest, let alone the meanest, nurse couldn't stand the patient.

(32) How natural does the sentence sound?

(Completely unnatural) 1 2 3 4 5 6 7 (Completely natural)

Items were presented in individually randomized and counterbalanced orders using Ibex Farm (Drummond, 2012), and were interspersed with 40 items from other, unrelated experiments, 28 non-experimental fillers, and 4 ungrammatical catch items.

Results

As expected, Local Final, the condition satisfying both Locality and Finality, was rated the most natural ($M = 5.89$, $SE = 0.14$), followed by Local Medial ($M = 5.55$, $SE = 0.15$). Non-Local Final ($M = 5.29$, $SE = 0.18$) and Local Initial ($M = 5.24$, $SE = 0.16$) were rated lowest among the group.

The rating data were first subjected to a linear mixed effects regression model, with by-subjects and by-items random slopes and intercepts as in the previous experiment, and then an additional set of t-tests to examine specific comparisons not modeled by the regression model. In the regression model, the condition of the item was the sole predictor. Non-Local Final was treated as the baseline intercept, to test whether the deviation of each condition from the grand mean is greater than what would be expected if all conditions were the same (assuming that the deviation exhibited by the baseline approximates the overall deviation). Only the Local Final condition (31a) showed any significant improvement from the grand mean in the model, $t = 3.46$; see Table 6. An additional pairwise t-test with Bonferroni correction revealed significant differences between the Local Final condition and both the Non-Local Final and the Local Initial conditions, p's < 0.05, although not the Local Medial condition. The penalties for violating Locality and Finality were confirmed in additional by-subjects (t_1) and by-items (t_2) one-tailed paired t-tests, which found a significant rating advantage for Local Final over two other conditions (Non-Local Final, $t_1(19) = 2.95$, $p < 0.01$, $t_2(15) = 1.9$, $p < 0.05$; Local Initial, $t_1(19) = 3.67$, $p < 0.001$, $t_2(15) = 2.32$, $p < 0.05$), and a marginal advantage over the Local Medial condition (Local Medial, $t_1(19) = 1.92$, $p < 0.05$, $t_2(15) = 1.02$, $p = 0.16$).

Discussion

As predicted, structures that obey both Finality and Locality are preferred. Indeed, interrupting a clause with a *let alone* coordination came at a small, but significant, cost to naturalness, especially if it also interrupted a phrase. Of course, we have not manipulated all possible configurations, and so cannot be certain that there are not circumstances in which Locality would be preferred above all else, especially considering the variation observed in corpora, exhibited in Tables 1 and 2. Some remnant categories, like V and P, for example, are much more likely to violate Finality. In conjunction with the corpus study, though, the results above support a general preference for *let alone* placement to obey both Locality and Finality, if possible.

One might ask why Finality should be preferred over Locality in these cases. One answer is a syntactic one: the derivation of non-clause-final cases could be more complex, requiring additional syntactic operations to reconstruct the proper syntactic form. Another answer would be that violating Locality could be reasonably mitigated when the appropriate prosodic or other discourse cues are present. The second proposal would predict that there *are* configurations in which violating Locality is *worse* than violating Finality: specifically,

when applying the necessary prosodic cues for disambiguation is not possible, or when satisfying Finality requires resolving additional dependencies. A case of the latter might be additional ellipsis or anaphora within the remnant, though we suspect that, on the whole, such cases are not terribly costly; we observed several examples in the corpora like *Mary didn't take two slices of pie, let alone one*, which results in a mismatch between remnant type and contrast. Of course, the syntactic and discourse approaches are not necessarily mutually exclusive.

General discussion

The *let alone* construction is an interesting one to study because of the many dimensions on which it varies, including the syntactic category of the remnant, the scale on which the phrases contrast, the syntactic category of the contrastive unit, the position of the remnant, and the relationship between the host sentence and the larger discourse, to name a few. Although some researchers have been tempted to grant the *let alone* structure a special status (Fillmore et al., 1988), given its adherence to a unique collection of grammatical and extra-grammatical constraints, our research suggests that its processing is governed by principles found in other instances of ellipsis.

First, the corpus distributions were consistent with Harris' (submitted) completion studies overall, in that the majority of *let alone* constructions involve VPs and NPs, even though the syntactic category may vary considerably. The corpora did evince a slight bias towards NP remnants, in contrast with the general preference for VP remnants that Harris found in processing. Thus, we suspect that there is no syntactic preference behind the findings, and that the VP bias is not simply the result of exposure and frequency.

Second, the *let alone* remnant was shown to obey a Locality bias, as expected if *let alone* coordination patterns with other ellipsis constructions. Corpus distributions supported the central prediction of Locality, especially for the most frequent syntactic categories. Experiments 1-2 used two different ways of biasing the position of the correlate of the *let alone* phrase, the first through the location of a scalar contrast within the matrix clause, and the second through the discourse established by a preceding question. Both methods proved to be effective, as each manipulation showed a reading time penalty for non-local contrasts. So, not only are local contrasts frequent in collected samples of this construction, they also (i) govern on-line expectations for unfolding structure, and (ii) interact with both sentence-internal and sentence-external discourse cues. Experiment 3 showed a preference for local contrast over non-local contrast, as well as an interaction with the position of the *let alone* coordinator.

We observed that the Locality bias interacts with an additional Finality bias. Corpus distributions show that *let alone* coordination is usually clause-final except for specific syntactic categories, such as bare verbs, prepositions, and determiners. Experiment 3 tested readers' preferences regarding the locality of contrast and the position of the remnant, with the remnant in clause-final, phrase-final, and phrase-interrupting positions. The least preferred position was when the remnant interrupted a noun phrase as well as a clause; the best position was following the complete clause. In the corpus data, most violations of

Finality appear to happen for the purposes of satisfying Locality. For example, adjectives, which are usually inside NPs, show 97% local contrasts but only 42% are in final position, because keeping the contrast local usually involves putting the remnant inside the clause. Similarly, verbs are overwhelmingly local but almost always non-final because, again, getting a local contrast requires the remnant to interrupt the VP. Nevertheless, it remains likely that Locality can be violated when there are other cues, such as pitch accent, context, or anaphoric elements in the remnant, to signal the location of the appropriate correlate, as discussed in connection with (29).

If all instances of *let alone* coordination involved contrast with subject and object noun phrases, as in Experiments 1-3, then it might be possible to explain the positional (Locality) effects as driven by default focus placement. That is, objects are more likely than subjects to be focused (either narrowly or broadly, indicating focus on the entire VP), and focused items are natural correlates for a contrastive phrase like a *let alone* remnant (see Carlson et al., 2009 for such an explanation regarding sluicing preferences). But the corpus results show Locality and Finality preferences across a wide range of different syntactic categories, not only NPs, including function words (which are rarely focused or accented; see German et al., 2006, for example). We have concentrated on providing evidence that *let alone* coordination is guided by a structural bias for local correlates, as well as a preference for appearing in clause-final position. However, there are many additional factors that could be explored, including the relationship between pitch accent placement and locality.

Our experiments above might seem to lack the appropriate non-ellipsis control, as pointed out by an anonymous reviewer. Unfortunately, the grammatical restrictions of the *let alone* construction prohibit such a control, at least if using the *let alone* coordinator, because the construction always requires ellipsis. We might have tested the consequences of violating Locality with ordinary coordinators. However, our intuitions are that comparable sentences (*The nicest nurse couldn't stand the patient and the meanest one*) are simply ill-formed. Another option might have been to use other connectives like *or even* in place of *let alone*, but such cases certainly allow ellipsis of the second conjunct, and quite possibly are strongly biased towards an ellipsis analysis. It is not clear therefore what the appropriate controls would be.

In general, our results suggest that the processor considers both structural information (explored here via the Locality bias) and contextual information (as illustrated by the need to contrast elements that cohere with the discourse) during online processing. However, one source of information is not sufficient to override the other: the Locality bias persists despite very good contextual cues regarding the location of the contrasting element. Not only was discourse information regarding contrast, both internal and external to the sentence, shown to strongly influence processing patterns, it was shown that Locality is not simply a preference used in the absence of more reliable indicators of contrast.

Although we have said less about the semantics than the syntactic distribution of *let alone*, the above studies provide insight not only into the narrow *let alone* construction, or even the class of focus-sensitive coordinators, but into the generation of semantic propositional alternatives during real-time processing. On Toosarvandani's (2010) account, the *let alone*

construction places propositional alternatives like *John doesn't love Mary* and *John doesn't love Sue* on a contextually salient scale as determined by contextual entailment. Similarly, Hulsey (2008) proposes that *let alone* semantically represents a disjunction whose disjuncts are in a scalar relationship. Either way, the processor is tasked with two potentially difficult processes when interpreting *let alone* coordination: in addition to recovering the complete propositional content from the remnant, it must also determine, or at least accommodate, the intended scalar relationship between the two propositions. We have concentrated on the former, showing that the processor recovers the proposition from the remnant as it would any other ellipsis structure – through a bias towards local contrasts.

However, recovery of salient alternatives is not altogether blind to contextual input: the processor seemingly recovers the appropriate correlate by comparing the structurally preferred option to expectations established by the discourse. The above experiments were not designed to distinguish whether such discourse expectations interact with structural ones simultaneously or occur after recovery of the ellipsis, or even how the propositional content and concomitant scalar contrast of the *let alone* remnant is integrated into the overall discourse. But at the very least, the online experiments above indicate that the discourse factors are considered while the remnant is being processed.

Integrating the remnant into discourse in *let alone* constructions presents a different perspective on the generation and interpretation of scalar inferences, a subject which has received much attention in recent literature (e.g., Noveck, 2001; Breheny, Katsos, & Williams, 2006; Geurts et al., 2010; Chemla & Singh, 2014a,b, among many others). Scalar implicatures, to use Grice's term of art, involve an inference in which using an item ranked lower on a scale, like *some*, is understood to negate the truth of higher-ranked items on the same scale, like *not all*. For example, using *Some cats like Whiskas* instead of the stronger *All cats like Whiskas* implicates *Not all cats like Whiskas*, provided that the latter is a live alternative in the discourse. Notably, in addition to scales formed from the lexical semantics of quantifiers *<all, some, none>* or simple linguistic expressions *<rich*, *poor>*, or *<fast, slow>*, etc., elements on a scale may be determined through accessing encyclopedic knowledge or even on an *ad hoc* basis. It is perhaps worth noting that in all these cases the stronger alternative must be inferred by the comprehender. What is interesting about the *let alone* construction is that it presents the terms to be compared *explicitly* in the syntax, as in example (1), *John won't drink coffee, let alone tea.* Therefore, language comprehenders need not worry about generating the alternatives the speaker or author may have had in mind implicitly, but must instead (i) complete the proposition expressed by the remnant, as in *John won't drink tea* above, and (ii) accommodate a scale implied by contrasting the correlate and the remnant.

We exploited an intuitive understanding of scalar contrast in the manipulation of contrastive adjectives and previous context in our online experiments, but acknowledge that there is much to be explored in terms of how the processor accommodates the scale. For example, are context-sensitive scales more difficult to infer than lexically encoded ones in real time processing? This might be anticipated given that children seem to perform worse on scalar implicatures involving scales formed through *ad hoc* and encyclopedic relations (e.g., Papafragou & Tantalou, 2004; Barner, Brooks, & Bale, 2011). That is, what sort of cues do

comprehenders use to generate hypotheses about the intended scale, and do different types of cues receive different consideration in online processing? Can discourse cues serve to overturn syntactic ones?

While more evidence is required to assess these questions, we believe that *let alone* coordination and related constructions provide a unique situation in which to study how the processor copes with a multitude of syntactic, semantic, prosodic, and discourse factors to create a sensible interpretation. In all, it seems that processing *let alone* utilizes just the sort of real-time processing defaults observed in other types of ellipsis. It remains to be seen whether these defaults persist when additional types of evidence are made available, and at what time point in processing such cues are considered.

Acknowledgments

Appendix A

Items from Experiment 1. The adjective in parentheses, e.g., *(nicest)*, appeared either before the subject or the object.

1. The (nicest) nurse couldn't stand the (nicest) patient, let alone the meanest one, and no one at the hospital was happy at all.

   Was the nurse on good terms with the patient? Yes / No.

2. The (second) plumber couldn't fix the (second) leak, let alone the first one, and water from the sink was getting everywhere.

   What couldn't be fixed? The sink / The shower.

3. The (most outgoing) reporter didn't bother the (most outgoing) performer, let alone the most reserved one, and the gala went well.

4. The (most experienced) contractors couldn't find work for the (most experienced) painters, let alone the most novice ones, no matter the job.

   Was there enough work for everyone? Yes / No.

5. The (goofiest) audience members didn't laugh at the (goofiest) jokes, let alone the most mature ones, and the comedian was flustered.

6. The (silliest) babysitter couldn't amuse the (silliest) child, let alone the gloomiest one, and the daycare center seemed bored.

   Where were the kids? At the daycare center / At the park.

7. The (liveliest) pediatrician couldn't cheer up the (liveliest) baby, let alone the drowsiest one, even with toys to play with.

8. The (first) client didn't send his (first) payment, let alone the second one, and the firm was starting to get anxious.

    Was the firm getting its payments? Yes / No.

9. The (richest) hedge fund managers didn't warn the (richest) investors, let alone the poorest ones, so the market crash was surprising.

10. The (flashiest) salesman couldn't sell the (flashiest) car, let alone the most subdued one, but this is a town where nobody drives.

11. The (calmest) veterinarian couldn't handle the (calmest) dog, let alone the most high-strung one, and the storm made it worse.

12. The (most dedicated) coaches couldn't motivate the (most dedicated) players, let alone the laziest ones, so the team lost all its games.

    Was the team doing poorly? Yes / No.

13. The (nearest) neighbors didn't hear the (nearest) explosion, let alone the farthest ones, so no one knew anything was wrong.

14. The (clearest) writer couldn't explain the (clearest) theory, let alone the most confusing one, as the topic is so technical.

    What was to be explained? A theory / A feeling.

15. The (best) attorney couldn't clear the (best) defendant, let alone the worst one, because the evidence was so clear.

    Which was compelling in the case? The evidence / The defendant.

16. The (most corrupt) lobbyist couldn't sway the (most corrupt) senator, let alone the most honest one, as the policy was so popular.

Appendix B

Items from Experiment 2. In the Non Local contrast condition, the conjunction *and Diana* modified the subject of the preceding context question, as in (1a). In the Local contrast condition, the conjunction modified the object of the question, as in (1b). Only the Local contrast conditions are shown in the examples beyond 1, since each condition is derivable from the other.

1. a. Did Mary call John and Diana?

    b. Did Mary and Diana call John?

    Mary didn't call John, let alone Diana, and I'm very upset about it all.

2. Did Sue forgive Dave and Linda?

    Sue didn't forgive Dave, let alone Linda, and I'll never understand why not.

3. Did Gina remember Paul and Susan?

Gina didn't remember Paul, let alone Susan, even though they met last year.

4. Did Angela thank Peter and Janice?

Angela didn't thank Peter, let alone Janice, which I thought was very rude.

5. Did Lily play with Ben and Jessica?

Lily didn't play with Ben, let alone Jessica, as there was a crisis in the kitchen.

6. Did Sally write Mike and Doris?

Sally didn't write Mike, let alone Doris, even though there was plenty of time.

7. Did Rita race Bob and Emily?

Rita didn't race Bob, let alone Emily, as they were already much too tired.

8. Did Megan talk to Phil and Tina?

Megan didn't talk to Phil, let alone Tina, and I think that something was wrong.

9. Did Fredo complain to Laura and Kyle?

Fredo didn't complain to Laura, let alone Kyle, despite all the difficult things going on.

10. Did Max interrupt Olivia and Nick?

Max didn't interrupt Olivia, let alone Nick, even though the meeting was running late.

11. Did Jay text Jill and Danny?

Jay didn't text Jill, let alone Danny, and nobody could find the cafe in time.

12. Did Rob email Nora and Howard?

Rob didn't email Nora, let alone Howard, even though the merger was in trouble.

13. Did George mention Lisa and Chris?

George didn't mention Lisa, let alone Chris, which I thought was very surprising.

14. Did Alex help Lyn and Seth?

Alex didn't help Lyn, let alone Seth, even when the project was failing.

15. Did Brad contact Karen and Dennis?

Brad didn't contact Karen, let alone Dennis, and everyone was late for the show.

16. Did Sam greet Jules and Tom?

Sam didn't greet Jules, let alone Tom, which was entirely expected at that point.

Appendix C

Items from Experiment 3. Items from Experiment 3 were the created on the basis of those in Experiment 1, manipulating the placement of the *let alone* coordination. As items from this experiment may be derived from Experiment 1, only a sample is shown below.

1. a. The nurse couldn't stand the nicest patient, let alone the meanest one, and no one at the hospital was happy at all.

b. The nicest nurse couldn't stand the patient, let alone the meanest one, and no one at the hospital was happy at all.

c. The nicest nurse, let alone the meanest one, couldn't stand the patient, and no one at the hospital was happy at all.

d. The nicest, let alone the meanest, nurse couldn't stand the patient, and no one at the hospital was happy at all.

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Experiment 1: Reading time by region
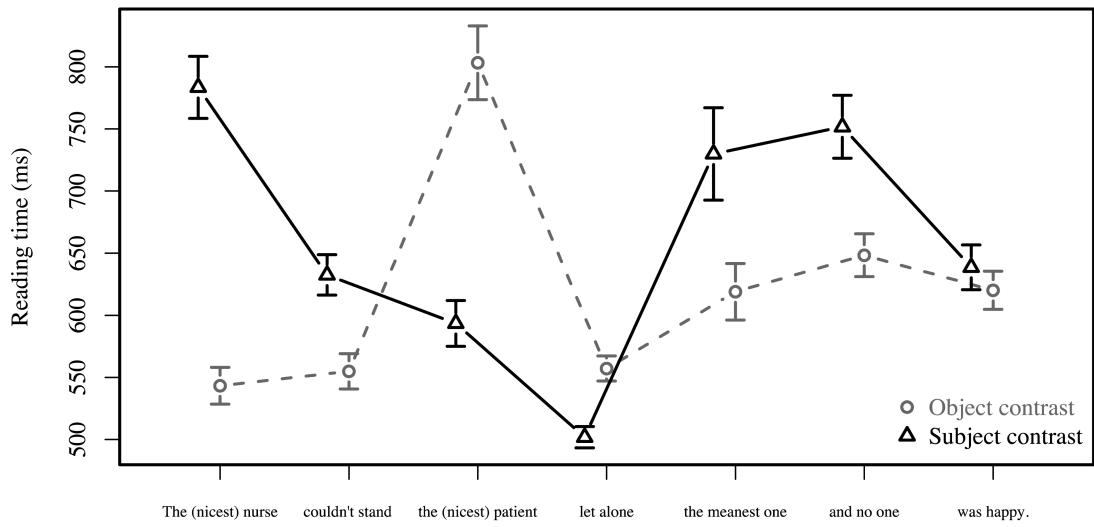
Figure 1.
Experiment 1. Reading time by region on data with outliers removed.

Experiment 2: Reading time by region
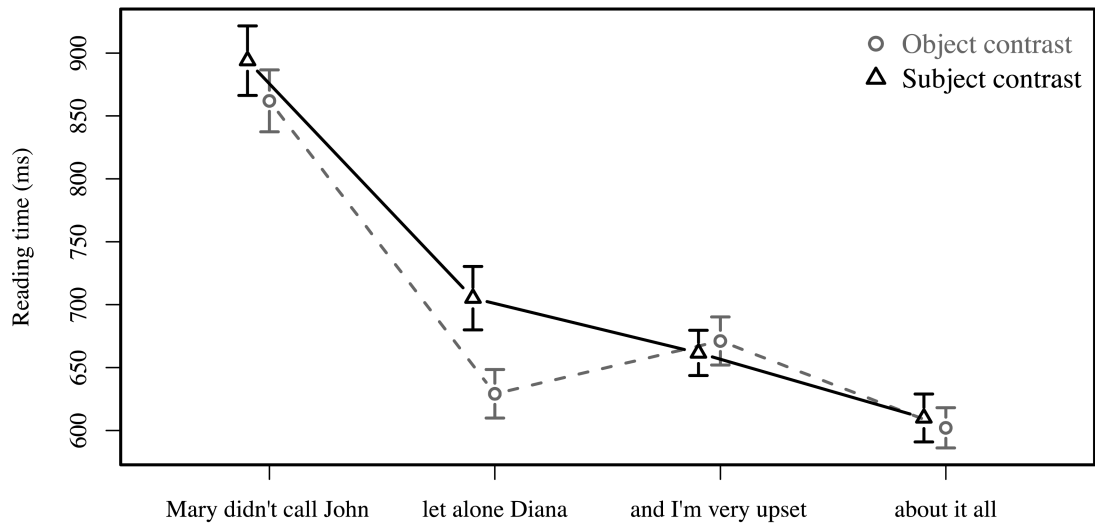
Figure 2.
Experiment 2. Reading time by region on data with outliers removed.
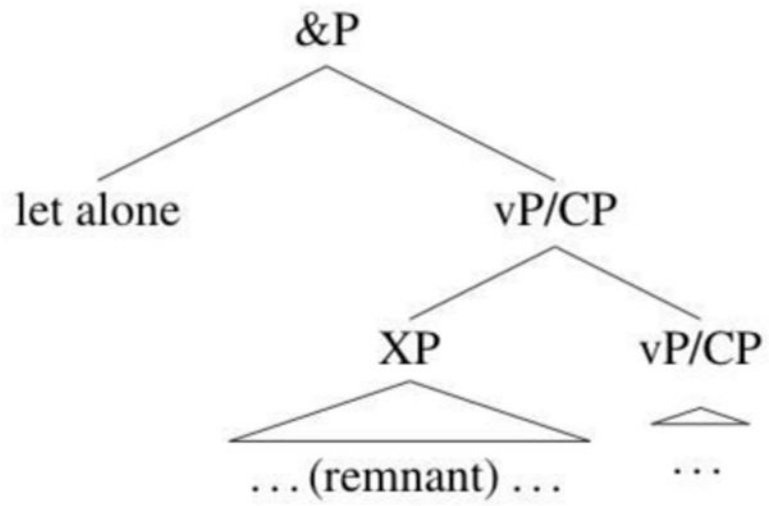
Figure (11).

Table 1

Counts and percentages from the British National Corpus. Total counts denotes the number of remnants by syntactic category in the data set. Locality and Non Local counts and percentages were calculated on the basis of Local and Non Local contrasts within the syntactic category, so the columns sum to 100% the instances per category; similarly for Finality. Contrast represents the semantic contrast within the remnant irrespective of the syntactic category of the remnant.

| Category	Total counts	Locality		Finality		Contrast
		Local	Non Local	Final	Non Final	
Adj	36 (3%)	35 (97%)	1 (3%)	15 (42%)	21 (58%)	89 (7%)
Adv	7 (1%)	7 (100%)	0 (0%)	5 (71%)	2 (29%)	8 (1%)
Det	1 (0%)	1 (100%)	0 (0%)	0 (0%)	1 (100%)	12 (1%)
N	6 (1%)	6 (100%)	0 (0%)	2 (33%)	4 (67%)	47 (4%)
NP	563 (47%)	417 (74%)	146 (26%)	457 (81%)	106 (19%)	511 (43%)
P	2 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	5 (0%)
PP	100 (8%)	79 (79%)	21 (21%)	94 (94%)	6 (6%)	61 (5%)
SC	35 (3%)	32 (91%)	3 (9%)	35 (100%)	0 (0%)	32 (3%)
V	62 (5%)	62 (100%)	0 (0%)	1 (2%)	61 (98%)	139 (12%)
VP	384 (32%)	357 (93%)	27 (7%)	370 (96%)	14 (4%)	292 (24%)

Table 2

Counts and percentages from the Contemporary Corpus of American English. Note that there were a few Determiner contrasts observed, which were not syntactically Determiners, and there were no instances of P contrasts. Otherwise, the table was computed as in Table 1.

	Total counts	Locality		Finality		Contrast
		Local	*Non Local*	*Final*	*Non Final*	
Adj	25 (3%)	25 (100%)	0 (0%)	14 (56%)	11 (44%)	64 (8%)
Adv	7 (1%)	7 (100%)	0 (0%)	7 (100%)	0 (0%)	10 (1%)
Det	NA	NA	NA	NA	NA	5 (1%)
N	2 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	34 (4%)
NP	395 (51%)	284 (72%)	111 (28%)	332 (84%)	65 (16%)	352 (45%)
PP	60 (8%)	48 (80%)	12 (20%)	59 (98%)	1 (2%)	35 (5%)
SC	28 (4%)	27 (96%)	1 (4%)	25 (89%)	3 (11%)	22 (3%)
V	27 (3%)	27 (100%)	0 (0%)	0 (0%)	27 (100%)	52 (7%)
VP	230 (30%)	218 (95%)	12 (5%)	219 (95%)	11 (5%)	201 (26%)

Table 3

Means and standard errors for Experiments 1 and 2 by region. Shaded cells indicate a significant difference between conditions.

Experiment 1	Target region						
	1	**2**	**3**	**4**	**5**	**6**	
	Subject	**Verb**	**Object**	**let alone**	**Remnant**	**Spill over**	**Final**
Local	522 (12)	527 (11)	708 (20)	533 (7)	586 (16)	630 (15)	602 (11)
Non Local	709 (18)	578 (11)	559 (14)	490 (8)	627 (19)	690 (18)	611 (13)
Non Local penalty	NA	NA	NA	NA	31	53	9

Experiment 2	Target region				
		1	**2**	**3**	**4**
	Context	**Matrix**	**let alone + remnant**	**Spill over**	**Final**
Local	1688 (49)	862 (11)	629 (19)	671 (19)	602 (16)
Non Local	1670 (49)	894 (11)	705 (25)	662 (18)	610 (19)
Non Local penalty	NA	NA	76	-9	8

Table 4

Experiment 1: Self-paced reading. Best fitting linear mixed effects regression models for Regions 5 and 6.

		Estimate	Std. Error	t-value
Region 5	*Best fit model: $\chi^2(1) = 89.04$, $p < 0.001$.*			
	(Intercept)	788.797	39.019	20.216[*]
	Contrast	36.587	10.946	3.342[*]
	Order	-20.032	2.056	-9.745[*]
Region 6	*Best fit model: $\chi^2(1) = 7.29$, $p < 0.01$*			
	(Intercept)	799.791	38.978	20.519[*]
	Contrast	79.857	21.126	3.78[*]
	Order	-15.742	1.922	-8.189[*]
	Contrast × Order	-5.337	1.973	-2.705[*]

[*] An asterisk indicates a significant effect under the $|t| > 2$ criterion

Table 5

Experiment 2: Self-paced reading. Best fitting linear mixed effects regression model for Region 2.

		Estimate	Std. Error	t-value
Region 2	*Best fit model: $\chi^2(1) = 120.57$, $p < 0.001$*			
	(Intercept)	923.619	43.555	21.206[*]
	Contrast	52.974	18.27	2.900[*]
	Order	-29.367	2.506	-11.72[*]

[*] An asterisk indicates a significant effect under the $|t| > 2$ criterion.

Table 6

AMT sentence rating task. Linear mixed effects regression model for the naturalness rating by condition.

	Estimate	Std. Error	t-value
(Intercept)	5.491	0.206	26.623[*]
Local Initial	0.059	0.128	0.464
Local Medial	-0.253	0.161	-1.569
Local Final	0.397	0.115	3.458[*]

[*]
An asterisk indicates a significant effect under the |t| > 2 criterion.