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Processing Elided Verb Phrases with Flawed Antecedents: the Recycling Hypothesis

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Abstract

Traditional syntactic accounts of verb phrase ellipsis (e.g. “Jason laughed. Sam did [] too.”) categorize as ungrammatical many sentences that language users find acceptable (they “undergenerate”); semantic accounts overgenerate. We propose that a processing theory, together with a syntactic account, does a better job of describing and explaining the data on verb phrase-ellipsis. Five acceptability judgment experiments supported a “VP recycling hypothesis,” which claims that when a syntactically-matching antecedent is not available, the listener/reader creates one using the materials at hand. Experiments 1 and 2 used verb phrase ellipsis sentences with antecedents ranging from perfect (a verb phrase in matrix verb phrase position) to impossible (a verb phrase containing only a deverbal word). Experiments 3 and 4 contrasted antecedents in verbal versus nominal gerund subjects. Experiment 5 explored the possibility that speakers are particularly likely to go beyond the grammar and produce elided constituents without perfect matching antecedents when the antecedent needed is less marked than the antecedent actually produced. This experiment contrasted active (unmarked) and passive antecedents to show that readers seem to honor such a tendency.

Keywords

Ellipsis; sentence comprehension; accommodation; sentence acceptability; ungrammaticality

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The interpretation of elided constituents depends entirely on the context in which they occur. Investigating the processing of elided constituents is interesting because it may provide insights about the operation of the language processor and about the role of language processing in determining judgments of acceptability (the core data of linguistic theory). In this paper we will be concerned with the role of syntax in the processing of elided verb phrases (VPs). A canonical example of an elided verb phrase is given in (1), where the missing verb phrase following did, indicated by square brackets below, is interpreted as laugh.

(1) Jason laughed. David did [] too.

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In psycholinguistic studies, Tanenhaus and Carlson (1990) have shown that verb phrase ellipsis sentences like (1), which they classify as surface anaphors (Hankamer and Sag, 1976), are more easily judged to “make sense” when the antecedent of the ellipsis is syntactically parallel to the form of the ellipsis (as in (2a)) than when it is not (as in (2b)).

(2)	a.	Someone had to take out the garbage. But Bill refused to [].
	b.	The garbage had to be taken out. But Bill refused to [].

A similar, but smaller, effect was found for instances of deep anaphors, e.g., But Bill refused to do it. It is possible to find examples where the absence of syntactically parallel antecedent for the elliptical verb phrase makes the sentence sharply unacceptable, as in (3a), while the corresponding deep anaphor is fully acceptable, as in (3b).

(3)	a.	*This information was released but Gorbachov didn't.
	b.	This information was released but Gorbachov didn't do it.

In the present work, we do not attempt to resolve the question of possible similarities and differences between deep and surface anaphora, concentrating our attention on verb phrase ellipsis (for further discussion of the possible difference between surface and deep anaphors, see Garnham & Oakhill, 1989, Murphy, 1985, and Ward, Sproat & McKoon, 1991).

In the linguistics literature, verb phrase ellipsis has been studied extensively (see Johnson, 2001 for an overview of issues, crucial early work is found in Sag, 1976, and Williams, 1977, and important recent work in Merchant, 2001, 2003a, 2003b). Two sharply contrasting approaches to verb phrase ellipsis phenomena exist. One approach is syntactic, claiming that an elided verb phrase requires a syntactically matching antecedent (in early proposals, a matching surface representation; in later theories, a matching Logical Form representation, cf. Sag and Hankamer, 1984, for example.) Such theories undergenerate (e.g., Sag, 1976, Sag and Hankamer, 1984, Williams, 1977), in the sense that they predict that some attested examples, like (4) due to Hardt [1993, p37, his example (131)], should be ungrammatical (see Garnham & Oakhill, 1989, Hardt, 1993, 1999, Kehler, 2000, 2002 for problematic examples).

(4)	This information could have been released by Gorbachov, but he chose not to. (Daniel Shorr, NPR, 10/17/92)
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The other approach is semantic, treating elided VPs as ‘VP pronouns’ (Dalrymple et al., 1991, Hardt, 1993). From this perspective, elided VPs have no internal structure. They are phonologically null referential expressions that pick up their referent from the context of utterance. Semantic theories only require the availability of a semantic antecedent, e.g., a property (Dalrymple et al., 1991, Hardt, 1993), but do not place any general syntactic requirements on the shape of the antecedent. Hence, they may generate examples like (4). However, theories overgenerate, incorrectly predicting examples like (3b) to be grammatical.

We will argue that substantial linguistic evidence exists favoring syntactic accounts, and we will provide psycholinguistic evidence that is most easily interpreted in terms of such accounts. Before turning to this evidence, however, we acknowledge that linguistic theorists have provided some very interesting attempts to reconcile semantic accounts with the data. One is due to Kehler (2000, 2002), who claimed that whether a parallel linguistic antecedent is required or not depends on the particular discourse coherence relation involved. With resemblance

relations between the antecedent and an ellipsis, as in (5a), a parallel antecedent is required; with a cause-effect relation, as in (5b), a semantic antecedent suffices, so no parallel antecedent is needed.

(5)	a.	#This problem was looked into by Bob and John did too. [Kehler, 2002, p.56, example (97)]
	b.	This problem was to have been looked into, but obviously nobody did. [Kehler, 2002, p.53, example (83), said by Vincent Della Pietra in conversation]

Although Kehler's solution is elegant, there is experimental evidence showing that, when other factors are held constant, syntactic parallelism has as large an effect on sentence acceptability in cause-effect as in resemblance relations (Frazier & Clifton, to appear). Another semantic approach appears in Hardt (1993), who deals with the overgeneralization problem by adopting a series of rules to restrict the generalized availability of ellipsis, e.g., a rule that favors subject co-reference. However, many of his rules are restricted to quite specific environments (e.g., to deal with antecedent-contained deletion) and do not all have independent motivation.

In our opinion, the most convincing linguistic evidence that favors a syntactic approach to ellipsis consists in arguments for the existence of syntactic structure inside the (phonologically null) ellipsis. Consider just one such argument (see Johnson, 2001, for additional arguments). There are well-known constraints ("island constraints;" Ross, 1967) on the possibility of extracting *wh*-words from certain phrases. For instance, a *wh*-word cannot be extracted from the embedded complement clause in (6a), although extraction is grammatical when no embedded clause exists (6b). Precisely the same contrast holds when extraction must take place out of an ellipsis, as in (7a) and (7b) (Haik, 1987). We take this as evidence for internal syntactic structure, in the form of traces, inside an ellipsis.

(6)	a.	*I know which book Mag read, and which book Mr. Yunioshi asked why you hadn't read (e).
	b.	I know which book Mag read, and which book you hadn't read (e).
(7)	a.	*I know which book Mag read, and which book Mr. Yunioshi asked why you hadn't.
	b.	I know which book Mag read, and which book you hadn't.

We therefore make the assumptions that structure exists inside a phonologically-null ellipsis and that the grammaticality of an ellipsis depends on the availability of a structurally-parallel antecedent in the context. We must, then, deal with the undergeneration problem, the apparent acceptability of sentences in which no parallel antecedent exists. We propose that this problem is best dealt with by appeal to performance factors, and propose a specific performance hypothesis that we will term the *VP Recycling* hypothesis. We claim that the grammatical resolution of an elided verb phrase requires the presence of a syntactically parallel antecedent. However, in the absence of such an antecedent, the processor may *recycle* materials at hand and create a suitable syntactic structure (see Tanenhaus, Carlson, & Seidenberg, 1985, for a similar hypothesis). We consider recycling to be a performance repair strategy for a structure that is, strictly speaking, ungrammatical. As such, it carries with it varying degrees of difficulty, and results in different levels of acceptability.

According to the recycling hypothesis, the construction of a verb phrase antecedent depends on grammatical properties of the input and the recycling process follows paths that are made available by grammar. The acceptability of the outcome will depend on the steps needed to

create a suitable antecedent. It should be relatively easy to create an antecedent if only one or a small number of grammatically defined operations must be performed on the actual verb phrase to create a verb phrase of the appropriate syntactic shape. If there is clear evidence concerning these operations or concerning the shape of the target verb phrase, then the recycling should be easy and the examples should be judged acceptable, at least relative to examples requiring more operations or examples where less evidence points to the need for these operations. On the other hand, if the processor does not have adequate material to work with in creating the target verb phrase antecedent, then the example should be relatively unacceptable. In particular, if the actual antecedent does not even contain the verb required to head the antecedent verb phrase, the creation of an appropriate verb phrase should be expected to fail and the example should be judged to be unacceptable.

The VP-recycling hypothesis predicts that finding an antecedent should be easier if the antecedent of the verb phrase ellipsis has the canonical properties of a verb phrase, i.e., it looks like a verb phrase and it occupies a position (e.g., post-subject) that is characteristic of verb phrases. In the first test of this prediction, in Experiments 1 and 2 below, we examine antecedents that contain verb phrases vs. antecedents that contain adjective phrases, and antecedents that appear in predicate position vs. ones that appear as a constituent of the sentence’s subject noun phrase. We predict that antecedents that are more similar to a canonical parallel verb phrase antecedent will be easier to process and judged more acceptable than antecedents that are less similar. In Experiments 3 and 4 we compare verbal gerunds with nominal gerunds, and predict that verbal gerunds will be more acceptable than nominal gerunds. Experiment 5 begins to probe into how a reader might compensate for a writer’s presumed memory errors (or the reader’s own memory errors; see Garnham & Oakhill, 1987) in constructing a parallel antecedent for an ellipsis and how a reader might be sensitive to the writer’s use of “presupposition triggers” (like too or already or again) to suggest that context might contain a missing antecedent.

In sum, the VP recycling hypothesis predicts that missing antecedent examples should be acceptable to various degrees depending on what material is present to provide an antecedent, what operations need to be performed on the antecedent, and what evidence is available to aid the processor in performing those operations.

Experiment 1

To test the VP recycling hypothesis, 16 sentences like those in (9) were tested in an online acceptability judgment study. Each sentence had four forms.

(9)	a.	None of the astronomers saw the comet, /but John did.	(Available verb phrase)
	b.	Seeing the comet was nearly impossible, /but John did.	(Embedded verb phrase)
	c.	The comet was nearly impossible to see, /but John did.	(Verb phrase with trace)
	d.	The comet was nearly unseeable, /but John did.	(Negative adjective)

In all forms, the final clause had the form but DP did (DP = Determiner Phrase). In the a-form (available verb phrase), the first conjunct contained a verb phrase that was appropriate as a parallel linguistic antecedent for the verb phrase ellipsis. In the b-form (embedded verb phrase), the subject of the first clause was a nominalized (gerund) form of a verb phrase. In the c-form (verb phrase with trace), the subject of the first clause is coindexed with an empty operator which binds an object trace following the critical verb (see); in order to construct an appropriate verb phrase antecedent the binder (the comet) must substitute for the trace (producing see the comet). In the d-form (negative adjective), the critical verb needed to construct the antecedent verb phrase is embedded inside an adjective.

In (9a) the reader receives an appropriate verb phrase antecedent in a prominent expected position, namely, the matrix predicate position. Therefore, the sentence should be judged quite acceptable and perhaps should be processed quickly. In (9b), we assume a verb phrase is present but not in the expected position: the verb phrase needed for the antecedent is embedded inside the subject DP. Thus, (9b) may be somewhat degraded compared to (9a). (9c), however, requires an operation on the available verb phrase: see the comet is the required antecedent, but see t is what the surface form provides. Therefore the given verb phrase must be recycled, though the process uses operations that we assume are defined in the grammar, i.e., it is a grammatically supported inference of replacing the variable with its binder. Finally, in (9d), where the content of the verb appears as a negative adjective, the required verb phrase antecedent can be constructed but to do so, one needs to take pieces of the sentence that occur inside a word. This should be difficult and should lead to very low acceptability.

Methods

Materials—Four versions of 16 sentences were constructed as illustrated in (9) and described above. All items appear in Appendix 1. These 16 sentences were combined with 122 other sentences and two-sentence discourses of a wide variety of constructions, including 32 sentences that were unacceptable for a variety of reasons (gender or number disagreement, missing or extra arguments, semantic anomaly, etc.) A six-item practice list was also constructed, with three acceptable and three clearly unacceptable items.

Participants and procedure—Forty-eight University of Massachusetts undergraduates were tested in individual half-hour sessions. Twelve participants saw each of four counterbalanced forms of the list of items, in each of which one quarter of the experimental items appeared in each experimental version. Each participant was instructed to read sentences or two-sentence discourses, phrase by phrase, pulling a trigger with the right hand if the sentence was grammatically acceptable to that point, and pulling a trigger with the left hand if the sentence had become unacceptable. They were told that the first phrase of a two-phrase sentence should always be treated as acceptable, and all participants complied with this instruction. “Unacceptable” was defined as violating the normal rules of everyday English. It was stressed that a sentence did not have to be the most “insightful, true, interesting, or elegant” sentence the subject had ever seen to be classed as “acceptable.” The participant then marked a sheet of 10 sentences as acceptable or unacceptable, and the experimenter discussed any differences of judgment (which were very rare).

After instructions, a session began with the randomized presentation of the six items in the practice list, followed by a break, followed by an individually-randomized presentation of all 138 items in the main list. On each trial, a series of underscores appeared on the screen to indicate where the characters were to appear. When the participant pulled the right-hand trigger, the first phrase of an experimental item (up to the/in (7)) or the first phrase of one of the other items appeared on the screen, replacing the first set of underscores. This first display was always acceptable, and participants always indicated that it was acceptable. After the participant pulled

the right-hand trigger to indicate its acceptability, it disappeared and was replaced by the original underscores and the second phrase or sentence replaced its underscores. The participant's response (left-hand trigger = unacceptable) and reaction time was recorded.

Results

The results (including reaction times for all responses) are presented in Table 1. The differences among the reaction times were not significant ($F(3,141) = 1.08$; $F(3,45) = 2.12$, $p = .110$; $\min-F' < 1$; the 95% confidence interval for a difference between any two means shown in Table 1, computed from the error term used in the analysis of variance, was 292 ms). However, the differences among the percentages of acceptable responses were highly significant ($F(3,141) = 70.87$; $F(3,45) = 65.05$; $p < .001$; $\min-F'(3, 130) = 33.92$, $p < .001$). All pairwise differences were significant, with a 95% confidence interval for the difference between any two means, derived from the error term used in the by-subjects analysis of variance, of 9.6% (note, all confidence intervals reported in this paper were derived from by-subjects analyses).

Discussion

The acceptability judgment data showed a significant drop in acceptability from (9a) through (9d). The results support the VP recycling hypothesis. When the processor postulates an empty verb phrase, it looks for a verb phrase antecedent, beginning with salient or focused verb phrases in the expected position for a verb phrase. In (9a), assuming that tense has been removed from saw (Tense + see), then an appropriate salient verb phrase occurs in the expected position. The processor need only copy the antecedent verb phrase (Frazier & Clifton, 2001) or perhaps equivalently represent the final clause as sharing the verb phrase antecedent with the first clause. In (7b), there will also be a verb phrase antecedent, assuming that the subject in (9b) is a nominalized verb phrase. But the verb phrase antecedent will not be focused or in the expected position of a verb phrase. Presumably identifying the verb phrase inside the subject is what results in the lower acceptability of (9b) relative to (9a).

Turning to (9c) we assume the structure in (10).

(10)	The comet _{<i>t_j</i>} was nearly impossible OP _{<i>j</i>} to see <i>t_j</i> but John did [].
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The verb see has an empty object, a trace, bound by an operator (OP). The operator is itself coindexed with the subject of the main clause. Assuming that the required verb phrase antecedent is see the comet, then the operator and trace are not both contained inside the antecedent. If the processor can create the needed verb phrase by substituting the comet for the trace with which it is coindexed, then an appropriate antecedent can be formed. But this takes not only locating see *t_j*, but also performing an operation on this constituent in order to construct the required verb phrase, thus predicting the lesser acceptability of (9c) than (9a) and (9b). Finally, in (9d) one must go inside a word to identify the verb see and then must build a verb phrase from scratch. Not surprisingly, this led to a predominance of judgments that (9d) was unacceptable.

Experiment 2

Although we attribute the differences among the four conditions of Experiment 1 (examples (9a) – (9d)) to differences in difficulty of comprehending the ellipsis, it is possible that some or all of the differences are due to differences in difficulty of comprehending the initial (pre-ellipsis) clause itself. Experiment 2 was designed to evaluate this possibility (and to provide a replication of Experiment 1 using a somewhat different technique) by obtaining acceptability judgments of sentences like those in (9a)–(9d) with and without the elliptical second clause.

Method

The 16 sentences used in Experiment 1 ((9a)-(9d)) were used in Experiment 2, but four additional versions of each sentence were prepared by deleting the elliptical clause (e.g., (9d) was modified to read The comet was nearly unseeable). This resulted in eight conditions, the four types of antecedent clause, as in Experiment 1 crossed with presence vs. absence of a following elliptical clause.

Eight different counterbalanced forms of a computerized questionnaire were prepared, in each of which two different sentences appeared in each of the eight conditions. In each form, these 16 sentences were combined with 100 other sentences of a variety of constructions (including the items used in Experiment 4). Each of the 16 experimental items, and 52 of the remaining items, were presented together with a 5-point acceptability judgment scale, ranging from 1 = unacceptable to 5 = acceptable. Each of the remaining 48 sentences was presented by itself, and followed by a two-choice interpretation question. Forty-eight University of Massachusetts undergraduates were presented with the 116-item questionnaire on a computer monitor. Six participants received each of the eight counterbalanced forms of the list, and each participant received all items in an individually-randomized order. Each item was preceded by a message on the computer monitor indicating whether the participant was supposed to read and rate the acceptability of, or simply read and understand, the following sentence. When the participant pressed the ENTER key on a keyboard, the next sentence (together with the 5-point rating scale in the case of the experimental items) appeared on the monitor. The participant was to press one of the keys 1–5 to indicate his or her acceptability rating (or to press the ENTER key to see the question about the item, in the case of 48 filler items). The computer recorded the participant's acceptability rating and showed the instruction for the next trial.

Results and Discussion

The mean ratings (1 = unacceptable, 5 = acceptable) appear in Figure 1. There were clear acceptability differences among the four versions of the ellipsis sentences, but not among the four non-elliptical sentences. Both main effects and the interaction were highly significant (ellipsis vs. nonellipsis, $F(1,47) = 106.70$, $F(1,15) = 294.0$, $\text{min-}F'(1,61) = 78.29$, $p < .001$; form of first clause, $F(3,141) = 45.13$; $F(3,45) = 28.17$; $\text{min-}F'(3,105) = 17.35$, $p < .001$; interaction, $F(3,141) = 42.39$; $F(3,45) = 17.33$; $\text{min-}F'(3,84) = 12.30$, $p < .001$). The interaction effect is of the most interest. The 95% confidence interval for the difference between any two means is 0.27 units on the rating scale, suggesting that while the apparent differences among the four elliptical conditions can be trusted, those among the four non-elliptical conditions cannot (apart, perhaps, from the high acceptability of the verb phrase with trace clauses, (9c)). We conclude that the differences observed in Experiment 1 do in fact reflect difficulty in comprehending the ellipsis when no appropriate antecedent is easily available.

Experiment 3

In order to further test the recycling hypothesis, Experiment 3 contrasted antecedents that appear inside verbal versus nominal gerundive subjects. Before turning to the experiment, we discuss the differences between these two structures. Gerunds are noun-like constructions derived from verbs, and exhibit characteristics of both nouns and verbs. They can appear in the syntactic positions normally reserved for nouns. In this experiment, they are subjects, and can take predicates like other noun phrases. Internally, however, gerunds can differ as to the *extent* of their verbal characteristics. The two types of gerundive phrases of interest in this experiment are what are often called verbal gerunds and nominal gerunds. Various syntactic tests distinguish the two types. Nominal gerunds, unlike verbal gerunds, require the particle *of* preceding their direct objects, just as nouns do (11a,b). Verbal gerunds, on the other hand, take direct objects, marking them with accusative case just like their verbal counterparts

(11c,d). Also, nominal gerundive phrases can be headed by articles just like noun phrases, verbal gerundives cannot.

(11)	a.	The singing of the opera	<i>nominal gerund</i>
	b.	The lyrics of the opera	<i>noun phrase</i>
	c.	(*The) Singing the opera	<i>verbal gerund</i>
	d.	John sang the opera.	<i>verb phrase</i>

In addition, nominal gerunds are modified by adjectives just like nouns (12a), while verbal gerundives are modified by adverbs, as are verb phrases:

(12)	a.	The loud singing of the opera	<i>nominal gerund</i>
	b.	?The singing of the opera loudly	<i>nominal gerund</i>
	c.	Singing the opera loudly	<i>verbal gerund</i>
	d.	*Loud singing the opera	<i>verbal gerund</i>

Both types, though, can appear in the syntactic position suitable for NPs, and can be predicated of like NPs (13a,b). Moreover, both can have subjects of their own, expressed by the possessive morpheme 's (13c,d)

(13)	a.	The singing of the aria was slow.	<i>nominal gerund</i>
	b.	Singing the aria was difficult.	<i>verbal gerund</i>
	c.	Maria's singing of the aria was slow.	<i>nominal gerund</i>
	d.	Maria's singing the aria was difficult.	<i>verbal gerund</i>

Gerunds are thus nouns with verbs inside them. One standard approach is to treat nominal gerunds as nouns derived from verbs in the lexicon (Chomsky, 1970). Under this approach, nominal gerundives retain the meaning of the verbs but have a syntactic structure of DPs 'Determiner Phrases' (Figure 2, Panel A). Verbal gerundives are syntactic hybrids: they contain a verb phrase that allows for direct objects and adverbial modification. They are syntactically dominated, however, by nominal categories (here Noun and D(eterminer)) (Figure 2, Panel B). This accounts for their external distribution and their genitive-marked subjects. Figure 2 shows the *-ing* affix heading a noun phrase. The verb moves into that position, creating the string we hear.

The exact syntactic representation of gerunds is a topic of debate: different structures appear in the literature (see Abney 1987, Pires 2001) and different views as to where in the grammar (syntax or morphology) gerunds are converted from verbs to nouns. Nevertheless, the distinction between nominal and verbal gerunds is well attested. Including a verb phrase in the verbal gerund, but not in the nominal gerund, is a direct way of representing this distinction. The evidence from verb phrase-recycling, to be presented below, points to this conclusion as well.

As already noted, an online acceptability judgment study examined verbal (14a,b) and nominal (14c,d) gerund subjects to further investigate the recycling hypothesis. Given that a verb phrase already exists in the verbal gerunds but not in the nominals, (14a,b) should be judged as more acceptable than (14c,d) because only the former contains a syntactically matching antecedent.

The basic (14a,c) forms were also modified by adding an adverb in (14b) and by adding an adjective in (14d). One possibility is that adding an adverbial modifier actually improves the status of (14a) by further indicating the verb phrase status of the subject and perhaps making it easier for the processor to locate the verb phrase even though it appears in subject position. Whether this hypothesized verb phrase-marking function of the adverb is enough to offset any complexity of the adverb cannot really be predicted, however. In (14d) adding an adjective to the basic sentence in (14c) may decrease the acceptability of (14c) if the adjective must be changed to an adverb when a verb phrase antecedent is created. In short, the central question is whether clearly nominal gerunds will be less acceptable than verbal gerunds and, secondarily, whether the presence of categorially marked modifiers (adjective for nominals, adverb for verb phrases) will further modulate the differences between the verb phrase (14a) and nominal (14c) antecedents.

Methods

Materials—Sixteen sentences were constructed with four versions of each: two with a verbal gerund (14a,b) and two with a nominal gerund (14c,d), two with a modifier (14b,d) and two without, as illustrated in (14). The subject DPs of half of the sentences had temporal possessives in the c,d-forms, as in (14); the remainder had definite determiners instead. These 16 items were combined with 120 other items of varying form (including 8 practice items), of which 36 were clearly unacceptable.

(14)	a.	Singing the arias tomorrow night will be difficult/but Maria will. (Verbal, –mod)
	b.	Singing the arias slowly tomorrow night will be difficult/but Maria will. (Verbal, mod)
	c.	Tomorrow night's singing of the arias will be difficult/but Maria will. (Nominal, –mod)
	d.	Tomorrow night's slow singing of the arias will be difficult/but Maria will. (Nominal, +mod)

Participants and procedures—Eighty-four University of Massachusetts undergraduates were tested in individual half-hour sessions. The procedures were as described for Experiment 1, except that no break intervened between the practice items and the main items. Twenty-four of the participants were rejected because they were less than 80% correct in rejecting the 36 clearly unacceptable filler items. We note that retaining these participants made no change in the pattern of results, but we discarded them in hopes of gaining more precision and power in the test of the effect of modifier presence.

Results

The verbal gerunds were judged more acceptable than the nominal gerunds (58 vs 35%; $F(1,59) = 45.36$; $F(2(1, 15) = 26.89$; $\min-F(1,34) = 16.88$), $p < .001$); 95% confidence interval of each of the difference between two means = 9.4% (see Table 2). The effect of presence vs. absence of the modifier was nonsignificant ($F < 1$), as was the interaction between modifier and verbal vs. nominal gerund. Reaction times (pooled over responses of acceptable and unacceptable) did not enter into any significant effects other than a nearly significant effect of verbal vs. nominal gerund in the by-items analysis ($F(2(1, 15) = 4.41$, $p < .06$). There was thus a nonsignificant tendency for faster times in the conditions that were more often judged acceptable.

Discussion

The principal result of Experiment 3 is very clear: Elliptical sentences with a verbal gerund as the presumed antecedent of a verbal ellipsis are more acceptable than sentences with a nominal gerund. This result was as predicted by the recycling hypothesis, since a verbal antecedent was

gerund were preferred to sentences with a nominal gerund ($F(1,47) = 13.84, p < .001$; $F(1,15) = 7.77, p < .02$; $\min F'(1, 33) = 4.98, p < .05$). No other effects were fully significant, although the main effect of presence vs. absence of a modifier and the interaction among type of gerund, presence of ellipsis, and presence of modifier approached or reached significance on the subjects analysis (for the former, $F(1,47) = 5.80, p < .02$; $F(1,15) = 2.94, p < .11$; $\min F'(1, 31) = 1.95, p = .17$; for the latter, $F(1,47) = 3.83, p < .06$; $F(1,15) = 1.81, p < .20$; $\min F'(1, 38) = 1.23, p > .20$). Examination of the means in Figure 3 provides no evidence for the suggestion that a verbal modifier would help, or a nominal modifier impair, the processing of an ellipsis that required a gerund antecedent.

Experiment 5

We introduce Experiment 5 by discussing when ungrammaticality is relatively acceptable, emphasizing the role of the speaker. We have argued that the grammar of ellipsis requires a syntactically matching antecedent for the elided constituent. This implies that ellipsis is ungrammatical when no syntactically matching antecedent is available, despite the actual occurrence of such examples in naturally-occurring speech (see Kehler, 2002, in particular). If so, then the acceptable examples of ellipsis with a mismatching antecedent are examples of acceptable ungrammaticality. Although we have seen how such examples might be interpreted by the listener or reader, there remains the question of why the speaker/author would produce ungrammatical sentences.

Blends are a well known category of speech error. Fay (1982) claims “A blend occurs when a speaker has in mind simultaneously two ways of expressing the same message.” (p.719). Cohen (1987) presents an entire book of attested blend examples. Stemberger (1982) claims that most syntactic errors are substitutions but that blends of two syntactic structures are also common (p.313). Kawachi (2002) analyzes a corpus of Japanese speech errors. Lexical blends (“fusions”) make up 8% of the lexicon-based errors and were found significantly more often in spontaneous speech than in live broadcast scripted TV speech. Syntactic blends made up 20% of the phrase-based errors and also occurred more frequently in spontaneous speech than in scripted TV speech. So it at least seems fair to say that blends are not uncommon.

We suspect that speakers at times find themselves in a situation where they have more than one way of expressing the same proposition and occasionally they may simply forget or not attend to the actual utterance that they produced in one clause when it comes time to structure a later clause. This predicts that speakers will be most likely to produce ungrammatical ellipsis in cases where a systematic paraphrase is available for the antecedent clause, e.g., such as the relation between active and passive clauses in English. It also suggests that an asymmetry should exist: wherever one member of a paraphrase pair is more complex, it should tend to be the better antecedent in a mismatching ellipsis example because speakers and listeners should be more likely to incorrectly recall the simpler form of a complex antecedent when in doubt than to incorrectly recall a more complex form of a simpler antecedent. (Note, though, that naturally occurring examples of a simpler phrase being used as an antecedent for a more complicated ellipsis do exist, as in Kehler, 2002, example (86): Actually I have implemented it [= a computer system] with a manager, but it doesn't have to be. We do not deny their existence, but do hypothesize that they are less common and less acceptable than their opposites.)

Actives and passives provide a good test for the systematic paraphrase hypothesis since it is already known that listeners are more likely to mis-recall a passive as an active than to mis-recall an active as a passive (Mehler, 1963). In Experiment 5 we test the prediction that a passive antecedent followed by an active elided verb phrase is more acceptable than an active antecedent followed by a passive elided verb phrase. One problem faced by the reader who

encounters an elided verb phrase without a matching antecedent is that the reader must decide whether to carry out a repair. The author's choice of certain words often implies the presence of preceding context. These words are known as 'presupposition triggers.' In effect a presupposition trigger may indicate to the reader that the speaker/author is acting as if an appropriate linguistic antecedent is available. Experiment 5 tests the idea that presupposition triggers aid the acceptability of elided verb phrases without parallel antecedents by encouraging repair of the actual antecedent verb phrase into one with the correct shape.

Experiment 5 was a written acceptability judgment study testing two hypotheses. The systematic paraphrase hypothesis predicts that mismatching antecedents for a later ellipsis should be better when the antecedent is the more complex or more marked member of a paraphrase pair than when it is the less marked member. Specifically, passive antecedent plus active elided verb phrase should be more acceptable than active antecedent plus passive elided verb phrase. Further, some words act as presupposition triggers, implying that certain information is already present in the discourse. If a presupposition trigger, e.g. already or previously, is included in a mismatching antecedent example, it may improve the status of the example by suggesting that the speaker had intended to provide an appropriate antecedent for the elided constituent. To test these predictions, we constructed 12 examples like those in (16) and 12 examples like those in (17). In each set of sentences, the active/passive status of the first clause was crossed with the presence vs. absence of a temporal like already or the word too in the second clause as presupposition triggers. Sets (16) and (17) differed in that the latter set contained a sentence-internal comma and ended with too, while the former set contained no comma, ended with a temporal like already or previously, and when such an ending was present, contained the temporal conjunction after.

(16)	a.	The dessert was praised by the customer after the critic did already.
	b.	The dessert was praised by the customer and the critic did.
	c.	The customer praised the dessert after the appetizer was already.
	d.	The customer praised the dessert and the appetizer was.
(17)	a.	The student was praised by the old schoolmaster, and the advisor did too.
	b.	The student was praised by the old schoolmaster, and the advisor did.
	c.	The advisor praised the student, and the old schoolmaster was too.
	d.	The advisor praised the student, and the old school master was.

Methods

Twelve sets of sentences like those in (16) and 12 like those in (17) were prepared in four versions each. Versions a and b contained a passive initial clause and a following active elliptical clause, while versions c and d contained an active initial clause and a passive elliptical clause. Versions a and c of the first set (16) used the conjunction after to introduce an elliptical clause ending with a temporal like already or on Monday as a presupposition trigger, while versions b and d contained the conjunction and and did not end with a temporal. In the second set (17), versions a and c ended with too as the presupposition trigger. All four versions of these sentences contained the same conjunction. All sentences appear in Appendix 3.

The resulting 96 sentences were divided into four counterbalanced questionnaire forms, each form containing equal numbers of versions a-d and each sentence appearing in each version in

one form. Each was followed by a 5-point rating scale, with “1” labeled “unacceptable” and “5” labeled “acceptable.” The 24 sentences in one form were combined with 67 other sentences into a written questionnaire. Forty of these other sentences were followed by a 5-point acceptability rating scale, while each of the remaining items was followed by a two-choice response offering two alternative interpretations of the sentence. Three independent random orders of each of the four questionnaire forms were prepared.

Forty-eight University of Massachusetts undergraduates completed the resulting written questionnaire, 12 completing each of the four forms. Each participant read instructions indicating that s/he was to rate the acceptability of some items and to indicate which of two possible meanings of the other items was closest to his/her understanding of the item. The instructions indicated that the participant was to rate the sentence as a “5” (acceptable) as long as it is one that s/he could easily imagine a native speaker of English saying or hearing and not noticing anything odd about it. Participants were told in addition not to worry about conceptual complexity, and were given a few examples. Each participant then completed the questionnaire working individually.

Results and Discussion

Figure 4 contains the mean ratings (5 = acceptable) for the four versions of each sentence, separated by items like those in (16) and those in (17). The core result is that sentences with an active-passive order of clauses were rated as more acceptable than sentences with a passive-active order (2.31 vs. 1.66; $F(1,47) = 116.81$; $F(1, 22) = 90.44$; $\min F'(1,54) = 50.97$; $p < .001$). This supports the prediction of the VP recycling hypothesis: a reader can quite easily recover something like the active equivalent of a passive initial clause to provide a match to an active elliptical clause, but changing an active initial clause into a passive to provide a match to a passive elliptical clause is not accomplished as easily or as readily.

In addition, the presence of a presupposition trigger (after plus a temporal phrase or too) led to higher ratings than its absence (2.42 vs. 1.61; $F(1,47) = 63.01$; $F(1,22) = 15.62$; $p < .001$; $\min F'(1, 33) = 12.52$, $p < .002$). This is also as predicted: the presupposition trigger suggests the presence of a context containing an appropriate antecedent for the ellipsis, facilitating recycling. The two factors (passive-active order and presence-absence of a presupposition trigger) interacted, with the passive-active order having a larger effect when the presupposition trigger was present ($F(1,47) = 30.36$; $F(1,22) = 50.40$; $p < .001$; $\min F'(1, 67) = 18.95$, $p < .001$). As expected, the presupposition trigger seemed to help the reader most when recycling was necessary.

While the overall difference between the two sets of items was nonsignificant ($p > .10$), item set entered into several interactions with the other factors, most saliently, a three-way interaction ($F(1,47) = 22.00$; $F(1,22) = 28.75$; $p < .001$; $\min F'(1, 65) = 12.46$, $p < .001$). The two-way interaction between passive-active and presence-absence of the presupposition trigger was larger in the first set (17) than in the second set (18), where in fact the interaction was nonsignificant ($t(47) < 1$). We tentatively suggest that the presupposition triggers used in the first set might be more salient than those used in the second set (already/previously vs. too) or might unambiguously point to the initial clause as the source of the presupposition.

General Discussion

The Recycling hypothesis

The central idea behind the recycling hypothesis is that an antecedent verb phrase is copied and, if it is of the wrong shape, it is then altered. The alteration is presumably on a par with reanalysis operations when an unconscious repair of the initial syntactic structure is needed

(see Fodor & Ferreira, 1998). The recycling or fixing up of the copied structure should be easy to the extent that the following hold:

- it involves only a few steps
- those steps are defined by the grammar
- the copied structure is related to the target structure by systematic operations available for systematic paraphrase relations
- a presupposition trigger implies that a matching antecedent may be available in preceding context

The class of really easy recycling operations seems to be those that don't involve structural alterations at all, for example, changing the features on a verb phrase from +tense to -tense, as in (18).

(18)	John left and Bill did [leave] too.
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Similarly intuitively it is very easy to move from a predictable feature, like the negative polarity feature of *anyone* to the corresponding noun phrase retaining only the +human, +indefinite features, as in (19a) (cf. (19b):

(19)	a.	John didn't see anyone, but Paul did [see someone]
	b.	*Paul did see anyone.

Changing features like plural may be similar though at times it has been claimed that some cost may be observed (Black, Coltheart & Byng, 1987).

One particularly difficult operation involves changing the meaning of homophones, as in Black et al.'s example in (20):

(20)	*He rights injustices and she books.
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Similarly it seems to be difficult if many structural changes are needed or if they must be applied to a copied phrase where the mismatching form of the copied phrase is highlighted by having many features which mismatch the target (e.g., many nominal features for a target verbal constituent as in (19c)) or a prominent pitch accent on the mismatching structure, as in (21d):

(21)	a.	John's loving Mozart was surprising, but he did.
	b.	??John's loving of Mozart was surprising, but he did.
	c.	??John's recent loving of Mozart was surprising, but he did.
	d.	????John's RECENT loving of Mozart was surprising, but he did

One interesting point to note is that the processor attempts to create a matching antecedent only when it cannot find an already matching one. When there is no need to recycle a mismatching antecedent, no backup interpretation will be available. For instance, while (22a) clearly means that Lucy made Sam unhappy ("Sam was made unhappy by Lucy"), (22b) only means that Sam was unhappy. The availability of an adjective antecedent for the ellipsis in (22b) means that one does not need to create a missing antecedent for a verbal ellipsis, and thus (22b) does not mean that Lucy made Sam unhappy.

(22)	a.	Fred was made unhappy by Lucy and Sam was too.
	b.	Lucy made Fred unhappy and Sam was too.

We acknowledge that alternatives to the recycling hypothesis are possible. Garnham and Oakhill (1987) presented one possibly distinct alternative in accounting for their observation that readers sometimes interpreted ellipses so that they were consistent with stereotyped beliefs but inconsistent with grammatical parallelism (e.g., a discourse like ...The elderly patient had been examined by the doctor during the morning rounds. The nurse had too. was frequently interpreted as meaning The nurse examined the patient.) Because such interpretations were associated with slow reading, Garnham and Oakhill suggested that real-world plausibility competed with faded memory for surface form, sometimes winning.

This raises the intriguing question of when and how semantically- or conceptually-based interpretations may override syntactically-based ones. However, this question is a very general one. As far as we can see, it is not tied to the investigation of ellipsis per se. For example, it will be important in general to an account of when and how listeners identify speech errors when the speaker utters a perfectly grammatical sentence, E.g., See you on Monday under circumstances where the previous conversation fixed Tuesday as the meeting day.

A more radical alternative would be to accept the approach taken by Hardt (1993), discussed earlier, by assuming that presence of a semantically acceptable antecedent is the critical condition for an acceptable ellipsis and specifying principles according to which ellipses that satisfy the semantic requirement are nonetheless unacceptable. However, as we suggested earlier, the principles Hardt proposes do not have the quality of turning an acceptable antecedent into an unacceptable one (as the principles of the VP Recycling Hypothesis turn an unacceptable antecedent into a possible one). The unacceptable The garbage needed to be taken out. John did. seems unacceptable, but it is hard to see what aspect of the interpretation would make the antecedent of the ellipsis semantically unacceptable.

Conclusions

Five experiments have been presented that suggest verb phrase ellipsis without a matching antecedent in a standard verb phrase position may be relatively acceptable depending on various characteristics of the example. When a matching verb phrase was available, just not in verb phrase position, then participants judged the ellipsis examples relatively acceptable. When an antecedent was available but needed to be revised, then an intermediate level of acceptability was seen. When there was not even a verb to work with to create a verb phrase antecedent (without going inside a word), then acceptability was very low indeed.

Acceptability was higher for mismatching examples with a passive antecedent and active elided verb phrase than for mismatching examples with an active antecedent and a passive elided verb phrase. We attributed this to the systematic paraphrase hypothesis: speakers/hearers are more likely to mistakenly think the first clause was active when it was actually passive than the other way around (cf. Mehler, 1963). Further, addition of an effective presupposition trigger in the elided clause also increased the acceptability of an ellipsis sentence with a mismatching antecedent, presumably because the presupposition may imply the presence of, or increase the salience of, an antecedent of the appropriate form.

Our experiments show that syntactic levels of representation contain information that is fine-grained enough to make sense of differences in acceptability judgments for elided VPs with flawed antecedents. Syntactic operations provide an appropriate metric with which to compare different types of flawed antecedents. A semantic account that could mirror our results would

need to find the same level of relevant fine-grained distinctions in purely semantic representations. Such an account would also have to deal with some non-trivial issues. Since all conditions have event-denoting verb roots, why would these event properties be made more salient or available in an active sentence than a passive, and why would they be made more available by an inflected VP than by a gerund, by a gerund than by a nominalization, etc. We don't see plausible, independently motivated, coherent distinctions that would account for the data as successfully as the distinctions made available by syntactic structure. It is interesting to note that even an account such as that proposed in Hardt (1993), which characterizes elided VPs semantically (as pronouns), appeals to structural constraints in explaining the relative salience of possible antecedents.

Clearly numerous questions remain concerning the precise details of the patching up operation that is required to comprehend and accept elided verb phrases which do not have matching antecedents. We think the present results do argue that simply calling such sentences grammatical will not suffice but an account based on acceptable ungrammaticality is promising. At very least it makes more refined predictions about acceptability than either the standard syntactic or semantic approaches. It also permits an approach to systematic asymmetries in mismatching cases that explains why a marked form of the antecedent with an unmarked form of the elided constituent is more acceptable than the other way around.

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Appendix 1

Materials used in Experiment 1 and (without elliptical clauses) Experiment 2. Alternatives separated by |, presentation regions separated by /

1. None of the astronomers saw the comet,|Seeing the comet was nearly impossible, |
The comet was nearly impossible to see,|The comet was nearly unseeable, /but John did.
2. Few people heard the distant siren,|Hearing the distant siren was difficult,|The distant
siren was difficult to hear, | The distant siren was almost unhearable, /but luckily Jane did.
3. No fireman detected the faint signal, |Detecting the faint signal was difficult, |The
faint signal was difficult to detect, |The faint signal was nearly undetectable, /but the dogs did.
4. Almost nobody approached the lion, |Approaching the lion was nearly impossible, |
The lion was nearly impossible to approach, |The lion was nearly unapproachable, /
but the trainer did.
5. Few students solved the calculus problem, |Solving the calculus problem was difficult,
|The calculus problem was difficult to solve, |The calculus problem was nearly
unsolvable, /but Erica did.
6. Almost nobody liked the owner, |Liking the owner was hard, |The owner was hard to
like, |The owner was nearly unlikable, /but the waitress did.
7. Very few visitors found Puffer's Pond, |Finding Puffer's Pond was difficult, |Puffer's
Pond was difficult to find, |Puffer's Pond was almost unfindable, /but Pierre did.
8. Few People tolerated Jim's antics, |Tolerating Jim's antics was hard, |Jim's antics
were hard to tolerate, |Jim's antics were nearly intolerable, /but Sally did.
9. Few people loved Fiona, |Loving Fiona was difficult, |Fiona was difficult to love, |
Fiona as almost unlovable, /but luckily Max did.
10. Few wrestlers beat Joe, |Beating Joe was nearly impossible, |Joe was nearly impossible
to beat, |Joe was almost unbeatable, /but in the end Sam did.
11. Almost nobody predicted the direction of the tornado, |Predicting the direction of the
tornado was difficult, |The direction of the tornado was difficult to predict, |The
direction of the tornado was nearly unpredictable, /but Channel 7 did.

12. Almost nobody identified the source of the odor, |Identifying the source of the odor was difficult, |The source of the odor was difficult to identify, |The source of the odor was nearly unidentifiable, /but Lisa did.
13. Few people mentioned the scandal, |Mentioning the scandal was unusual, |The scandal was seldom mentioned, |The scandal was nearly unmentionable, /but today Tom did.
14. Almost no one noticed the hidden camera, |Noticing the hidden camera was rare, |The hidden camera was seldom noticed, |The hidden camera was almost unnoticeable, /but today the secretary did.
15. Almost nobody verified the applicants' credentials, |Verifying the applicants' credentials was rare, |The applicants' credentials were seldom verified, |The applicants' credentials were nearly unverifiable, /but this week Higgins did.
16. Few people thought about the scale of the problem, |Thinking about the scale of the problem was rare, |The scale of the problem was rarely thought about, |The scale of the problem was nearly unthinkable, /but Ben did.

Appendix 2

Materials used in Experiment 3 and (without elliptical clauses) Experiment 4. Alternatives separated by |, optional modifier indicate by &

1. Singing the arias& slowly& tomorrow night will be difficult but Maria will.| Tomorrow night's& slow& singing of the arias will be difficult but Maria will./ { 15 71
2. Running the race& rapidly& tomorrow will be arduous but John will nevertheless.| Tomorrow's& rapid& running of the race will be arduous but John will nevertheless.
3. Drinking beer& heavily& Thursday night was irresponsible but Jake did anyway.| Thursday night's& heavy& drinking of beer was irresponsible but Jake did anyway.
4. Rescheduling the meeting& at the last minute& caused problems but the boss did anyway.| This morning's& last minute& rescheduling of the meeting caused problems but the boss did anyway.
5. Auctioning the violin& publicly& yesterday wasn't supposed to happen but the Douglas Gallery did.| Yesterday's& public& auctioning of the violin wasn't supposed to happen but the Douglas Gallery did.
6. Hiking the mountain& slowly& yesterday proved difficult but the children did.| Yesterday's& slow& hiking of the mountain proved difficult but the children did.
7. Playing football in the dark& secretly& tonight was forbidden but the teenagers did anyway.| Tonight's& secret& playing of football in the dark was forbidden but the teenagers did anyway.
8. Renovating the house& extensively& last year cost a lot of money but the homeowners did anyway.| Last year's& extensive& renovating of the house cost a lot of money but the homeowners did anyway.
9. Repainting the community center& annually& was rather laborious but volunteers did.| The& annual& repainting of the community center was rather laborious but volunteers did.
10. Washing the breakfast dishes& carefully& was boring but Jake did.| The& careful& washing of the breakfast dishes was boring but Jake did.

11. Rewriting the annual report& constantly& took forever but Joan did.|The& constant& rewriting of the annual report took forever but Joan did.
12. Cooking an elaborate meal& slowly& conflicted with the rehearsal but Julia did anyway.|The& slow& cooking of an elaborate meal conflicted with the rehearsal but Julia did anyway.
13. Rewriting the constitution& illegally& caused great opposition but the delegates did anyway.|The& illegal& rewriting of the constitution caused great opposition but the delegates did anyway.
14. Rebuilding the town hall& recently& was expensive but we did anyway.|The& recent& rebuilding of the town hall was expensive but we did anyway.
15. Planting tomatoes& in the Spring& was successful and John did.|The& Spring& planting of tomatoes was successful and John did.
16. Winning all the gold medals& repeatedly& was a surprise yet the team did.|The& repeated& winning of all the gold medals was a surprise yet the team did.

Appendix 3

Materials used in Experiment 5. Alternatives separated by |. Acceptability rating scale indicated for item 1.

SET A

1. The girl was pushed again by Bill after John did already.|The girl was pushed by Bill and John did.|. Bill pushed the new girl after Jill was already.|Bill pushed the new girl and Jill was.|
Unacceptable 1 2 3 4 5 Acceptable
2. The student was questioned by Customs after Immigration did previously.|The student was questioned by Customs and Immigration did.|. Customs questioned the student after his friend was previously.|. Customs questioned the student and his friend was.
3. The accountant was investigated by the IRS on Tuesday after the police did on Monday. |The accountant was investigated by the IRS and the police did.| The IRS investigated the accountant after the CEO was on Monday.| The IRS investigated the accountant and the CEO was.
4. .The volleyball team was beaten by the Cubans after the Germans did previously. | The volleyball team was beaten by the Cubans and the Germans did.|. The Cubans beat the volleyball team after the tennis team was previously.| The Cubans beat the volleyball team and the tennis team was.
5. The guitarist was booed by the audience after the club owner himself did earlier.|The guitarist was booed by the audience and the club owner himself did.| The audience booed the guitarist after the lead singer herself was earlier.|. The audience booed the guitarist and the lead singer herself was.|
6. The table was criticized by the seller after the buyer did already.|The table was criticized by the seller and the buyer did.|. The seller criticized the table after the chairs were already.|The seller criticized the table and the chairs were.
7. The dessert was praised by the customer after the critic did already.|The dessert was praised by the customer and the critic did.| The customer praised the dessert after the appetizer was already.| The customer praised the dessert and the appetizer was.

8. The house was photographed by Jill after Sally did previously.|The house was photographed by Jill and Sally did.|Jill photographed the house after the garage was previously.|Jill photographed the house and the garage was.
9. The old 400 meter record was broken by Phelps after Thorpe did previously.|The old 400 meter record was broken by Phelps and Thorpe did.|Phelps broke the old 400 meter record after the 200 meter was previously.| Phelps broke the old 400 meter record and the 200 meter was.
10. The secret recipe was revealed by Kate after Sandra did already.|. The secret recipe was revealed by Kate and Sandra did.|. Kate revealed the secret recipe after the chef's private notes were already.|. Kate revealed the secret recipe and the chef's private notes were.|
11. The library was called by the department head after the department secretary did previously.|. The library was called by the department head and the department secretary did.|. The department head called the library after the records office was previously.|. The department head called the library and the records office was.
12. The local writers were criticized by Tom after the professor did already.|. The local writers were criticized by Tom and the professor did.|. Tom criticized the local writers after the local paper was already.|. Tom criticized the local writers after the local paper was.|

Set B

1. Mary was scolded by her father, and today her mother did too.|. Mary was scolded by her father, and today her mother did.|. Mary's father scolded her, and today her sister was too.|. Mary's father scolded her, and today her sister was.
2. The report was first read by the judge, and then the lawyer did too.| The report was first read by the judge, and then the lawyer did.| The judge read the report first, and then the confession was too| The judge read the report first, and then the confession was.
3. The fireman was first praised by the Mayor, and today the President did too.|The fireman was first praised by the Mayor, and today the President did.| The Mayor first praised the fireman, and then the policeman was too.|The Mayor first praised the fireman, and then the policeman was.
4. The winner was hugged by the talk-show host, and the announcer did too.|The winner was hugged by the talk-show host, and the announcer did.| The talk-show host hugged the winner, and the loser was too.| The talk-show host hugged the winner, and the loser was.
5. The student was praised by the old schoolmaster, and the advisor did too.|The student was praised by the old schoolmaster, and the advisor did| The advisor praised the student, and the old schoolmaster was too.| The advisor praised the student, and the old school master was.
6. Mary was given French classes by her French grandmother, and her French aunt did too.|Mary was given French classes by her French grandmother, and her French aunt did.|. Mary French grandmother gave her French classes, and her sister was too.|. Mary French grandmother gave her French classes, and her sister was.
7. Susan was offered a loan by the bank, and the credit union did too.|Susan was offered a loan by the bank, and the credit union did.|. Susan bank offered her a loan, and her sisters were too. Susan bank offered her a loan, and her sisters were.|

8. The witness was surprised by the policeman question, and the lawyer did too.| The witness was surprised by the policeman question, and the lawyer did.| The policeman question surprised the witness, and the accused was too.| The policeman question surprised the witness, and the accused was.
9. The autoworkers were exploited by the local businesses, and the big corporations did too.|The autoworkers were exploited by the local businesses, and the big corporations did.|. The local businesses exploited the autoworkers, and the metal workers were too.|. The local businesses exploited the autoworkers, and the metal workers were.
10. The Mayor was interviewed by the newspapers, and the TV networks did too.|The Mayor was interviewed by the newspapers, and the TV networks did too.|The newspapers interviewed the Mayor, and the Chief of Police was too.|The newspapers interviewed the Mayor, and the Chief of Police was.
11. The suspect was questioned by the police, and the lawyer did too.|The suspect was questioned by the police, and the lawyer did.|.The police questioned the suspect, and the witness was too.|The police questioned the suspect, and the witness was.
12. The doctor was blamed by the child parents, and the insurance company did too.|The doctor was blamed by the child parents, and the insurance company did.|.The child parents blamed the doctor, and the head nurse was too.| The child parents blamed the doctor, and the head nurse was.

Figure 1. Mean ratings, Experiment 2. Error bars indicate 95% confidence interval of difference between two means.

Figure 2.
Assumed syntactic structures of nominal and verbal gerunds.

Figure 3.

Mean ratings, Experiment 4. Data presented for verbal and nominal gerunds, with and without modifiers. Error bars indicate 95% confidence interval of difference between two means.

Figure 4.

Mean ratings, Experiment 5. Data presented separately for items with and without temporal (already, previously) and “too” presupposition triggers. Error bars indicate 95% confidence interval of difference between two means.

Table 1
Percentage Acceptable Responses and Reaction Time (ms), Experiment 1

Condition	Percentage Acceptable	Reaction Time
a. Available verb phrase	82.8	2146
b. Embedded verb phrase	66.1	2230
c. verb phrase with trace	43.9	2399
d. Negative adjective	17.1	2298

--Note: 95% confidence interval of the difference between any two percentages is 9.6%, and between two RTs is 292 ms.

Table 2
Percentage Acceptable and Reaction Times (ms), Experiment 3

Condition	Percentage Acceptable	Reaction Time
a. Verbal Gerund, -modifier	56.2	1891
b. Verbal Gerund, +modifier	59.7	1801
c. Nominal Gerund, -modifier	36.3	2014
d. Nominal Gerund, +modifier	33.7	1875

--Note: 95% confidence interval of the difference between two percentages is 9.4%, and between two RTs is 198 ms.