

Accounting for Voice Mismatch in Ellipsis

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1. Introduction

Common approaches to ellipsis typically posit one of two kinds of identity between elided material and some local antecedent: syntactic or semantic, exclusively. When such identity is present, the ellipsis is allowed, and not otherwise. The fact that mismatches in voice between antecedent and elided material are only sometimes allowed poses problems for both theories. A third, hybrid approach – the discourse based approach in Kehler (2000) – accounts for such facts by employing coherence relations between the clauses that contain the antecedent and elided material. In this study, we present experimental evidence from an acceptability judgment task carried out on Amazon Mechanical Turk that (i) a syntactic identity condition cannot be totally regulated by discourse conditions; syntactic identity plays a critical role in licensing ellipsis when the crucial notion of size is taken into account; (ii) discourse effects do modulate the acceptability of small ellipses, but not of big.

Voice mismatch (VMM) in ellipsis is when the elided material and its antecedent differ with respect to voice: a passive phrase is elided based on an active antecedent or vice versa. Some ellipses containing VMM are rendered unacceptable while others are judged to be acceptable. (1) and (2) illustrate this contrast. In these examples and in the rest of the paper, we will show the putative elided material at the end of the sentence, offset in angled brackets. The antecedent to the elided material will be placed in italics.

- (1) The janitor must *remove the trash* whenever it is apparent that it should be. <removed> (Merchant to appear: 3)
- (2) * John had *observed many of the enemy's soldiers*, but hadn't been by them. <observed> (Sag 1976: 17)

These facts raise questions about the nature of the relationship between the antecedent and the ellipsis site: why is it that sometimes the antecedent and ellipsis site must match in syntactic structure, while at other times they can (at least appear to) mismatch? This touches on a larger question in the study of ellipsis known as the **identity** question, articulated by Merchant (2012) as the following:

- (3) What is the relationship between the understood material in ellipsis and its antecedent?

Attempts to answer this question typically posit that there is some identity relationship between the antecedent and the elided material; however, the exact nature of this identity is a topic of much debate. The two dominant proposals are that this identity includes either (a) a syntactic component (Merchant to appear; Chung to appear; Chung et al. 1995; Sag 1976; Hankamer 1979; and many others); or (b) a semantic one (Dalrymple et al. 1991; Hardt 1993; Merchant 2001; and others).

The varying acceptabilities of VMM ellipsis constructions pose challenges for both types of identity conditions. The non-acceptability of the VMM in (2) is problematic for pure semantic identity, since a semantic antecedent is available: the active and passive are mutually entailing and thus should satisfy

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semantic identity, under versions of such conditions proposed in the literature. The acceptability of the VMM in (1) is problematic for pure syntactic identity, since a structurally identical antecedent is not obviously available. For this reason, syntactic theories of identity have typically undergenerated while semantic theories have overgenerated (cf. Kehler 2000; Merchant to appear): syntactic theories fail to predict all of the grammatical cases of ellipsis while semantic theories fail to rule out all of the ungrammatical cases.

The discourse-based approach proposed by Kehler (2000) is a hybrid approach. Under this approach, both types of identity may be required: in certain cases, only semantic identity is required, while in other cases, both semantic and syntactic identity are required. Discourse relationships between the antecedent and elided material are what determine which type of identity is required.

This paper presents psycholinguistic data from an acceptability judgment task carried out on Amazon Mechanical Turk in order to choose between these three proposals. Previous psycholinguistic work (e.g. Arregui et al. 2006; Kim et al. 2011; Tanenhaus & Carlson 1990; Frazier & Jr. 2006) has shown evidence for a syntactic requirement in verb phrase ellipsis. Moreover, Kim & Runner (in press) present evidence from several magnitude estimation experiments on VPE. Their results provide evidence for syntactic identity; in addition, they also show that syntactic identity in VPE may be modulated by discourse relations.

However, there is not as much experimental work comparing verb phrase ellipsis to other types of ellipsis. Such work is necessary because a full account of ellipsis must be able to explain the many subtypes of ellipsis in addition to the more well-studied VPE. In this paper, we examine two types of ellipsis: VPE and sluicing. We find that syntactic identity is required in both, but that in VPE only, discourse effects do further modulate acceptability. Thus, we conclude that the syntactic notion of size plays a critical role in answering the identity question: while syntactic identity is always required, the height of the deletion site may place additional restrictions on the relationship between the antecedent and the elided material.

The paper will proceed as follows. In section 2, we give an overview of the proposals being tested. In section 3, we outline the design, methods, and results of an experiment testing these three proposals. Finally, in section 4, we conclude.

2. Theoretical background

2.1. Syntactic identity

Syntactic theories posit a structural identity between the antecedent and the ellipsis site. Under a syntactic model of ellipsis, a constituent may be elided only if it has an antecedent which is explicitly pronounced and which is identical to it in structure. Such a theory would account for the acceptability of (4) and the unacceptability of (5).

- (4) John will *go to the store*, and Mary will too. ⟨*go to the store.*⟩
(5) * John will *go to the store*, and the school will be too. ⟨*gone to by John.*⟩

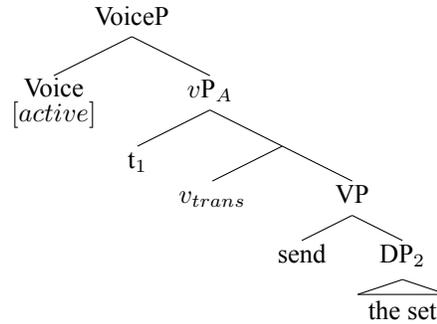
On a syntactic identity theory, (5) is ungrammatical because the antecedent *go to the store* is not identical to the elided phrase *gone to by John*.

2.1.1. Size

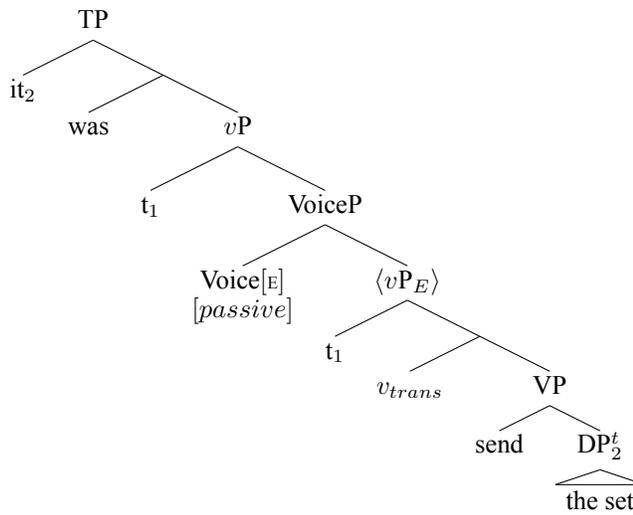
While syntactic theories easily capture the facts in examples like (4) and (5), many fail to account for cases of acceptable VMM. For this reason, more recent proposals of syntactic identity have attempted to explain the graded acceptability of VMM in ellipsis by refining the structure of the ellipsis site (see Merchant 2008a). One way that syntactic theories have done this is by distinguishing between big and small (or high and low) ellipses. Merchant (to appear) argues that in small ellipses (e.g. VPE), the elided material does not contain the voice head, and thus VMM is illusory: since the ellipsis occurs below the voice head, the syntactic structure of active and passive VPs is identical, making ellipsis licit in these cases. However, in big ellipses (e.g. sluicing), the elided material contains the voice head, and thus the syntactic structures of an active and passive clause are not identical, resulting in the ellipsis being illicit in these cases.

The following pair illustrate this contrast. In these examples, the antecedent phrase will be marked with a subscript A , and the elided phrase will be marked with a subscript E .

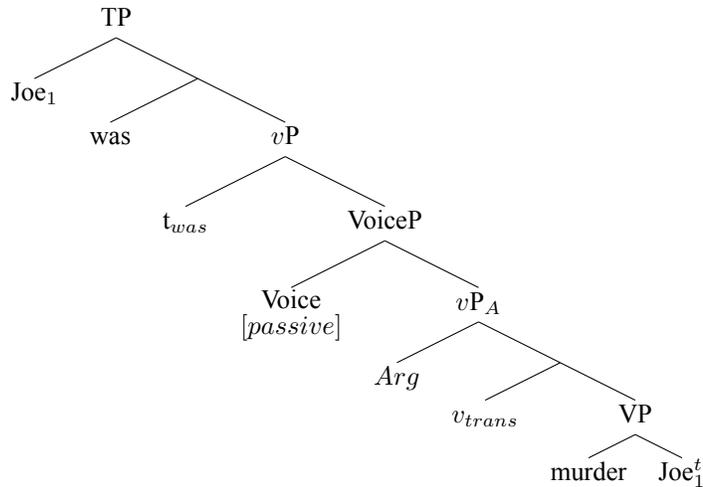
- (6) a. Steve asked me to send the set by courier through my company insured, and it was. (Kehler 2002: 53)
 b. Steve asked me to...



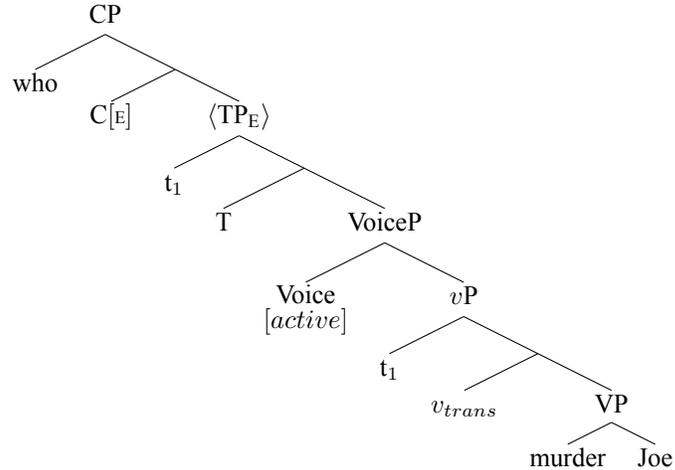
c.



- (7) a. * Joe was murdered but I don't know who. (Merchant to appear: 19)
 b.



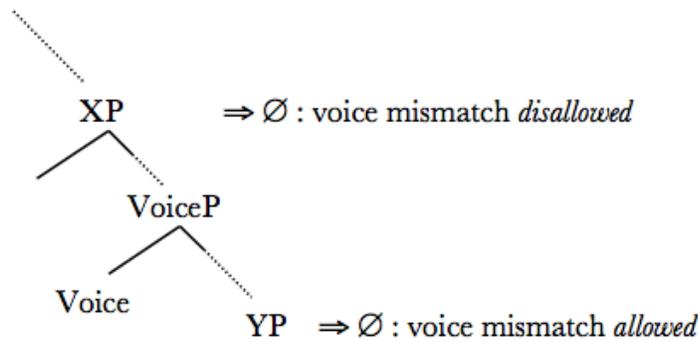
c. but I don't know...



In (6), a case of VP (small) ellipsis, the elided phrase is by hypothesis at most the *vP* *send the set* (and possibly even just the VP). Because this phrase is located below the crucial voice head indicating passive voice, it has an identical antecedent earlier in the sentence. This kind of ellipsis is a small ellipsis, and is licit under this type of syntactic identity proposal. Thus, the apparent asymmetry of structure in (6) is an illusion: what seems to be a syntactic asymmetry is really a morphophonological one – namely, that the presence of an active versus passive head results in different pronunciations of the verb *send*. In (7), by contrast, the ellipsis occurs above the voice head, and so is illicit. The elided phrase *murder Joe* includes the head indicating active voice. Because there is no corresponding active head in the antecedent phrase, the ellipsis does not have a syntactically identical antecedent. It is therefore illicit.

The following diagram, taken from Merchant (to appear: 15), illustrates the geometry of licit versus illicit VMM.

(8)



2.2. Semantic identity

Semantic theories posit that the ellipsis site and the antecedent must be identical in meaning, not structure. Under this view, ellipsis resolution resembles anaphora resolution: the elided material receives meaning from the context (Dalrymple et al. 1991; Hardt 2007). Since active and passive are not typically distinguished semantically, semantic theories predict that all cases of VMM should be licit.

2.3. Discourse

The discourse theory represents a particular hybrid of the syntactic and semantic theories. Kehler (2000) argues that sentences in a discourse are linked together by coherence relations. Acceptability of VMM in ellipsis is determined by what coherence relation is operative between the elided material and its antecedent. On this theory, ellipsis always requires semantic identity; in addition, depending on what

relation holds, syntactic identity may also be required. When only semantic identity is operative, VMM is licit; when both syntactic and semantic identity are required, VMM is illicit.

Coherence refers to the ways in which hearers attempt to link together the sentences that form a discourse (Kehler 2000: 539). For example, in a discourse, hearers do not interpret the two sentences in (9a) to be unrelated, but they infer that Mary is upset at Bill because Bill forgot her birthday. Because it is more difficult to infer how the two sentences in (9b) could be connected, the discourse is less coherent.

- (9) a. Mary is upset with Bill. Bill forgot her birthday.
- b. Mary is upset with Bill. #Jupiter has 63 moons.

Kehler (2000) discusses two types of coherence relations relevant to ellipsis: *resemblance* and *cause/effect*. When a resemblance relation holds, the entities or properties in the elided material are interpreted as in some way parallel to those in its antecedent. For example, in (10), John and Bill are the entities, and they are parallel in that they both went to the store.

- (10) John *went to the store* because Bill did. ⟨go to the store⟩

When a cause/effect relation holds, the proposition expressed by the elided material has some sort of causal relationship to the proposition in the antecedent. For example, in (11), the fact that Bill went to the store is the cause for John to.

- (11) John *went to the store* because Bill did. ⟨go to the store⟩

Kehler outlines many subtypes of these coherence relations. This paper focuses on three main subtypes: the *parallel* subtype of resemblance; and the *explanation* and *denial of the preventer* subtypes of cause/effect.

2.3.1. Resemblance relations

The canonical type of resemblance relation is the *parallel* subtype, defined below (Kehler 2000: 542-43).

- (12) a. **Parallel.** Infer $p(a_1, a_2, \dots)$ from the assertion of S_0 , and $p(b_1, b_2, \dots)$ from the assertion of S_1 , where for some property vector \vec{q} , $q_i(b_i)$ for all i .
- b. Bill likes to play golf. Al enjoys surfing the net.

In this example, *Bill* and *Al* are the parallel entities a_1 and b_1 . The common relation, p , according to Kehler, is “participation in some recreational activity,” (Kehler 2000: 542-43).

There is a class of connectives and adverbs which serve as markers for the resemblance coherence relation, including *and*, *also*, *as well*, *too*, *likewise*, etc.

2.3.2. Cause/effect relations

The fundamental theme of all cause/effect type relations is that one sentence is in a causal relationship to the other; however, the exact nature of this relationship may vary. Kehler (2000: 541) defines *explanation* as the canonical case of cause/effect. The definition of *explanation* is given below.

- (13) a. **Explanation** Infer P from the assertion of S_0 and Q from the assertion of S_1 , where normally $Q \rightarrow P$.
- b. Bill called his lawyer because he was about to be impeached.

In (13b), according to Kehler, “ P corresponds to the meaning of Bill called his lawyer, Q corresponds to the meaning of Bill was about to be impeached, and the conditional that usually holds is that if X is about to be impeached, then it plausibly follows that X will call his lawyer.”

The other subtype we examine in this study is the *denial of preventer* subtype, defined below.

- (14) a. **Denial of preventer.** Infer P from the assertion of S_0 and Q from the assertion of S_1 , where normally $Q \rightarrow \neg P$.

		Coherence			
		Height	Voice	Res	C/E
Elliptical	Big	M			
		MM			
	Small	M			
		MM			
Non-elliptical	Big	M			
		MM			
	Small	M			
		MM			

Figure 1: A table illustrating the 16 experimental conditions. (M=matched voice, MM=mismatched voice, C/E=cause/effect, Res=Resemblance)

- b. Bill didn't call his lawyer, even though he was about to be impeached.

Like in *explanation*, there is an implication relationship between the two propositions in a *denial of preventer* utterance. However, they differ in that the *denial of preventer* relation also contains a negation.

As with the resemblance relations, certain adverbs and connectives regularly appear in cause/effect sentences which can serve as markers of this coherence relation, including *but*, *even though*, *because*, *as a result*, *therefore*, *so*, *consequently*, etc.

Kehler (2000) argues that when there is a VMM in ellipsis, sentences where there is a cause/effect relation between antecedent and ellipsis site are licit, while sentences where there is a resemblance relation are illicit. The contrast can be seen in (15a) and (15b) below, where the acceptable (15a) contains a cause/effect relation, and the unacceptable (15b) contains a resemblance relation.

- (15) a. In March, four fireworks manufacturers asked that the decision be *reversed*, and on Monday, the ICC did. <reverse the decision> (Dalrymple et al. 1991)
- b. * This problem was *looked into by John*, and Bob did too. <look into the problem> (Kehler 2000: 551, example 34)

This contrast is due to the fact that cause/effect relations require only semantic identity, which tolerates VMM, while resemblance relations require syntactic identity in addition to semantic (Kehler 2000: 543-46). This pattern is caused by what Kehler defines as the arguments of the coherence relations. Since the arguments of a cause/effect relation are propositional (P and Q), identity must be at the propositional level (i.e. identity is semantic). However, the arguments of a resemblance relation are sub-sentential units, much closer to syntactic objects (a_1 , b_1 , etc.), and so identity occurs at the syntactic level in addition to the semantic level in ellipses with a resemblance relation.

3. The current study

The discourse theory seems to unite the syntactic and semantic approaches in a way which accounts for the data. However, a problem with the discourse approach is that the data in Kehler (2000) come mostly from VP ellipsis. Because the syntactic approach distinguishes between ellipses based on the syntactic notion of size, it predicts a difference between VP ellipsis and sluicing, where the discourse

theory does not. We therefore look at both types of ellipsis in order to test the effect of size and coherence on the acceptability of VMM.

3.1. Design

The experiment was carried out as an online acceptability judgment survey conducted through Amazon Mechanical Turk. Eighty 16-condition items were created, along with forty filler items, each with a context sentence. In a Latin Square design, 51 native English speakers between the ages of 18-40 rated the acceptability of these sentences on a 1-7 scale (where 7 is the highest). Subjects were paid \$0.02 per sentence, totaling \$2.40 per experiment.

The experiment has a $2 \times 2 \times 2 \times 2$ design with four factors: coherence relation (cause/effect vs. resemblance), voice (matched vs. mismatched), size (big vs. small), and sentence type (elliptical vs. non-elliptical). Figure 1 illustrates the design.

Arregui et al. (2006: 241) observed an asymmetry based on the direction of the voice mismatch: they observed that mismatches which follow an active-passive order of clauses are judged less acceptable than mismatches which follow a passive-active order. In order to ensure that our results were not confounded by the order of the clauses, we also controlled for the direction of voice mismatch. Half of the stimuli contain a passive antecedent with an elided site, and the other half contain an active antecedent with a passive elided material.

An example stimulus is given in (16) and (17)

- (16) Jean was trying to sell her car. I know that someone bought it,
Elliptical conditions
- | | | |
|----|---------------------------------------|-----------------------------------|
| a. | and Lisa knows who. | (big, resemblance, matched) |
| b. | and Lisa knows by who. | (big, resemblance, mismatched) |
| c. | because she told me who. | (big, cause/effect, matched) |
| d. | because she told me by who. | (big, cause/effect, mismatched) |
| e. | and Lisa also knows that someone did. | (small, resemblance, matched) |
| f. | and Lisa also knows that it was. | (small, resemblance, mismatched) |
| g. | because she told me that someone did. | (small, cause/effect, matched) |
| h. | because she told me that it was. | (small, cause/effect, mismatched) |
- (17) **Non-elliptical conditions**
- | | | |
|----|---|-----------------------------------|
| a. | and Lisa knows who bought it. | (big, resemblance, matched) |
| b. | and Lisa knows who it was bought by. | (big, resemblance, mismatched) |
| c. | because she told me who bought it. | (big, cause/effect, matched) |
| d. | because she told me who it was bought by. | (big, cause/effect, mismatched) |
| e. | and Lisa also knows that someone bought it. | (small, resemblance, matched) |
| f. | and Lisa also knows that it was bought. | (small, resemblance, mismatched) |
| g. | because she told me that someone bought it. | (small, cause/effect, matched) |
| h. | because she told me that it was bought. | (small, cause/effect, mismatched) |

3.2. Predictions of the three theories

The semantic theory predicts no differences between any of the conditions, since they are all truth-conditionally equivalent. The discourse theory predicts that in the elliptical conditions, VMM with cause/effect relations will be judged better than VMM with resemblance relations; size of ellipsis is not predicted to have an effect. The syntactic theory predicts that VMM in small ellipses will be judged better than VMM in big ellipses; coherence is not predicted to have an effect.

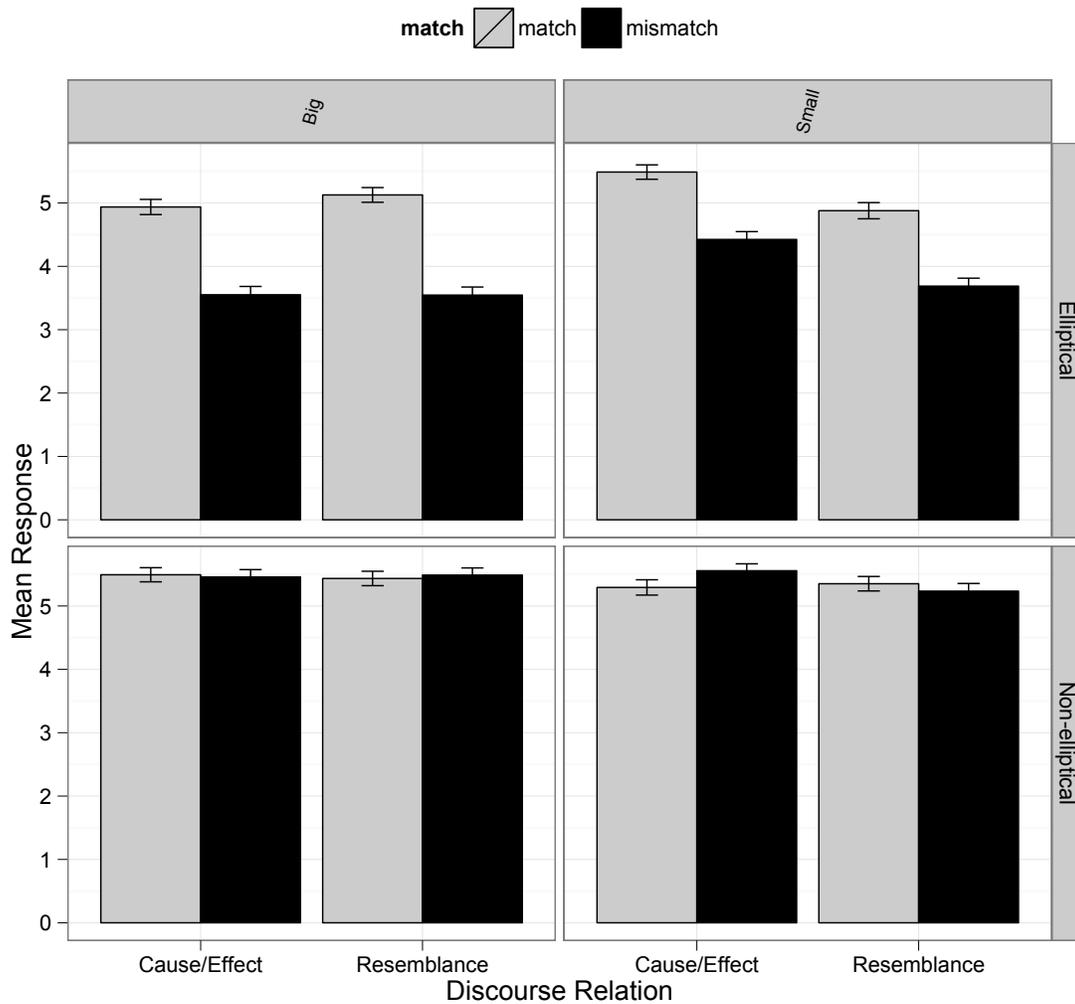


Figure 2: Results for all four groups (Error bars represent standard error of the mean)

3.3. Results

The elliptical and non-elliptical conditions were analyzed as two separate groups. The results can be seen in Figure 2. No significant differences were found between any of the non-elliptical conditions (i-p). In the elliptical conditions (a-h), we found a main effect of voice as well as an interaction between size and discourse relation (all p s < .001). The main effect shows that the elliptical voice matched conditions (conditions a, c, e, and g; mean rating of 5.14) were rated higher on average than the elliptical VMM conditions (conditions b, d, f, and h; mean rating of 3.82). The interaction shows that in the small elliptical conditions only, cause/effect conditions (conditions g and g; mean rating of 4.94) were rated higher than resemblance conditions (conditions e and f; mean rating of 4.32). Most critically, pairwise comparisons showed a significant difference (p < .001) between the mismatched cause/effect condition (condition h; mean rating of 4.42) and the mismatched resemblance condition (condition f; mean rating of 3.69), but only in the VP ellipsis conditions. No effect of coherence was seen in the big elliptical conditions (conditions a-d).

3.4. Discussion

The main effect of voice in the elliptical conditions confirms that there is a penalty for VMM in ellipsis. This VMM penalty is problematic for the semantic identity approach, which does not account for such a penalty. However, neither the syntactic nor the discourse-based approaches can fully account for the data alone. The interaction in the elliptical conditions between coherence and size shows that there is a discourse effect of coherence, but crucially this effect only appears in small ellipses, not big. We take this to mean that a syntactic identity condition is necessary to identify the set of grammatical ellipses, and that acceptability within this set is further modulated by discourse-level effects. In big ellipses, such as sluicing, the syntactic identity condition rules out any cases of VMM because the voice head is always contained in the ellipsis site in big ellipses. However, in small ellipses, because the voice head is not contained in the ellipsis site, VMM is allowed. Within small ellipses, discourse-level effects act as a heuristic, ordering sentences containing small ellipsis on a scale of acceptability. This heuristic can be thought of as a preference for the cause/effect coherence relation over the resemblance relation between the antecedent and the elided material.

Additionally, our results have significant implications for approaches to ellipsis which rely on principles of information-structure. For example, Kertz (2012) proposes an account of ellipsis which argues that general information-structural principles not specific to ellipsis – such as focus structure and topic structure – can explain the VMM facts. However, because such accounts rely on principles not specific to ellipsis, they predict a difference between conditions in the non-elliptical sentences as well as in the elliptical ones. The lack of any effects in our non-elliptical conditions therefore poses a potential problem for such information-structural accounts, which warrants further investigation.

One slightly surprising aspect of our results, though, is that in the small elliptical group, we see discourse-level effects not just in the VMM conditions (conditions f and h), but also in the voice matched conditions (conditions e and g). While Kehler's proposal allows for effects of coherence on voiced matched ellipses, it does not explicitly predict such an effect. A closer look at the stimuli reveals a possible explanation, which is that there may be a hidden effect of MAX_{ELIDE} in the data.

MAX_{ELIDE} is a constraint on ellipsis proposed in Merchant (2008b) and elaborated in later work which requires that ellipsis target structurally higher rather than lower nodes. Merchant (2008b: 141) defines MAX_{ELIDE} as follows:

- (18) MAX_{ELIDE} . Let XP be an elided constituent containing an A' - trace. Let YP be a possible target for deletion. YP must not properly contain XP.

This constraint explains the following pattern of acceptability:

- (19) James likes someone and Sally knows who (*/?he does).

A closer inspection of the data reveals that in some items, condition (e) – the elliptical condition containing a small, voice matched, resemblance sentence – could be elided higher while still preserving the same meaning. For example, in (16e), reproduced as (20a) below, the ellipsis is not as high as it possibly could be. There is an alternative version of this sentence where a higher node is targeted for ellipsis, shown in (20b).

- (20) Jean was trying to sell her car. I know that someone bought it,
a. and Lisa also knows that someone did.
b. and Lisa also does.

Future work should test whether MAX_{ELIDE} does indeed have an effect in these cases.

4. Conclusion

The data show clear effects of both discourse and syntax, but no evidence of semantic effects. We find the syntactic-level effect of size as well as the discourse-level effect of coherence. We therefore conclude that both the discourse and syntactic approaches must play some role in accounting for the VMM facts in ellipsis. We have proposed that syntactic identity is always a requirement on ellipsis, but

that within the syntactically licensed ellipses, discourse acts as a heuristic, modulating the acceptability of small ellipses, but not of big ones. that within the syntactically licensed ellipses, discourse acts as a heuristic, modulating the acceptability of small ellipses, but not of big ones.

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