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Effects of discourse on control[1]

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This study examined discourse effects on obligatory and non-obligatory control interpretations. Seventy participants undertook three online forced-choice surveys, which monitored preferred interpretations in complement control, verbal gerund subject control, long-distance control and sentence-final temporal adjunct control. Survey 1 ascertained their baseline interpretations of the empty category in these constructions. Survey 2 primed the critical sentences used in survey 1 with a weakly established topic of discourse and survey 3 primed them with a strongly established one. Reference assignment in complement control remained consistent across all three conditions, illustrating that pragmatics does not infiltrate this structurally regulated and syntactically unambiguous construction. Changes in interpretation were found in the remaining three constructions. An accessibility-motivated scale of influence, combining three independent discourse factors (topichood, competition and linear distance) was created to model reference determination in verbal gerund subject control and long-distance control. The results for temporal adjunct control are novel. They revealed a much stronger susceptibility to pragmatic interference than that reported in the literature yet the construction behaved differently from non-obligatory control under discourse pressure. We propose a structural account for sentence-final temporal adjunct control, which permits the evident interpretation shift while still excluding arbitrary and sentence-external interpretations.

KEYWORDS: control, discourse, English, reference assignment, syntax

1. INTRODUCTION

Control constructions in English are made up of a main clause and an embedded infinitival or non-finite clause. The embedded clause has a phonetically empty understood subject whose interpretation can be gained from various sources. Broadly, control constructions fall into two categories, known as OBLIGATORY CONTROL and NON-OBLIGATORY CONTROL (see Williams 1980). The basis for this demarcation is in the availability of referents for their empty subjects:

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in obligatory control the referent is restricted, while in non-obligatory control, the empty subject can take variable reference.

In canonical obligatory control, the reference of the empty subject (*ec*) is confined to a particular antecedent in the main clause.

(1) (a) Harry$_1$ tried [*ec*$_1$ to read the book].
(b) Ron persuaded Hermione$_1$ [*ec*$_1$ to kick the ball].
(c) *Harry$_1$'s teacher tried [*ec*$_1$ to read the book].
(d) *Ron$_1$ persuaded Hermione [*ec*$_1$ to kick the ball].

This may be the subject, as in (1a) or the object, as in (1b), but this is syntactically determined; the antecedent must be in a structurally higher position than the *ec* it assigns a reference to and must also be local to it (Williams 1980). These restrictions are demonstrated in (1c) and (1d), respectively, where the sentences are ungrammatical on the readings indicated by the indices. In (1c), *Harry* is embedded within the possessive subject NP, which means it no longer c-commands the subject position in the infinitival clause, and in (1d), the object has been skipped over as a referent in favour of the subject.

The other type of control is non-obligatory, in which the *ec* exhibits flexibility in its interpretation.

(2) Harry said to Hermione that [[*ec* waving the wand slowly] was a good strategy].

In (2), for example, either *Harry* or *Hermione* can be understood as the potential agent in the embedded clause, and the choice depends on the context rather than grammar (compare (1b) and (1d) above).[2]

Non-obligatory control also permits sentence-external referents.

(3) [*ec* Reading the book slowly] made *Ron* sleepy.

In (3), there is a strong bias to link the reference of the *ec* to the only sentence-internal referent mentioned, namely *Ron*, but the link is not mandatory, and it is possible to think of an alternative, if less preferred interpretation, such as Ron listening to someone else read.

In addition to sentence-external specific interpretations, non-obligatory control constructions may also have *ec*s to which no specific referent is attributed. In this instance, the referent is interpreted generically.

(4) [*ec* Dancing in tap shoes] is a tricky affair.

In the absence of any contextual cue, the interpretation of (4) is that for people in general, it is in general tricky to dance in tap shoes.

[2] There are other options in terms of reference choice for this sub-type of control, namely both the subject and object collectively, or someone else entirely. In this paper we concentrate only on the choice between the subject and the object for this construction. We return to how we exclude the other options later.

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There are further differences between and within these constructions but the examples above illustrate the two main categories: those in which the reference of the *ec* is obligatorily determined and regulated by structural principles, and those which admit flexibility in the *ec*'s reference assignment, where either discourse rules or genericity are relevant. The current paper narrows the focus to cases in which the *ec* receives a specific interpretation either sentence-internally or sentence-externally, setting aside the 'generic reference' type (for its generic interpretation, see especially Bhatt & Izvorski 1998, Bhatt & Pancheva 2006). Although there is a consensus that the demarcation line between obligatory control (OC) and non-obligatory control (NOC) is a valid one (see Williams 1980, Manzini 1983, Petter 1998, Landau 2000, Manzini & Roussou 2000, Hornstein 2001, Janke 2007), where precisely to make the cut is not entirely resolved. For one type of control in particular, this is especially true, namely the construction known as 'sentence-final temporal adjunct control', so called because the clause containing the *ec* is adjoined optionally.

(5) Luna tapped Harry [while *ec* feeding the owl].

There is a large body of theoretical work on this sub-type of control which assumes an obligatory subject interpretation (see especially Landau 2013). Indeed the bulk of the acquisition literature that has tracked children's development of this construction does so on the assumption that the adult reading is subject-oriented and that any deviation from this is indicative of an interim developmental milestone on the child's path to an adult grammar (see Guasti 2004 for a review). On the basis of its reported obligatory subject interpretation it is often categorised under OC, but an important difference between it and other types of OC is that the adjunct is not selected by a control verb. Yet it does not fall naturally under NOC either. In particular, it does not exhibit the flexibility of other NOC structures in that neither an arbitrary interpretation nor one with an external referent is possible in (6) and (7), respectively.

(6) *Luna tapped Harry while ec_{arb} feeding the owl.
(= the feeding of owls by people in general)

(7) *Luna_1 tapped Harry_2 while ec_3 feeding the owl.
(= an owl-keeper is feeding the owl)

A main aim of the current article is to construct a test that can enable a clear distinction between OC and NOC to be made. One of the key properties that seems most promising in being able to distinguish between OC and NOC empirically is whether or not their *ec*s' interpretations are fixed sentence-internally or whether they show flexibility within or outside the sentence.[3] For some of our test items

[3] Landau (2000) draws a distinction between exhaustive and partial control within the OC classification (see also Williams 1980 and Martin 1996). This article does not draw on these sub-types; we avoid examples that combine a partial control verb in the matrix clause with a

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(complement control, verbal gerund subject control and long-distance control), the data corroborate theoretically motivated classifications by providing empirical support for long-reported author-based intuitions and smaller samples of data. For these cases, the current contribution is that of a methodology that tests a large sample of participants in a structured survey on the same number of trials for each construction, where order effects within tasks are controlled for by randomisation. This is in line with the growing body of work arguing that 'traditional' introspective syntactic judgements should be subject to experimental validation (e.g. Bader & Häussler 2010). Having shown that NOC is discourse-regulated, we propose an order of influence of three independent discourse factors that interact when guiding people's interpretations of the two NOC sub-types examined. For temporal adjunct control, the data demonstrate something not generally reported: it is not obligatorily subject-oriented and pragmatics can affect its interpretation. This necessitates a reassessment of its classification. We present the argument that temporal adjunct control IS a structurally regulated control construction, but one with a potentially ambiguous syntax. It is the presence of more than one structural possibility that enables pragmatics to influence the parsing process.

In the next section, we set out the basis for a test which can be used to support or refute the OC/NOC distinction. It uses established notions of topichood (e.g. Reinhart 1981, Neeleman et al. 2009) to examine whether or not contextual cues can affect participants' reference assignment in four control constructions: complement control (which is an uncontroversial example of OC), long-distance control and verbal gerund subject control (both uncontroversially NOC), and sentence-final temporal adjunct control (argued in the literature to be OC).[4] These were illustrated in (1), (2), (3) and (5), respectively. Having set out the basis for our experimental design, we introduce two other factors which can influence interpretations of discourse-anaphoric elements, namely competition and linear distance. We discuss how these additional factors might interact with our experimentally induced contextual cues during reference determination.

2. DISCOURSE-REGULATED ANTECEDENTS

An essential difference between the two types of control outlined above is the locus of the controller of the *ec*. For OC, it is syntactically licensed by a local, c-commanding element. For NOC, syntactic restrictions are not operative and there are various independent factors that can direct the underspecified argument

collective predicate in the infinitival, which invite a partial control reading for some speakers, and the binary nature of the forced-choice questionnaire used here also removes the need to refer to this distinction. See Landau (2000) for the first analysis of this phenomenon.

[4] There are many more types of adjunct control than the example we discuss here. We have selected this sub-type of control because it has been explicitly analysed as subject-oriented, and because the bulk of the acquisition literature on this construction bases its accounts chiefly on final temporal adjunct control (see Guasti 2004 for a review).

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towards an interpretation. The factors we examine here are discourse topics, competition and linear distance; these will ultimately be ranked according to how they interact as an *ec* in the two cases of NOC secures its reference.

There is much literature on the influence of pragmatics in NOC (see especially Bresnan 1982, Williams 1994, Adler 2006, Landau 2013). Bresnan (1982) uses the example in (8) below to illustrate how a preceding discourse can determine the reference of an *ec* in a gerund subject.

(8) Tom$_1$ felt sheepish. *ec*$_1$ Pinching those elephants was foolish.
(Bresnan 1982: 328)

In (8), the subject of the preceding sentence is highly preferred as the antecedent of the *ec* in the second sentence. Aside from being the subject of the preceding sentence, *Tom* is the topic of that sentence, as the sentence is about *Tom*, where topichood is intuitively defined by 'aboutness' (Strawson 1964, Reinhart 1981, Givón 1983, Vallduví 1992, Erteschik-Shir 1993, Neeleman et al. 2009) and sentences are typically interpreted as being 'about' the subject (Reinhart 1981). It is in virtue of being the topic that *Tom* in (8) licenses the *ec* in the non-obligatorily controlled gerund.

The reference of *ec*s in pro-drop languages is also topic-led (see Samek-Lodovici 1996 for Chinese, Greek, Italian and Hebrew, and Bailey 2011 for a similar phenomenon in colloquial English). In the Italian example below, for instance, the antecedent of the *ec* in (9b) is the topic in the previous sentence, in (9a).

(9) (a) Questa mattina, **Gianni**$_i$ ha visitato la mostra. (Italian)
this morning Gianni has visited the exhibition
'This morning, Gianni visited the exhibition.'

(b) Più tardi, ***ec***$_i$/?**egli**$_i$/??**lui**$_i$ ha visitato l'università.
more late (he)/he/he has visited the.university
'Later, he visited the university.'

Proof that it is TOPICHOOD that is at stake and that a previously mentioned referent is not enough comes from (10), where the potential antecedent occurs in the 'by'-phrase of a passive and so can no longer license the *ec*'s reference, since this type of phrase cannot be a topic (see Strawson 1964, Samek-Lodovici 1996).

(10) (a) Questa mattina, la mostra è stata visitata da **Gianni**$_i$.
this morning the exhibition has been visited by Gianni
'This morning the exhibition was visited by Gianni.'

(b) Più tardi, ***ec***$_i$**/egli**$_i$**/lui**$_i$ ha visitato l'università.
more late (he)/he/he has visited the.university
'Later on, he visited the university.'
(Samek-Lodovici 1996: exx. (3) & (7))

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Although a subject is most often associated with topichood, this preference can be cancelled by introducing an alternative. It is well known that the 'as for' marker, for example, introduces a sentence topic. Thus, although the subject is the preferred topic in (11), the topic that has been introduced in (12) is *Ron*, and it is this and not the subject that the discourse-anaphoric expression *he* refers back to.

(11) Harry danced with Ron.

(12) As for Ron, Harry thought that he would enjoy dancing the tango.

From this we can see that a distinction must be drawn between the different degrees to which a topic has been established. A subject might be preferred as a topic when all else is equal but other factors can affect that preference (see Ariel 2001). Recognising that topics can be either weakly or strongly established is important as it will inform how we construct the contextual cues to precede the critical sentences in the current tasks. The example in (8) has shown that a topic in one sentence can provide the reference of an *ec* in another sentence.

Our aim in this paper is to create two contextual cues of very different strengths in terms of the pressure they put on an *ec* to take a specific referent. We turn to the weak cue first. An established method in the acquisition literature is to provide a child with an introductory sentence that announces what the next sentence is going to be about (for a review of the methodology, see Lust 1986) and then see if the child consults this contextual cue when assigning reference to a term in a following sentence:

(13) I'm going to tell you a little story about John. John saw Tom when he ran down the street.

(adapted from Lust et al. 1986: ex. (1a))

The same method has been used with children on the *ec*s in control (see Janke forthcoming). In (14), the verbal gerund is preceded by a sentence introducing *John*, which, as an instance of new information, is the focus (Erteschik-Shir 1993, Neeleman et al. 2009).

(14) I'm going to tell you something about John. *ec* Dancing in tap shoes was a big mistake.

The sentence promises to make *John* the topic of discourse in what follows, and in this sense, *John* is weakly established as a topic. As a discourse-anaphoric element, the *ec* in the following sentence can take its reference from this weakly established topic, although other, less preferred interpretations can still be reached.

It is also possible to create a stronger contextual cue, which leans very strongly in favour of one referent, by constructing a short narrative about that referent. This has been used to check the degree to which participants remain resilient to interpretation shift even under very strong discourse pressure (Janke forthcoming). In (15), *John* is the sentence topic of the first sentence since

it is about *John* (as well functioning as the topic of discourse in what follows). The person *John* refers to is elaborated on and continues as the topic of discourse in the second sentence. It is now a familiar topic and in this sense can be considered strongly established.

(15) John is looking after the birds. John takes out the food. Mary tapped John while *ec* feeding the owl.

The two examples provide us with two contextual cues of very different strengths, which we will refer to as weakly and strongly established topics of discourse, respectively. The first is designed to assess the effect of a weak cue on reference assignment, and the second, to assess reference assignment choices under severe discourse pressure. They will form the basis against which we measure participants' interpretation of the *ec*s in the four control constructions illustrated in Section 1.

Note that contextual cues should only be relevant to pragmatically regulated constructions. Arguments whose referents are syntactically determined should not be susceptible to pragmatic manipulations since those referents are set structurally (see also Cohen Sherman & Lust 1993). In (16), the topichood of *Harry* cannot override the syntactic process that links the reflexive to *Ron*.

(16) As for Harry_1, Ron_2 likes $\text{himself}_{*1/2}$.

Similarly, we predict that as complement control is syntactically regulated, it should not show any shift in interpretation no matter how strong the contextual cue.

In Ariel's (1988, 2001, 2004) Accessibility Theory, a number of factors which interact during the process of reference assignment are discussed. These factors can strengthen or detract from a referent's so-called 'accessibility' and the interplay between them makes discourse-governed reference assignment a complex process. One of the main ideas of Ariel's theory is that referential expressions differ in terms of the amount of information they encode and that the degree of information each has signals how accessible the mental representation of the discourse entity is. Thus, referring expressions are termed 'accessibility markers', which are either very elaborate, indicating that the referent is not easily accessible, or at the other extreme very spartan, in which case the referent should be highly accessible to the interlocutor. On this basis, referential expressions are ordered on a so-called accessibility scale. At one end are proper nouns, which are classified as low accessibility markers, and used by a speaker who may even assume no contextual knowledge on the part of their addressee. At the opposite end are zero elements, which, being underspecified, are high accessibility markers, and used when a highly accessible antecedent can be presumed:

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(17) Full name + modifier > full name > long definite description > short definite description > last name > first name > distal demonstrative + modifier > proximate demonstrative + modifier > distal demonstrative + NP > proximate demonstrative + NP > distal demonstrative (–NP) > proximate demonstrative (–NP) > stressed pronoun + gesture > stressed pronoun > unstressed pronoun > cliticised pronoun > verbal personal inflections > zero

(Ariel 2001: ex. (2))

Two further independent factors (in addition to topichood and the inherent accessibility of a referential expression) that can contribute to the accessibility of a discourse-derived referent for anaphoric element are competition and linear distance.[5, 6] For example, if two arguments are mentioned in a discourse, both are contenders – or in COMPETITION – for the *ec*'s reference, with one nearer to the *ec* than the other; this is the situation in our original long-distance control example in (2), repeated here for convenience:

(2) Harry_1 said to Hermione_2 that [[$ec_{1/2}$ waving the flag slowly] was a good strategy].[7]

In (2), the last argument to be mentioned before the *ec* is *Hermione* in the prepositional complement, making it linearly more local to the *ec* than the subject, which, as we saw above, is often the preferred topic of a sentence. LINEAR DISTANCE is well known to contribute to referent choice in pragmatically regulated reference assignment across sentence boundaries. In (18) below, for example, 'Pooh' is the linearly more local argument, and as such is the preferred referent for the pronoun in the subsequent sentence. A question that arises is how competition and linear distance are resolved in NOC.

(18) (a) Tigger looked at Pooh. #He had tripped over the honey pot and so had Pooh.

(b) Tigger looked at Pooh. He had tripped over the honey pot and so had Tigger.

[5] Ariel examines more factors than distance and competition, which we focus on here. For the most recent full review of Accessibility Theory, we refer the reader to the original text (Ariel 2001).

[6] The factors discussed here have been subject to much experimental work. In particular, Gibson's (2000) Dependency Locality Theory, which assesses the human computational resources that are employed during sentence parsing, posits locality as one of the key factors that consumes resources. Specifically, linking a referentially dependent element to a more distant antecedent is attributed with a higher cost than linking it to a local one, rendering the local one preferable (all else being equal). A later model (Lewis & Vasishth 2005) proposes that competition and distance, where the former is expressed as similarity-based retrieval interference, both contribute to how resources are allocated during sentence parsing.

[7] Recall from footnote 2 above that in principle, this sub-type of control permits an external controller too.

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The current task assesses the degree to which four control constructions are susceptible to pragmatic manipulation. We selected for investigation four examples that involve a specific referent, illustrated in (1b), (2), (3) and (5) in Section 1, repeated here for convenience:

(1) (b) Hermione persuaded Ron_1 [ec_1 to kick the ball].

(2) Ron_1 said to Hermione_2 that [[$ec_{1/2}$ waving the wand slowly] was a good strategy].

(3) [$ec_{1/2}$ Reading the book slowly] made Ron_1 sleepy.

(5) Luna_1 tapped Harry [while ec_1 feeding the owl].

Complement control in (1b) and temporal adjunct control in (5) represent OC by the matrix object and subject, respectively (though see Section 3.4 below for discussion of (5)), while long-distance control in (2) and verbal gerund subject control in (3) represent NOC with the interpretation of the *ec* varying between subject and object control or internal and external control, respectively.

We have also seen how three independent factors known to contribute to the accessibility of discourse-regulated antecedents combine in these sentences (19), and we will monitor how they interact when participants determine referent choice for the *ec*s under three different conditions.

(19) (a) Topichood (of varying strengths)
(b) Competition (between referential candidates)
(c) Linear distance (between the category in need of a reference and a referential source)

3. The current task

To examine the effect of contextual cues on the interpretation of the *ec*s, we measure participants' reference assignment choices in three different conditions. Survey 1 ascertains their preferred interpretations of the *ec*s in the sentences without contextual cues. This is important as the lexical items used might already affect participants' preferences. Survey 2 tests whether their baseline interpretations shift when cued with a weakly established topic that either contradicts or reinforces their baseline preferences. Survey 3 measures interpretation shift from surveys 1 and 2 when the same sentences are cued by a strongly established topic. Our predictions for the four examples of control are as follows.

3.1 *Complement control, e.g.* Ron persuaded Hermione *ec* to kick the ball

We expect referent choice in complement control to be unaffected by any of the contextual cues because the interpretative relation between the antecedent and the *ec* is structurally constrained. If this is so, participants should choose the matrix object as the antecedent consistently across all three surveys.

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3.2 *Verbal gerund subject control, e.g. ec* Reading the book slowly made Hermione sleepy

The *ec* in verbal gerund subject control has no structurally superior antecedent from which it can gain its reference. On this basis, it is an NOC relation so the discourse factors we mentioned above (topichood, competition and linear distance) come into play. In survey 1, we expect a strong preference for a sentence-internal interpretation of the *ec – Hermione* in the example above. In surveys 2 and 3, topichood and competition become relevant, as an alternative referent to the one already in the critical sentence is introduced in the preceding sentence(s). We expect a significant interpretative shift towards the weakly established topic in survey 2 relative to survey 1 and a further visible shift towards the strongly established topic in survey 3 relative to survey 2.

3.3 *Long-distance control, e.g.* Hermione said to Ron that *ec* waving the wand slowly was a good strategy

Long-distance control is also categorised as NOC and has two potential antecedents in the main clause, which suggests that topichood, competition and distance are already relevant factors in survey 1. The subject is a possible topic in virtue of its syntactic function but the prepositional complement or object is linearly more local. We leave the order of importance of these two factors open. With their introduction of topics, we expect surveys 2 and 3 to affect participants' interpretation of the *ec* relative to their interpretations in survey 1, with survey 3 having a stronger effect than 2, due to its stronger contextual cue. The data should also shed light on how the experimentally induced factors interact with those already present in the baseline condition (i.e. survey 1).

3.4 *Final temporal adjunct control, e.g.* Harry tapped Luna while *ec* feeding the owl

The OC/NOC status of temporal adjunct control is not clear. If it is a structurally determined relation with a designated argument as a controller (see Landau 2013), it should remain impervious to discourse pressure and so, like complement control, display a consistent (subject) interpretation in all three surveys. If it is NOC, which is a theoretical possibility on the basis of the facts noted in Section 1 above, we expect an interaction of discourse effects along the lines of those predicted for NOC.

4. Method

4.1 *Participants*

Seventy adults (34 male and 36 female) aged between 19 and 74 years took part in the study. Participants were recruited via calls put out on the university website,

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by email and on social network websites. All were native speakers of English and none had any neurocognitive impairments. Twenty-eight linguists (where this term includes students of English language and linguistics) and 42 non-linguists agreed to take part.[8]

4.2 *Materials and procedure*

Participants were sent the link to one of the three online surveys. The surveys used a forced-choice questionnaire design. They comprised a series of sentences where, for each sentence, the participants needed to indicate their preferred interpretation from a binary choice. For example, when presented with the sentence in (20), they were asked a question for which there were two possible responses:

(20) Ron persuaded Hermione to kick the ball.[9]
Who kicked the ball?
- Hermione
- Ron

Participants were told that sometimes a number of interpretations might come to mind but that for each sentence, they should choose the interpretation they preferred from the two provided. One trial appeared on the screen at a time and on making their choice by clicking next to one of the names, they were taken to the next trial. They were familiarised with the procedure with three practice items prior to the start of the experiment, and three further practice items were included after they were informed that the experiment had begun. These were later discarded. Participants were not timed and were instructed to complete the survey at their own pace.

For every participant, there was a gap of ten days between the sending out of each link. The sentences within each survey were pseudo-randomised, with three different orders produced for each survey. Participants were assigned randomly to one of the orders for each of the surveys.

The first survey (baseline) consisted of four critical and two filler conditions. Each critical condition tested one of the four control sub-types. The examples below show one sentence from each (the complete lists of all three surveys are in the appendix). The order in which the choices appeared underneath each question was counterbalanced throughout the trials.

[8] There were no significant differences between linguists' and non-linguists' responses – see footnote 10 below.

[9] The sentences used here were chosen so that they could be compared more easily with ongoing work on these constructions in children. In order to aid comparisons between adults' and children's interpretations, the same characters and themes were used, namely those from the Harry Potter books.

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1. Complement control
   Hermione ordered Harry to bake the cake.
   Who baked the cake?
   - Hermione
   - Harry

2. Verbal gerund subject control
   Pouring the water quickly made Harry wet.
   Who poured the water?
   - Harry
   - Someone other than Harry

3. Long-distance control
   Harry shouted to Luna that flying the broom upside-down was a great trick.
   Who flew the broom?
   - Harry
   - Luna

4. Temporal adjunct control
   Luna tapped Harry while feeding the owl.
   Who fed the owl?
   - Harry
   - Luna

5. Filler (*while*)
   Hermione poured the water while Harry baked the cake.
   Who baked the cake?
   - Hermione
   - Harry

6. Filler (passive voice)
   Luna was tapped by Ron.
   Who was tapped?
   - Luna
   - Ron

Each condition used three verbs twice (with the arguments reversed), amounting to six trials in each one. Thus, with the fillers, survey 1 totalled 36 trials.

The second survey included the same set of sentences as the first, with one modification: in front of each critical sentence was a sentence providing a weakly established topic of discourse. This primed either the subject or the object/prepositional complement as the *ec*'s referent, or, in the case of the verbal gerund subjects, the internal or external argument as the *ec*'s referent. The sentences below illustrate one trial from each construction set.

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1. Complement control
   I'm going to tell you something about Hermione. Hermione ordered Harry to bake the cake.
2. Verbal gerund subject control
   I'm going to tell you something about Luna. Pouring the water quickly made Harry wet.
3. Long-distance control
   I'm going to tell you something about Harry. Harry shouted to Luna that flying the broom upside-down was a great trick.
4. Temporal adjunct control
   I'm going to tell you something about Luna. Harry tapped Luna while feeding the owl.
5. Filler (as in Survey 1)
6. Filler (as in Survey 1)

For each sentence, there were two different referents to be primed, which doubled the trials in the critical conditions in this survey. With four sub-types of control, two potential referents and two filler conditions, the second survey had 60 trials.

The third survey employed the same set of sentences as survey 1 with one modification: each critical sentence was preceded by two sentences creating a strongly established topic. This topic primed the subject or the object/prepositional complement as the *ec*'s referent or, in the case of the verbal gerund subjects, the internal or external argument as the *ec*'s referent. A sample from each construction set is illustrated below.

1. Complement control
   Hermione is having a birthday party. Hermione makes all the party food. Hermione ordered Harry to bake the cake.
2. Verbal gerund subject control
   Luna is making a potion. Luna holds the jug clumsily. Pouring the water quickly made Harry wet.
3. Long-distance control
   Harry is testing his flying skills. Harry takes off in the air. Harry shouted to Luna that flying the broom upside-down was a great trick.
4. Temporal adjunct control
   Luna is looking after the birds. Luna takes out the food. Harry tapped Luna while feeding the owl.
5. Filler (as in surveys 1 and 2)
6. Filler (as in surveys 1 and 2)

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As with survey 2, for each sentence, there were two referents to be primed, thereby doubling the trials in the critical conditions. Thus, with four sub-types of control, the priming of two referents, and two filler conditions, survey 3 also had a total of 60 trials.

5. RESULTS

Each construction set included three verbs presented twice, amounting to six trials in each condition. For complement control, long-distance control and temporal adjunct control, the responses were summed according to the number of times the object was chosen as the referent, which gave a seven-point scale, ranging from 0 (= not chosen at all) to 6 (= chosen in every trial). Comparisons focused on the degree to which the participants' initial preferences for the object altered as a function of the primes. For verbal gerund subject control, responses were summed according to the number of times the internal referent was chosen. This gave the same seven-point scale and the comparison focused on the degree to which the participants' initial preferences for the internal or external referent were altered as a function of the primes. The fillers, which achieved a 100% correct response rate, were discarded prior to analysis.[10]

5.1 *Complement control*

We first looked at object responses in complement control across the five different levels of prime: no prime, weak priming of the object (weak prime-O), weak priming of the subject (weak prime-S), strong priming of the object (strong prime-O) and strong priming of the subject (strong prime-S). The median matrix object score was uniform in all five conditions (6, 6, 6, 6, 6), and from a total of 420 data points, 100% were object responses. This demonstrates that neither the weak nor the strong primes affected interpretation choice in complement control. Figure 1 illustrates the uniformity of object responses across all conditions.

[10] In addition to the analyses reported, the data were fitted to a mixed-effects logistic regression model predicting Response, including Prime Strength and Construction Type as fixed effects. We included Participant, Verb, Linguist, Age, Gender and Geographical Region as random effects, and eliminated random effect terms from the model one at a time based on model comparison, to see if including the term did not significantly improve model fit. Only the random effect of Participant survived model comparison. On this basis, we did not need to separate our participants according to Gender, Linguists and Non-Linguists, or Geographical Region.

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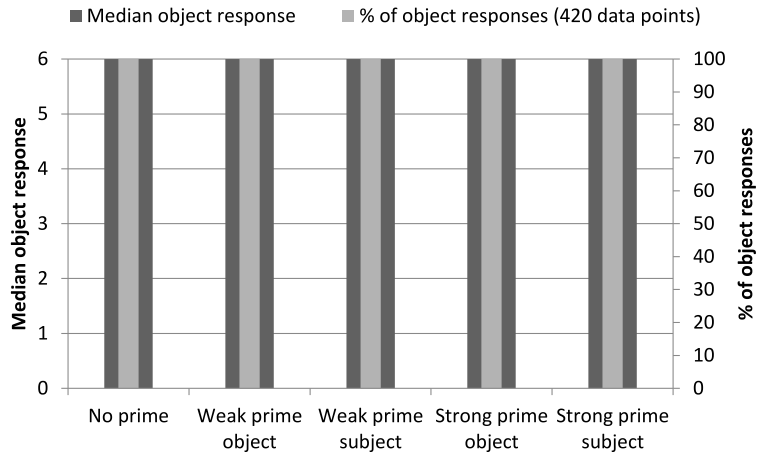

Figure 1
Median number and percentage of object choices in complement control.

5.2 *Verbal gerund subject control*

Comparisons of participants' responses in verbal gerund subject control did reveal an effect of the primes on referent choice. The median internal referent scores across the five conditions – no prime, weak priming of the internal referent (weak prime-I), weak priming of the external referent (weak prime-E), strong priming of the internal referent (strong prime-I) and strong priming of the external referent (strong prime-E) – were 6, 6, 0, 6 and 0, respectively. These medians and percentages can be seen in Figure 2.

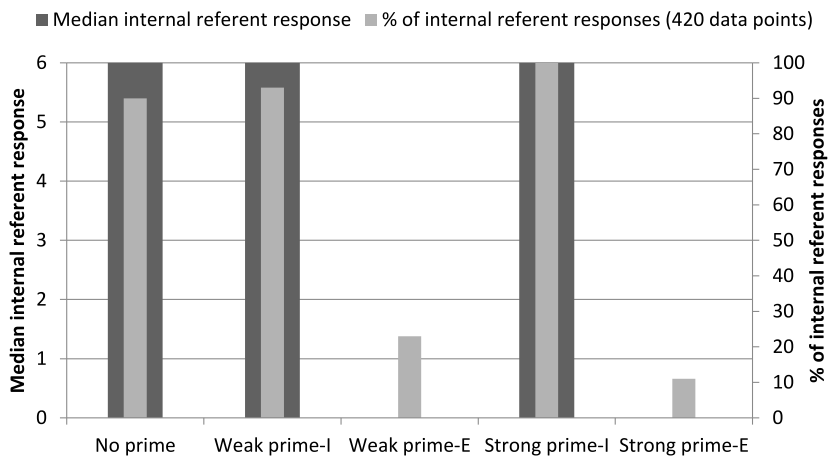

Figure 2
Median number and percentage of internal referent choices in verbal gerund control.

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The medians pointed to the source of the difference being the external-referent primes rather than the internal-referent ones. However, we first checked the internal-referent primes and a Friedman test conducted on the no prime, weak prime-I and strong prime-I conditions did reveal a difference ($p < .001$). A subsequent Wilcoxon test (Bonferroni adjusted) comparing the no prime condition and the weak prime-I condition indicated no contrast ($p = .107$) but one comparing the no prime condition with the strong prime-I condition did ($p < .001$). Thus, for the minority of participants who opted for a sentence-external referent in the baseline condition (10% of 420 trials), their choices switched to the internal referent when it was strongly primed but not when weakly primed.

We then compared the no prime condition with the two external-referent prime conditions. A Friedman test confirmed that the external-referent primes induced interpretative effects ($p < .001$). A Wilcoxon text (Bonferroni adjusted) conducted on the no prime condition and the weak prime-E condition revealed a difference ($p < .001$) as did the same test comparing the weak prime-E and strong prime-E conditions ($p = .001$). This indicates a contextual effect whereby the shifts in interpretation towards the external referent increased in line with the strengths of the primes.

5.3 *Long-distance control*

For the long-distance control trials (no prime, weak priming of the object (weak prime-O), weak priming of the subject (weak prime-S), strong priming of the object (strong prime-O), strong priming of the subject (strong prime-S)), we examined the effects of priming the object first. The respective medians (5, 6, 4, 6, 0), illustrated in Figure 3, were suggestive of a topic effect between the no

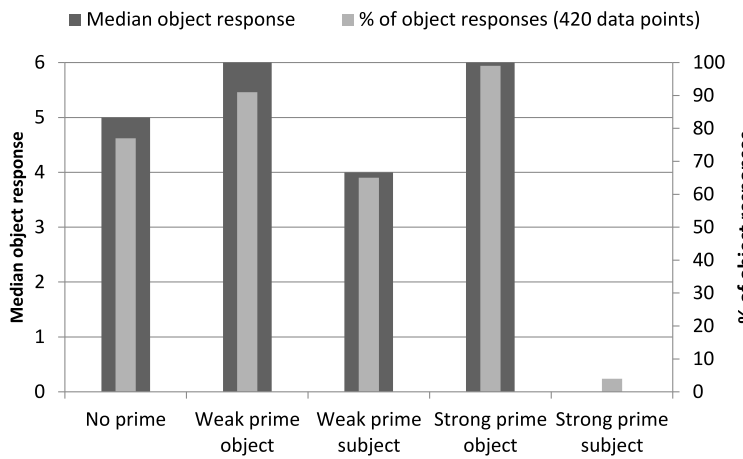

Figure 3
Median number and percentage of object choices in long-distance control.

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prime and weak prime-O condition but not between the weak prime-O and strong prime-O conditions.

However, a Wilcoxon test (Bonferroni adjusted) conducted on the no prime condition and the weak prime-O condition was significant ($p < .001$), as was the same test conducted on the weak prime-O condition and strong prime-O conditions ($p = .001$). This demonstrates that the weak priming of the object was sufficient to steer a significant number of participants with an initial preference for the subject in the baseline condition (23% of 420 data points in survey 1) towards an object reading and the stronger prime continued to increase that shift. This again indicates an effect of the primes, whereby interpretations changed in line with the strength of the primes.

With respect to the subject primes, the medians indicated a strong effect: 5 in the baseline condition reduced to 4 in the weak prime-S condition and to 0 in the strong prime-S condition. These large differences in referent choices were confirmed by a Friedman test ($p < .001$). A subsequent Wilcoxon test (Bonferroni adjusted) comparing the no prime and weak prime-S condition revealed a difference ($p = .002$), as did the same test comparing the weak prime-S and strong prime-S ($p < .001$). These tests illustrate that although the largest effect is seen in the strong subject prime condition (as supported by the median differences), the weak subject prime is also sufficient to switch interpretation choice to the topic for a significant number of trials.

5.4 *Final temporal adjunct control*

Comparisons for temporal adjunct control also focused on the number of object choices across conditions (no prime, weak prime-O, weak prime-S, strong prime-O, strong prime-S). As illustrated in Figure 4, the median scores for object responses were 0, 0, 0, 4 and 0, and a Friedman test indicated a contrast ($p < .001$).

We examined the effects of priming the subject first. Despite the medians suggesting no (0, 0, 0) and the percentages very little (4%, 1.2%, 1%) variation in interpretations between the no prime condition and the subject prime conditions, a Friedman test showed a contrast ($p = .002$). Using a Wilcoxon test (Bonferroni adjusted), we found a difference between the no prime and weak prime-S conditions ($p = .005$), but not when we carried out the same test on the weak-prime-S and strong prime-S conditions ($p = .516$). In other words, the weak prime was sufficient to shift interpretation in a few trials away from the object towards the subject but the stronger prime did not continue to increase that shift.

The medians for the no prime, weak prime-O and strong prime-O conditions, did, however, indicate a marked difference between conditions (0, 0, 4) and a Friedman test confirmed this ($p < .001$). Two Wilcoxon tests (Bonferroni adjusted) compared responses in the no prime and weak prime-O condition and also the no prime and strong prime-O conditions. The first narrowly missed

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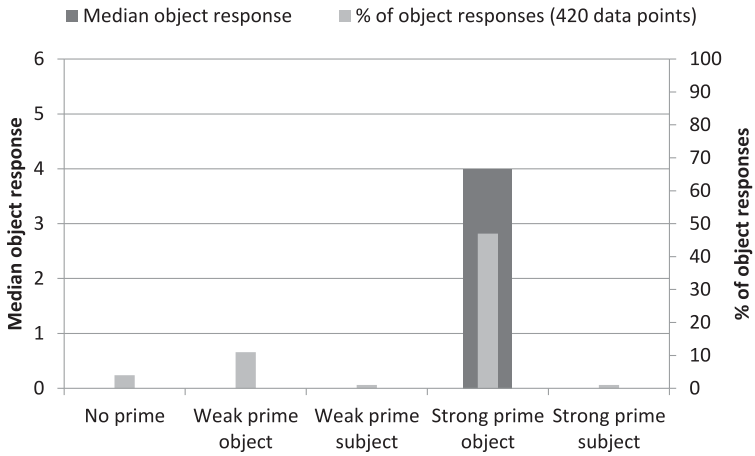

Figure 4
Median number and percentage of object responses in adjunct control.

significance ($p = .02$)[11] but the latter was significant ($p < .001$). Viewed in conjunction with the percentages of object choices (no prime 4%; weak prime 11%; strong prime 51%) and median scores, this indicated that although a weakly primed object did influence some trials, it was the strong priming of the object which led to the substantial shift in participants choosing an object-oriented reading over a subject-oriented one.

6. Discussion

This study took four control sub-types (complement, verbal gerund subject, long-distance and temporal adjunct control) and tested 70 participants' interpretations of the empty subject in three surveys. The first served to establish a baseline condition, which assessed preferred interpretations of the *ec* in the absence of any contextual cues. The second constituted a weakly primed condition, where the critical sentences from survey 1 were preceded by a sentence creating a weakly established topic. The third survey was the strongly primed condition, in which the critical sentences from survey 1 were preceded by two sentences that created a strongly established topic. The questions approached were which sub-types of control were open to pragmatic manipulations and which were not, and of those that were, whether they differed in terms of the strength of cue necessary before a shift in interpretation became detectable. For those examples of control whose interpretations did shift under discourse pressure, a further question we posited was whether three different discourse factors could be ranked according to their effect on participants' referent choices. The overall aim was to provide further

[11] Significance cut off point was set at .017 after Bonferroni correction.

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empirical support for the theoretical divisions drawn between obligatory and non-obligatory control and to see if this experimental method could provide a means for classifying a construction whose status was not clear, namely temporal adjunct control.[12]

The data showed that contextual cues could not interfere with judgements on complement control and that both types of contextual cue could alter judgements for verbal gerund subject control and long-distance control. This provided empirical justification for the existing classification of these constructions. The results for temporal adjunct control were more surprising in that they revealed flexibility in interpretation not previously reported in the literature for this construction. Although most participants preferred a subject reading in the baseline survey, this was not so for all, unlike the results for complement control, which were uniformly object-oriented in this condition. The survey using a weak prime revealed a marginal effect on original interpretations in terms of switching to the object but the strongly primed survey indicated a shift to the object in just over half of the trials. We now consider these results in this order, establishing how they support and build upon, but also present challenges for, existing literature, and the implications they have for the classification of these control structures.

The results for complement control, where neither cue could affect participants' interpretations, corroborate the long-established obligatory-control classification of this construction. Controlled complements are selected by a control verb and the interpretation of the understood subject in that complement is constrained structurally (see Williams 1980; Manzini 1983; Landau 2000, 2013; Hornstein 2001; Janke 2007, 2008). Note also that there is no ambiguity with respect to the structure of object-controlled complements: the complement, selected by the head, is sister to that head. Any material inside the complement falls within the domain of the matrix object, which is also the most local c-commanding argument. Canonical complement control then, as an example of a control construction with an unambiguous syntax, has a unique interpretation, and thus resists pragmatic interference.

[12] Duffley (2014), brought to our attention by an anonymous *JL* referee, uses corpus evidence to argue for the claim that all control is pragmatic. Although no precise figures are provided, he does state that structures standardly reported as subject-oriented do indeed exhibit an 'overwhelming tendency' (p. 59) to have subject control (and elsewhere, he claims that this is 'always' the case, as on p. 58). Gerund participle clauses are more variable in their control, he states, although they still take internal referent control more than an external controller. These constructions have only a choice between an internal and external referent and correspond with our findings regarding these types of control, which showed that 90% of respondents chose an internal referent in the absence of any context. Duffley's findings for *persuade* again match our own: no instances of subject control were found at all, precisely as in our experiment, where 100% of responses were object-oriented in all three conditions. Duffley does not address the adjunct control cases that we discuss in this work, but the constructions that are discussed provide corpus-based support for our findings, and it is interesting in itself that the corpus data are not more promiscuous than our experimental data, given the extra challenges of working with naturally-produced utterances that may contain more performance errors than considered judgements.

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The interpretation of *ec*s in verbal gerund subject control and long-distance control is widely reported as being regulated extra-syntactically (Williams 1980, Bresnan 1982, Landau 2000, Janke 2013). We have seen that in contrast to complement control, there need not be a syntactic antecedent at all (demonstrating the lack of c-command and locality vacuously) but when there is, it is not restricted to a designated argument. As illustrated in Section 1 above, these types of control have arbitrary instantiations, where the *ec* is interpreted generically, but they can also host specific interpretations, where the *ec* receives its specification from the discourse. The present study focused on the latter type in order to test how strong a contextual cue was needed before a shift in specific interpretations could be induced.

We turn to verbal gerund subject control first. Firstly, we note that in the baseline survey, participants' responses were not uniform. Although the majority of participants did opt for the sentence-internal referent, 10% of choices were for an unspecified sentence-external referent (i.e. 'Someone other than X'). In terms of the discourse factors set out in the introduction, the sentence-internal referent is the most local and most salient antecedent (there being no other competitors) so participants were predicted to exhibit a strong preference for this argument (see Adler 2006), as indeed they did. A degree of fluctuation, however, is expected in a pragmatically regulated construction, as unlike a structural constraint, a discourse metric should guide but not decide interpretation (Ariel 1988, 2001). In the second survey, a topic was weakly established prior to the critical sentence. Recall that in one of these conditions, the cue reinforced the argument in the critical sentence (*I'm going to tell you something about Luna.* ec *Pouring the water quickly made Luna wet*). In this condition, there was a marginal effect of the weakly established topic in the preceding sentence: 97% (a rise of 3% from the baseline) of responses now equated with the sentence-internal referent. Of greater note is the shift apparent in the trials in which the weakly established topic was a sentence-external referent NOT reinforced in the critical sentence (*I'm going to tell you about Harry.* ec *Pouring the water quickly made Luna wet*). In these sentences, there are two competitors: the weakly established topic in the priming sentence and the sentence-internal referent. With respect to the example above, *Harry* is not only the weakly established topic but is also more local to the *ec*, where for discourse-regulated reference resolution, we have taken linear locality as the relevant measure of distance (see Section 2), predicting a strong preference for *Harry*. The current data bore this out, as witnessed by the huge shift in interpretation: 75% of trials resulted in external-referent responses, indicating an overwhelming shift from participants' original, non-primed, sentence-internal interpretations.

Given such a substantial change in reference choice under the weak priming in survey 2, the still stronger effects of the strong prime demonstrated by the results in survey 3 were expected. In the condition in which the two priming sentences collectively reinforced the referent in the critical sentence, the number of data points corresponding to this referent being chosen as the antecedent rose to 100%.

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In this instance, the strongly established topic and locality map together in terms of the antecedent each favours, and there is no other contender. In the condition in which the two preceding sentences primed a topic that was NOT reinforced in the critical sentence (*Luna is making a potion. Luna holds the jug clumsily.* ec *Pouring the water quickly made Harry wet*), the constellation of competing factors is altered. The topic of discourse is again more local but there is also a sentence-internal competitor, namely *Harry* in the example above. Despite this element of competition, there was still a significant shift in favour of a sentence-external reading of the *ec*: 89% of trials, which was an increase of 14% from survey 2. The difference between survey 2 and 3 for verbal gerund subject control overall provides empirical support for the intuition that a strongly-established topic of discourse has a stronger effect on referent choice than a weakly-established topic of discourse.

So far we have discussed the lack of interpretative shifts in complement control and the presence of them in verbal gerund subject control, using an accessibility-motivated metric to capture the pattern in the latter. At this interim point, the test we have applied supports the theoretical division between obligatory and non-obligatory control. As predicted in Section 3, the *ec* in complement control cannot be affected by topics, whereas the same in verbal gerund subject control can. The differing effects of weakly established topics of discourse versus strongly established topics of discourse are visible in the NOC conditions, where the latter have a stronger effect than the former. This is in line with the literature and the general assumption that an unmarked sentence is 'about' the established topic of discourse. However, the influence of the discourse topics in relation to locality cannot yet be assessed, as we have yet to encounter an example in which there is a mismatch in terms of the referent each of these factors would favour. Thus, our first approximation of the scale of influence is limited to topics:

(21) strongly-established topic > weakly-established topic

We turn now to long-distance control, where, on the basis of its NOC classification, discourse effects were expected. However, we anticipated that the results in long-distance control might diverge from verbal gerund subject control as the constructions are rather different. In particular, in long-distance control (22), there are two arguments in the main clause that could serve as antecedent for the *ec* in the embedded clause, whereas in verbal gerund subject control (23), there is only one.

(22) **Harry** shouted to **Luna** that [[*ec* flying the broomstick upside down] was a great trick].

(23) [*ec* Pouring the water quickly] made **Harry** wet.

The availability of two arguments in (22) introduces an element of competition already in the baseline. The two arguments serve different syntactic functions,

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where one is the subject and the other is in a prepositional complement. Subjects are more frequently associated with topichood (Reinhart 1981, Lambrecht 1996, Neeleman et al. 2009) so the subject's preferred topic status might have given it precedence independently of any topic-based primes. In terms of linear distance, *Luna* is more local to the *ec* so this construction enabled us to compare the influence of linear distance with that of topichood. What our results in fact demonstrated was a resounding preference of the object/prepositional complement over the subject in the baseline survey (77% of 420 trials), suggesting linear distance to be the deciding force for most. However, the remaining 23% of responses were subject-oriented, illustrating a role for this weakest example of topichood for a sizeable minority of trials. As a possible topic, the subject is a contender. In this baseline condition, then, when other pragmatic influences are held in check, the salience afforded the subject in virtue of being a possible topic is competitive but not sufficiently so to win over locality, which proves the more dominant force. Thus, locality must be placed before this topic in terms of its influence on the *ec*'s interpretation.[13]

(24) locality > possible topic

The results for long-distance control in survey 2 provide support for an expanded version of the rankings in (21) and (24). The prime in survey 2 created the weakly established topic (*I'm going to tell you something about X/Y*). Primed with the subject, subject responses for long-distance control did rise by 12% to 35%, yet 65% of responses remained object-oriented, which suggests that locality acts as a stronger force than a weakly established topic. This order of influence is supported by the results of the object-primed condition, where the object/prepositional complement responses rose to 91% (from the baseline of 77%), leaving only 9% as subject responses.

Lastly, the responses to long-distance control in the final survey further corroborate that strongly established topics have the most influence of all: when the object/prepositional complement was strongly primed, 99% of responses were object-oriented and when the subject was strongly primed, 96% of responses were subject-oriented.

To summarise, the test we have applied supports an NOC classification for this construction, since both types of topic affected interpretation significantly, again like verbal gerund subject control and unlike complement control. We therefore see the test working as predicted on a second type of NOC. A complete metric, incorporating all the different factors we measured here, would look like this:

(25) strongly established topic > locality > weakly established topic > possible topic

[13] Note that there are now three notions of topic in operation, namely strongly-established topic, weakly-established topic, and possible topic. In the final scale, we will integrate all of these factors in the order of their influence.

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The data so far support a clear divide between OC and NOC, where the former cannot be manipulated pragmatically and the latter can. We turn now to temporal adjunct control. One surprising finding in the current surveys was that interpretations of temporal adjunct control were susceptible to manipulation by the primes, which appears to point towards an NOC classification of temporal adjunct control. Yet we have seen in the introduction that this example of temporal adjunct control is reported widely not to share other properties with NOC. In fact, like OC, it liberally permits non-animate controllers, and does not permit arbitrary interpretations or those linked to sentence-external referents.[14]

One question is why temporal adjunct control, which is widely reported to be obligatorily subject-oriented, permits an object reading at all. The current data show that in the absence of a contextual cue, the majority of people do opt for a subject reading. The weakly established topic altered this initial choice for a minority of trials. Effects were most visible in the last survey, however, where the strongly established topic steered 51% of the trials to an object-oriented interpretation. Importantly, this is not the same pattern as that found for complement control, which demonstrated a 100% object-response rate in the baseline, as well as complete resilience to either level of pragmatic interference, but neither is it the same as the pattern seen in either of the non-obligatory control cases, where the strongly established topic determined referent choice definitively.

One possibility that needs to be ruled out for this pattern is that participants were not paying attention to the whole trial before making their interpretative choice. A less focused participant might, for example, register the topic being established in the prime and choose it as the referent without properly processing the adjunct control sentence. There are two reasons this can be dismissed. Firstly, for any individual who was not paying attention we would expect that all trials in the strong-prime subject condition would result in subject-oriented interpretations and all those in the strong-prime object condition would result in object-oriented interpretations. There was no participant for whom this was the case.

[14] An anonymous *JL* referee notes that there are a few exceptions when an external reading is permitted, such as with *after*, as also pointed out by Landau (2000: 178):

(i) ?*Darkness fell quickly after pitching our tents [Landau's judgement].

This feels different from *while* adjuncts; in particular, this *after* adjunct can occur as a nominal (indicated by the possibility of a determiner and adjective):

(ii) Darkness fell quickly after the (clumsy) pitching of our tents.

Clearly, there are differences between this example and *while*, which are worthy of further exploration.

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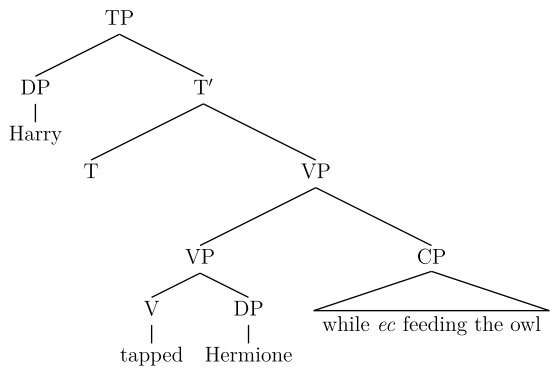
Secondly, this account ought to generalise to the complement control trials, which remained 100% resilient to pragmatic interference.[15]

We therefore argue that this shift in reference is permitted by the adjunct's flexibility in terms of where it attaches. Multiple attachment sites answer for the availability of more than one interpretation in sentences which host adjuncts. In well-known examples of the type *The policeman tortured the witness in his pyjamas*, for example, either the subject or the object can be associated with the pyjamas. On an object-oriented reading, the adjunct is attached inside the VP in the domain of the object (see Larson 2004), whereas on a subject-oriented reading, it is attached higher at the VP level, in the structural domain of the subject.

With respect to temporal adjunct control, we need to account for the baseline survey, which demonstrated an overwhelming preference for a subject-oriented reading, while not excluding the few who preferred an object-oriented one. An analysis in which temporal adjunct control is a structurally constrained relation that permits two attachment sites can account for these available, yet not equally preferred, interpretations. For the majority of people, the adjunct attaches at the VP level. In this configuration, only a subject-control reading is possible, as only the subject c-commands into the CP, as seen in (26).

(26)



For the people who permit an object reading, a different attachment site is necessary. Using an analysis of English VP structure developed in Janke & Neeleman (2012), we suggest that people who switch to an object reading of temporal adjunct control under severe discourse pressure permit the adjunct to attach low, merging directly with the verb (see also Larson 2004). In this instance, a VP-shell is generated, as in English a verb must be left-adjacent to an argument

[15] An anonymous *JL* referee suggests that these might be less susceptible to interference because they are syntactically regulated. However, the literature shows that people do make strange judgements when they are being lazy, paying insufficient attention or are tired. In Buchstaller & Corrigan (2011: 43), for example, a participant produced ungrammatical questions when asked to reformulate interrogatives as declaratives because he was following a 'lazy' strategy. Participants also provide incorrect syntactic judgements in uncontroversial fillers. It is for this reason that it is standard practice to remove from the results any participant who scores below a certain threshold on filler stimuli (which was not the case for any of our participants).

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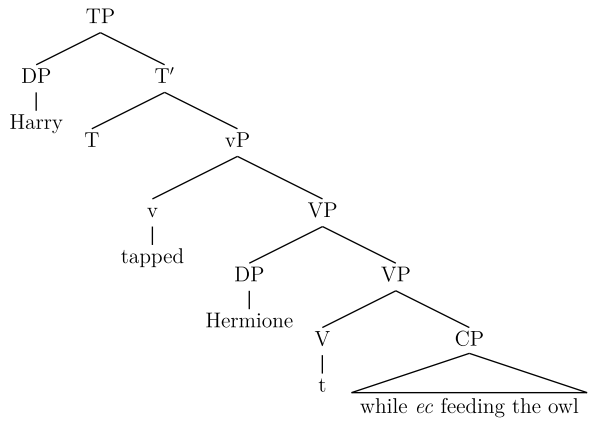
dependent on it for accusative case (see Janke & Neeleman 2012 for further motivation). Under this configuration, the object is the closest c-commanding DP of the adjunct.

(27)



Given that the majority of people prefer a subject-oriented reading, it would seem that there is a general preference not to attach these modifiers low. However, if some pressure is put upon the system, as in the primed conditions created here, an increasing number of people will opt for an object-oriented interpretation. It is the availability of these two syntactic structures that permits a choice between the two referents: when the syntax provides more than one structural possibility, pragmatics can influence the parsing process. Note that this analysis correctly predicts that this type of temporal adjunct control will not allow an external-referent reading.

The availability of two structures can account for the possibility of the two readings in temporal adjunct control but a remaining question is why one reading should be substantially preferred over the other. Janke & Neeleman (2012) propose that VP-shell formation is subject to economy, where a structure with no movement is more economical than one with movement. Since the subject-oriented reading is possible in structures without VP-shell formation, it should be preferred over the object-oriented reading, which is marked due to the verb movement it relies on.[16] VP-shell formation in temporal adjunct control is

[16] An anonymous *JL* referee asks about the various other types of controlled adjuncts, such as the to-infinitives discussed by Huettner (1989). Our study does not deal with this type of clause for the reasons given in footnote 4 above, but further work should indeed investigate such clauses. The referee notes that some of Huettner's clauses are attached high on her analysis, and can only have a subject reading (e.g. *Sam threw away the book, only to discover she needed it for a class*), in line with our own findings. Others are able to have an object interpretation more readily than our temporal adjuncts: the referee gives examples like *I bought a bookcase to contain my books*. Note that this could be analysed as a DP with the (partial) structure in (i), in which case it is a relative clause and *bookcase* is expected to be the referent:

(i) [. . . bookcase [$_{CP}$ [$_{TP}$ *ec* [$_{T'}$ to [$_{VP}$ contain my books]]]]]

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triggered by sentence-external factors, which may also account for its resilience to interpretation shift, relative to other instances of VP-shell formation motivated by sentence-internal considerations and so more routine.[17] That there should only be the VP-shell structure available for object control is expected, because the control verb selects a CP and it is obligatorily merged as complement to the verb (see also Larson 1991).

A prediction arising from this structural account is that people who accept an object reading of the adjunct should revert back to subject-oriented readings when a c-command relation between the object and the adjunct phrase is made impossible. Here we outline two small-scale experiments that corroborate this expectation. The first blocks low attachment of the adjunct and the second embeds the matrix object inside a selected prepositional phrase.[18]

For those that are adjuncts, Huettner argues that they are attached at the VP level, allowing the object interpretation. There is a strong pragmatic reason for the object control in this sentence (bookcases contain books), while our temporal adjunct control clauses contained two equally pragmatically plausible referents. If we use verbs more plausible with a subject-oriented reading, examples can be created that permit a subject reading, demonstrating that object control is not inherently more natural in the clauses mentioned:

(ii) (a) I_i hired a servant [ec_i to boss about whenever the desire grabbed me].
(b) I_i kicked the goal keeper [ec_i to make sure he couldn't play on].

Further study can ascertain which of the readings is preferred when all else is kept constant. At this point, we do not think this type of example is inconsistent with our analysis. Two structures are possible and the availability of two structures permits pragmatics to influence how the string is parsed.

[17] But see D'Elia (2016) on how perceived visual proximity can influence double-complement alternations.

[18] An anonymous *JL* referee raises an interesting question about control shift, asking if the manipulation that causes control shift in complement control can do so in adjunct control. Control shift would be created by fiddling with the semantics of the matrix verb and the modality of the embedded event in a sentence like (i) to give (ii).

(i) Harry tapped Luna while feeding the owl.

(ii) The teacher supervised the students$_i$ while ec_i being allowed ec_i to feed the owl.

It would be interesting to test this sentence on participants who reject object readings in AC under the pressure of a strongly established topic and those who do. We suspect that control shift will occur in both types of participant, which would support temporal adjunct control and complement control patterning similarly with respect to the control shift phenomenon but not topic manipulation. This is because control shift in complement control (certainly with *promise*: *I promised the students to be allowed to leave*) affects most people yet far fewer are persuaded to switch referent choice in temporal adjunct control under the pressure of a strong topic.

A further question is whether people who allow control shift in temporal adjunct control in (ii) above revert back to the subject when primed by a topic. That is, do people who accept an object reading in (ii) return to a subject reading in either (iii) or (iv)?

(iii) I'm going to tell you something about the teacher. The teacher$_i$ supervised the students while ec_i being allowed ec_i to feed the owl.

(iv) The teacher was nervous around birds of prey. She asked permission to approach one. The teacher$_i$ supervised the students while ec_i being allowed ec_i to feed the owl.

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One expectation regarding the claim that the object reading is a product of low attachment (rather than being an example of NOC) is that when low attachment of the adjunct is blocked independently, an object-oriented reading will not be permissible, no matter what the context. High attachment of the adjunct, where the adjunct has a subject-oriented reading, means that there is no VP-shell structure, as shown in (26). Low attachment of the adjunct, where the adjunct has an object-oriented reading, means that there is a VP-shell structure as illustrated in (27). Constituency tests such as ellipsis are sensitive to VP-structure, disallowing omission/replacement of the moved verb and the post-verbal DP in a VP-shell structure. Thus, when VP-shell formation has taken place, as in (28), neither *do so*-substitution nor VP-ellipsis is possible:

(28) (a) *If he [$_{V}$ gave [$_{VP}$ Mary [$_{V}$ t_{v} anything]]], he did so a woollen scarf.

(b) *If he [$_{V}$ gave [$_{VP}$ Mary [$_{V}$ t_{v} anything]]], he did *e* a woollen scarf.

(Janke & Neeleman 2012: exx. (13 a, b))

If VP-fronting is now performed on temporal adjunct control, we preclude the generation of a VP-shell structure so the possibility of an object-oriented reading of the adjunct should disappear. That is, in (29), an object reading should not be possible.

(29) Harry is looking after the birds. Harry takes out the food. Harry expected Hermione to tap him and tap Harry Hermione did while feeding the owl. Who fed the owl?

- Hermione
- Harry

The topichood's manipulation working in a different direction to the control shift could cancel out the effect of control shift, thereby effecting a return to the subject. In the absence of any topic manipulation, the subject is the highly preferred antecedent so a shift back to the subject when primed should be possible for these 'flexible' participants. We think, however, that control shift and the topic-led switch are of a different ilk. Participants' responses to topics and control shift in temporal adjunct control could pattern in four ways:

	(A)	(B)	(C)	(D)
Affected by strong topic in temporal adjunct control	Yes	No	Yes	No
Affected by control shift in temporal adjunct control	Yes	No	No	Yes

Type A participants, who accept an object reading under the pressure of a strong topic and also with control shift, don't enable us to distinguish between the two. The same is true of Type B. We suspect Type C participants, affected by the topic but not by control shift, are highly unlikely to exist, given the availability of control shift with *promise* for most people and the far less persuasive nature of the strong topic on temporal adjunct control, as evidenced in this article. Type D participants, however, do exist, and the present authors belong in this category. Our existence is in line with control shift being different from the topic-led switch as we find it possible to switch to the object in a control shift temporal adjunct control example yet impossible with a topic.

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Twenty-six participants who permitted an object reading of temporal adjunct control were asked to give a considered judgement on the sentence above. Twenty-one of them chose a subject-oriented interpretation of the *ec*.

Since a number of participants did not like the construction in (29) per se, we conducted a further small-scale study on 22 participants who had previously allowed an object reference for the *ec*. We constructed six test sentences in which the matrix object was embedded in a possessive, which itself was in a selected prepositional phrase:

(30) Peter talked to Jane's friend while *ec* pouring the drinks.
Who was pouring the drinks?
- Peter
- Jane
- The friend

The sentences were pseudo-randomised and interspersed with six fillers, and the three options were randomised for each question. Participants were invited to choose as many referents that they thought could, in principle, be interpreted as engaging in the relevant activity. A practice set was given as an illustration. From a possible 132 data points (22 participants on 6 trials), none at all were object-oriented: all referents for the *ec* were the subject, indicating that the object reading had become impossible.[19] Larger-scale experiments based upon that conducted in the main part of this paper could further corroborate these results, which provide preliminary support for the analysis within.

7. Summary

This study adopted a method to test how discourse factors interact with individual properties of control constructions to affect people's interpretations of the *ec*s within them. For two examples of NOC constructions, namely verbal gerund subject control and long-distance control, three independent factors affecting interpretation were ordered on a scale in terms of their influence, a scale whose validity can now be tested on further NOC constructions. The relevant factors were defined by building on established notions of topichood (Reinhart 1981), competition and linear distance (Ariel 1988, 2001). Strongly established topics had more influence than linear distance and weakly established topics, whereas linear distance was more influential than weakly established topics. One important difference between verbal gerund subject control and long-distance control is that the latter construction needed a stronger contextual cue than the former to

[19] On the six fillers, participants performed as expected: for two versions of the passive construction *Samuel watched Caleb being pushed by Tabitha*, just one of 44 data points was the incorrect argument. On two versions of *Susan noticed Brian talking to Anita* and *Colin talked to Douglas while he ate a banana*, one or both of the two correct options was chosen in all 88 trials.

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substantially switch referent choices. As predicted, no prime had any effect on complement control, which, being analysed as a construction with an unambiguous syntax, and therefore a unique interpretation, was expected to remain unaffected by contextual cues. By demonstrating a significant effect of pragmatics on temporal adjunct control judgements, our results for this construction are novel. This has long been analysed as obligatorily subject-oriented, yet the significant shift in interpretation in the strongly primed condition suggests a revision is in order. Our suggestion here is that it is the availability of more than one structure in temporal adjunct control that permits pragmatics, when pressure is put on the system, to influence the way in which the structure is parsed. When attached low, the matrix object c-commands into the adjunct and an object interpretation is licensed. The availability of an external referent for the *ec*, a hallmark of NOC, remains impossible, supporting our classification of final temporal adjunct control as a further type of structurally constrained control. We concluded this study by formulating and conducting some initial testing of some further predictions for this account, which could be examined in more detail in a future study, using a similar method to that employed here.

APPENDIX

Survey data

I. Sentence list for survey 1

1. Complement control

Hermione ordered Harry to bake the cake.
Harry ordered Hermione to bake the cake.
Ron persuaded Hermione to kick the ball.
Hermione persuaded Ron to kick the ball.
Luna told Harry to pop the balloon.
Harry told Luna to pop the balloon.

2. Final temporal adjunct control

Ron lifted Luna while waving the wand.
Luna lifted Ron while waving the wand.
Harry tapped Luna while feeding the owl.
Luna tapped Harry while feeding the owl.
Ron kissed Hermione while flying the broom.
Hermione kissed Ron while flying the broom.

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3. Long-distance control

Harry told Hermione that baking the cake quickly was a big mistake.
Hermione told Harry that baking the cake quickly was a big mistake.
Ron said to Hermione that waving the wand slowly was a good strategy.
Hermione said to Ron that waving the wand slowly was a good strategy.
Harry shouted to Luna that flying the broom upside down was a great trick.
Luna shouted Harry that flying the broom upside down was a great trick.

4. Verbal gerund subject control

Reading the book slowly made Ron sleepy.
Reading the book slowly made Hermione sleepy.
Pouring the water quickly made Luna wet.
Pouring the water quickly made Harry wet.
Rowing the boat clumsily made Ron seasick.
Rowing the boat clumsily made Luna seasick.

N.B. For the verbal gerund subject control sentences, the choice was either the internal referent, where the name was given (e.g. *Ron*), or the external referent, where a name was not given:

Reading the book slowly made Ron sleepy.
Who read the book?

- Ron
- Someone other than Ron

5. Filler (while)

Ron patted the owl while Hermione popped the balloon.	Who patted the owl?
Luna read the book while Ron flew the broomstick.	Who read the book?
Harry rowed the boat while Hermione waved the wand.	Who rowed the boat?
Luna kicked the ball while Harry fed the owl.	Who fed the owl?
Hermione poured the water while Harry baked the cake.	Who baked the cake?
Harry kissed the owl while Ron lifted the broom.	Who lifted the broom?

6. Filler (passive)

Hermione was pushed by Harry.	Who was pushed?
Luna was tapped by Ron.	Who was tapped?
Harry was kissed by Luna.	Who was kissed?
Ron was kicked by Hermione.	Who did the kicking?
Hermione was read to by Harry.	Who did the reading?
Luna was lifted by Ron.	Who did the lifting?

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II. Sentence list for survey 2

Survey 2 consisted of the same sentences as survey 1 but in front of every critical sentence, a preceding sentence, priming the subject, object, internal referent or external referent appeared: *I'm going to tell you something about X/Y*. For the verbal gerund subject control sentences, there was one modification in terms of the choices available. Now that the external referent was explicitly mentioned in the prime, both the referential possibilities were mentioned by name:

I'm going to tell you something about Hermione. Reading the book slowly made Ron sleepy.
Who read the book?

- Ron
- Hermione

III. Sentence list for survey 3

1. Complement control

Hermione/Harry is having a party. Hermione/Harry makes all the party food.
Hermione/Harry ordered Harry/Hermione to bake the cake.
Hermione/Ron is learning a new game. Hermione/Ron aims at the goal post.
Hermione/Ron persuaded Ron/Hermione to kick the ball.
Luna/Harry is practising a difficult trick. Luna/Harry takes out the pin.
Harry/Luna told Harry/Luna to pop the balloon.

2. Final temporal adjunct control

Luna/Ron is learning about magic charms. Luna/Ron tries out the new spell. Luna/Ron lifted Ron/Luna while waving the wand.

Luna/Harry is looking after the birds. Luna/Harry takes out the food. Luna/Harry tapped Harry/Luna while feeding the owl.

Ron/Hermione is preparing for a flying competition. Ron/Hermione practises on his/her broom. Hermione/Ron kissed Ron/Hermione while flying the broom.

3. Long-distance control

Hermione/Harry is having a party. Hermione/Harry makes all the party food. Harry/Hermione told Hermione/Harry that baking the cake quickly was a big mistake.

Ron/Hermione is practising magic. Ron/Hermione tries out a difficult spell. Ron/Hermione said to Hermione/Ron that waving the wand slowly was a good strategy.

Harry/Luna is testing his/her flying skills. Harry/Luna takes off in the air. Harry/Luna shouted to Luna/Harry that flying the broom upside down was a great trick.

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4. Verbal gerund subject control

Hermione/Ron is looking up a spell. Hermione/Ron says each word carefully. Reading the book slowly made Ron/Hermione sleepy.

Harry/Luna is making a potion. Harry/Luna holds the jug clumsily. Pouring the water quickly made Luna/Harry wet.

Luna/Ron is going out on the lake. Luna/Ron takes the oars awkwardly. Rowing the boat clumsily made Ron/Luna seasick.

5. Filler (as in surveys 1 and 2)

6. Filler (as in surveys 1 and 2)

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