

ABSTRACT

Title of dissertation: **ADJUNCT CONTROL:
SYNTAX AND PROCESSING**

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This dissertation analyzes the syntax and processing of adjunct control. Adjunct control is the referential relation between the implicit (PRO) subject of a non-finite adjunct clause and its understood antecedent, as in the temporal adjunct in ‘*Holly₁ went to bed [after PRO₁ drinking milk]*’, or the rationale clause in ‘*August₁ sat on the couch [in order PRO₁ to read library books]*’. Adjunct control is often assumed to involve a syntactic ‘Obligatory Control’ (OC) dependency, but I show that some adjuncts also permit what is referred to as ‘Non-Obligatory Control’ (NOC), as in the sentences ‘*The food tasted better [after PRO drinking milk]*’ and ‘*The book was checked out from the library [in order PRO to read it]*’, where PRO refers to some unnamed entity. I argue that for some adjuncts, OC and NOC are not in complementary distribution, contrary to assumptions of much prior literature, but in agreement with Landau (2017). Contrary to implicit assumptions of Landau, however, I also show that this OC/NOC duality does not extend to all adjuncts. I outline assumptions that Landau’s theory would have to make in order to accommodate the wider distribution of OC and NOC in adjuncts, but argue that this is

better accomplished within the Movement Theory of Control (Hornstein, 1999) by relaxing the assumption that all adjuncts are phases.

Even in adjuncts where both OC and NOC are possible, OC is often strongly preferred. I argue that this is in large part due to interpretive biases in processing. As a foundational step in examining what these processing biases are, the second part of this dissertation uses visual-world eyetracking to compare the timecourse of interpretation of subject-controlled PRO and overt pronouns in temporal adjuncts. The results suggest that PRO can be interpreted just as quickly as overt pronouns once the relevant bottom-up input is received. These experiments also provide evidence that structural predictions can facilitate reference resolution independent of next-mention predictions.

ADJUNCT CONTROL:
SYNTAX AND PROCESSING

by

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Forward

Portions of Chapter 3 represent joint work with Alexander Williams and are published in A. Williams and Green (2017). The experiments in Chapter 6 were completed in collaboration with Michael McCourt, Ellen Lau, and Alexander Williams.

Dedication

To Alli, August, and Holly,
who are the reason I do all of this.

Acknowledgments

As is the case with any major milestone, this dissertation is the culmination of a long journey, along which there have been many people who have helped me in more ways than I can express, and more than I think even I realize. I'd like to thank just a few of those people.

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List of Abbreviations

ACT Active

AOI area of interest

CED Condition on Extraction Domain

do Direct Object

Fin Predication head in the TTC

GEN Genetive

io Indirect Object

MTC Movement Theory of Control

NOC Non-Obligatory Control

NPI negative polarity item

Num Numeration

OC Obligatory Control

OPC object-gap purpose clause

PASS Passive

PC purpose clause

PCC Principle of Controller Choice

PCCRC Principle of Controller Choice in RatCs

RatC rationale clause

RESP Responsibility relation

SPC subject-gap purpose clause

SUBJ Subject

TTC Two-tiered Theory of Control

Part I

Theory

Chapter 1: Introduction

The study of referential dependencies has strongly influenced the development of syntactic, semantic, and pragmatic theory. The study of how such dependencies are resolved in online comprehension has similarly influenced our understanding of the way we integrate information and the rapid deployment of memory structures in discourse processing. This dissertation explores the syntax and processing of one family of referential dependencies: the dependency between PRO¹ in an adjunct clause and its understood antecedent in sentences such as those in (1) and (2).

- (1) a. Holly₁ went to bed [after PRO₁ drinking some milk].
b. August₁ sat on the couch [in order PRO₁ to read some library books].
- (2) a. The food tasted better [after PRO drinking milk].
b. The book was checked out from the library [in order PRO to read it].

The first part of the dissertation discusses the distribution of Obligatory Control

¹ Although I use the PRO label for clarity throughout the dissertation, the conclusions are not dependent on a PRO analysis of the implicit subject of control structures. I will also not generally distinguish between labels of the implicit subject in OC and NOC, as some theories do (such as Hornstein (1999); see §4.3), although the nature of the implicit subject may indeed differ in the two types of control. For a discussion on the debate over the representation of PRO, see Hornstein (2003).

(OC) (1) and Non-Obligatory Control (NOC) (2) in adjuncts as well as what factors may influence the choice of controller. It will be shown that OC and NOC are both allowed by the grammar for some adjuncts, in contrast to the often-assumed complementarity of OC and NOC. I argue that instead of sentence structure alone determining the availability of NOC, extra-grammatical factors such as perspective and responsibility are also involved.

The second part of the dissertation details a preliminary investigation of the real-time processing and interpretation of adjunct control where it is shown that PRO in temporal adjuncts can be interpreted as quickly as overt pronouns in similar sentences.

1.1 Constraints on reference

Some constraints on reference are grammatical, in that reference is determined by structural properties of the sentence itself. For example, in (3), the anaphor *himself* must be understood as coreferential with *Jon's father*; it cannot refer to any other entity, no matter what context the sentence is uttered in. The referent of the reflexive is determined based on the structure of the host sentence. Because reflexives require a local antecedent in a particular syntactic configuration, Chomsky (1980, 1981) posits a syntactic dependency (binding) between reflexives such as *himself* and a c-commanding antecedent (*Jon's father* in (3)) within a limited domain. This syntactic dependency is then interpreted as coreference. Therefore, according to what he calls Principle A of the Binding Theory (Chomsky, 1981), the referent of a

reflexive is completely determined by the grammatical structure of the sentence it is found in.

- (3) Bill₁ said [Jon₂'s father]₃ likes himself_{3/*1/*2/*4}.

A similar grammatical constraint (Principle B) applies to pronouns, but instead of determining reference, the constraint rules out coreference with locally c-commanding antecedents.² For example, in (4), the pronoun *him* may not corefer with the locally c-commanding *Mike*.³ However, *him* may refer to any other salient male individual, including Jon's father, in contrast to the reflexive in (3). When *him* does corefer with *Jon's father* in (4), this does not seem to involve a syntactic link between the two, since structural position is not decisive. *Jon's father* and *him* will be understood as coreferential only if pragmatic context permits this, by making it sufficiently clear that the speaker means to refer to Jon's father in using the pronoun. Given the proper context, however, *him* could just as easily refer to someone else. Although a grammatical constraint rules out one possible referent for the pronoun, non-grammatical, contextual constraints determine who a speaker can ultimately refer to with the word *him*.

- (4) Bill₁ told [Jon₂'s father]₃ that Mike₄ likes him_{1/2/3/5/*4}.

² Although see Heim and Kratzer (1998) and Reinhart (1983) for a discussion of examples such as (i) from Evans (1980), in which the grammatical constraint on the referent of the pronoun seems to be suspended.

(i) I know what Bill and Mary have in common. Mary likes Bill and Bill likes him too.

³ Note that by using coindexation in this and other examples, I am not necessarily making the claim that the relation is syntactic. Instead, coindexation will simply be used to demonstrate coreference possibilities.

Other times, there are no grammatical constraints on reference, and the effect of non-grammatical constraints becomes more obvious. For example, in interpreting (5), we are guided by whichever resolution of *they* results in the most coherent discourse (Hobbs, 1979; Kehler, 2004; Kehler, Kertz, Rohde, & Elman, 2008). In (5a) the pronoun is understood as referring to the city council, because it is more plausible that the denial of a permit would result from their fear of violence than from the demonstrators' fears. The preference is reversed in (5b). Notice that the interpretation of the pronoun here is not being determined grammatically, since it is in the same structural position in each case. Instead, coherence is constraining reference.

- (5) The city council denied the demonstrators a permit because...
- a. ...they *feared* violence.
- b. ...they *advocated* violence.

Coherence and plausibility are not the only non-grammatical constraints on reference, and there are some non-grammatical constraints for which structure matters, due to its effects on information structure. Kehler (2004) compares (5) to (6), which differs only in that the first clause is passive. Importantly, the subject of a passive is even more likely than the subject of an active to be mentioned in surrounding discourse, and in this sense is more 'topical'. Because of this, the pronouns in both (6a,b) is resolved to the demonstrators, even though in (6a), resolving *they* to the city council would make a more coherent discourse; we are left wondering why

the demonstrators' fear of violence would lead to them being denied a permit. As Kehler notes, in this case, coreference, determined by information structural factors, is constraining coherence, rather than the other way around.

- (6) The demonstrators were denied a permit by the city council because...
- a. ...they *feared* violence.
 - b. ...they *advocated* violence.

We see, then, that the referent of a reflexive is determined by grammatical constraints, while the referent of a pronoun is determined by other factors, even though syntactic structure can be relevant, even if its relevance is indirect, by way of information structure.

1.2 Obligatory and Non-obligatory Control

This dissertation discusses PRO, the silent subject of a non-finite clause. A similar distinction to the contrast between reflexives and pronouns has been applied to PRO, under the headings of OC and NOC (Williams, 1980). In traditional definitions of OC, the referent of PRO is uniquely determined. Consider the examples in (7), for example. Using reflexives as a diagnostic because they require a local antecedent, we can see that the referent of PRO is fixed by the expression. In (7a), PRO can only refer to Harry. It cannot be used to mean that Harry promised that someone else would make themselves invisible. Similarly, (7b) cannot be used to express that Ron's mother promised that he would make himself invisible; PRO must

refer to Ron’s mother. In (7c), PRO again must refer to Harry; the sentence cannot be used to report Hermione hearing that Harry promised that she would make herself invisible.

- (7) a. Harry₁ promised PRO₁ to make himself/*oneself invisible.
 b. *Ron₁’s mother promised PRO₁ to make himself invisible.
 c. *Hermione₁ heard that Harry promised PRO₁ to make herself invisible.

The interpretation of PRO in (7) differs from that of overt pronouns in similar constructions. In each of the examples in (8), the pronouns can refer to any salient individual consistent with the pronouns’ gender presuppositions and as determined by context.

- (8) a. Harry₁ promised that he_{1/2} would make himself_{1/2} invisible.
 b. [Ron₁’s mother]₂ promised that he_{1/3}/she_{2/3} would make himself_{1/3}/herself_{2/3} invisible.
 c. Hermione₁ heard that Harry₂ promised that she_{1/3}/he_{2/3} would make herself_{1/3}/himself_{2/3} invisible.

Because of the interpretive restrictions on PRO in examples such as (7), OC is often classified as a syntactic constraint on reference, with PRO entering a syntactic dependency with a locally c-commanding antecedent (Chomsky, 1981; Manzini,

1983; Hornstein, 1999; Landau, 2000).⁴ In other words, the referent of PRO is said to be determined by the sentence itself, just as was the case with reflexive pronouns.

In NOC, on the other hand, the referent of PRO is determined by the speaker or hearer, based (at least) on the context of the utterance; the sentence itself is not sufficient to determine the referent of PRO. In (9a), for example, PRO receives an arbitrary interpretation; in (9b), it can be coreferential with either Fleur or Bill, or it can receive a generic/arbitrary interpretation, referring to no individual specifically. Because the referent of PRO is not strictly determined by the sentence itself, it is believed not to enter a syntactic or semantic dependency with its understood antecedent. Instead, its interpretation is similar to an overt pronoun (Chomsky, 1981; Manzini, 1983; Hornstein, 2001; Landau, 2015).

- (9) a. [PRO_{arb} to park here] is illegal.
- b. Fleur₁ realized [that it would help Bill₂ [PRO_{1/2/arb} to behave herself₁/himself₂/oneself in public]].

Control, then, can either result from syntactic binding on the one hand or discourse resolution of something like a free pronoun on the other. OC occurs when PRO is bound by a local antecedent in the proper syntactic configuration (c-command); NOC occurs when PRO's interpretation is not locally bound. More generally, two noun phrases in a sentence or discourse can be construed as corefer-

⁴ There are also those who maintain that the dependency is not syntactic, but semantic, i.e. that the dependency is mediated by the embedding verb, whose meaning requires that PRO in its complement be coreferent with another one of its arguments (Farkas, 1988; Chierchia, 1989; Sag & Pollard, 1991). In either case, the sentential context determines the interpretation of PRO, either through the semantics of a verb, or through the semantics of a binding relation.

ential through either binding (by which I mean any syntactic/semantic dependency between the two noun-phrases that determines coreference, not just the dependency so labeled in Chomsky (1981)), or not by binding. In binding, coreference is enforced by the grammar. It is determined based on syntactic or semantic properties of the sentence that contains the phrases. Without binding, this is not so. Coreference is decided not by the syntactic properties of the sentence, but only by its speaker or hearer, based on contextual and other extra-grammatical constraints.

It has been argued (e.g. by Manzini, 1983) or at least implicitly assumed in many theories of control, that OC and NOC are grammatically complementary. If a given structure allows NOC, it is only because OC is blocked. Whether PRO will be obligatorily or non-obligatorily controlled in examples such as (7) and (9), for example, is dependent on the structural role of the clause containing PRO (i.e. whether it is the complement of a control verb or a subject). Even some more modern theories such as the Movement Theory of Control (MTC), while eschewing *grammatical* complementarity between the two, still argue that “NOC is only licit where OC is not” i.e. that “NOC will only occur where [OC] is prohibited” (Boeckx & Hornstein, 2007, p. 252). McFadden and Sundaresan (2016) make a similar argument, stating that NOC only happens when establishing an OC dependency fails. However, I will demonstrate that this is not the case. In some adjuncts, a single structure can indeed support both OC and NOC resolutions of PRO.

For the purposes of this dissertation, I will follow Hornstein (1999) and Landau (2017) in my use of the terms OC and NOC. OC will be used to refer to cases where the interpretation of PRO is determined by a syntactic dependency between

it and a local antecedent, even if such a syntactic dependency is not grammatically obligatory, as I argue is sometimes the case. Where a syntactic (OC) dependency is required by the grammar, I will label it “strict OC.” NOC will refer to any case of control where PRO’s referent is not determined by a syntactic dependency. There may also be cases of “strict NOC,” where a syntactic antecedent for PRO is grammatically impossible. Note that throughout this dissertation I will use “control” in a somewhat nontraditional way simply to refer to understood coreference between PRO and an antecedent; PRO will be said to be “controlled” by its antecedent “controller,” regardless of whether there is any grammatical dependency between the two.

1.3 Adjunct control

The study of control has most often focused on complement control, as in (7), and theories of the control dependency have been built around its properties. Adjunct control has been largely ignored, despite the fact that adjuncts and complement are quite different syntactically. For example, complements, but not adjuncts, are selected by the main verb; and adjuncts, but not complements, are often islands to *wh*-movement. Where adjunct control is discussed, it is often assumed to be strictly OC, parallel to complement control (Mohanalan, 1983; Clark, 1990; Hornstein, 1999; Pires, 2007). Because PRO in adjuncts such as those in (10) can only be controlled by the matrix subject, it is argued that adjunct control must involve a syntactic dependency between it and PRO, it being the closest c-commanding

potential antecedent to PRO. Even theories that do not rely on a syntactic binding relation for complement control (e.g. Culicover & Jackendoff, 2001) do presume that control into adjuncts is syntactically based.⁵ Assuming complementarity between OC and NOC, this OC dependency should be obligatory.

- (10) a. Ron₁ talked to Harry₂ [before PRO_{1/*2} leaving the room].
 b. [PRO_{1/*2} Having washed himself/*herself/*oneself], Harry₁ talked to Ginny₂.
 c. Harry₁ grew up [PRO_{1/*2} to be a famous wizard].
 d. The ball₁ fell, [only PRO_{1/*2} to be picked up again].

Landau (2017), however, argues that temporal and rationale adjuncts are not restricted to OC. Although the control relation in the examples in (10a) may indeed be OC, the examples in (11) demonstrate that NOC is also possible.

- (11) a. All preparations were made [before PRO inviting the senator to the hearing].
 b. The painting was on the wall [in order PRO to check how it would be received]. (Landau, 2017, p. 98)

But even Landau maintains something of the spirit of complementarity between OC and NOC. He claims that NOC will only be possible if OC would make the

⁵ Culicover and Jackendoff (2001) note that for some adjuncts some semantic components may be important, but their discussion is limited mainly to Rationale Clauses (*in order PRO to...*). See also Farkas (1988).

sentence denote a strange or unlikely situation. This distinction also does not hold in all instances. I will argue that OC and NOC truly are non-complementary in many adjuncts. NOC does not always require that OC be ruled out syntactically or otherwise.

1.4 Organization of this dissertation

This dissertation explores the following questions: How do structural (OC) and non-structural (NOC) referential dependencies interact? What is the representation of OC and NOC? When the grammar allows both OC and NOC, how do comprehenders select an interpretation? How quickly do comprehenders resolve control dependencies in adjuncts? Is the processing of adjunct control distinct from the processing of other forms of anaphora? These questions relate to broader issues in the study of anaphora, how the processing of dependencies differs when there is an overt versus an implicit cue to that dependency, whether syntactic and non-syntactic anaphoric dependencies show distinct processing profiles, and the difference between arguments and adjuncts in syntax and processing.

The dissertation is organized into two main parts. The remainder of Part I focuses on the syntactic theory of adjunct control. Chapter 2 expands on Landau’s (2017) arguments that temporal adjuncts allow both OC and NOC. I demonstrate that several factors can influence the distribution of NOC, but none of these factors on their own strictly determines when it will be available. For example, NOC is not restricted to environments where OC would lead to strange interpretations, or to

adjuncts in active voice, contrary to claims made in Landau (2017), although each of these can contribute to the likelihood of NOC. In Chapter 3, I provide evidence in agreement with Landau’s (2017) argument that rationale adjuncts also allow both OC and NOC, contrary to earlier theories claiming that they were either strictly OC (e.g. Whelpton, 2002) or strictly NOC (e.g. A. Williams, 2015).

Chapter 4 evaluates the prediction implicit in Landau (2017) that all adjuncts will similarly allow both OC and NOC. Although this prediction is confirmed in several different adjuncts, others require either strict OC or strict NOC. I outline the assumptions Landau’s theory would have to make about these adjuncts in order to accommodate them, but argue that such assumptions are unfounded in some cases. I propose an alternative theory couched within the MTC (Hornstein, 1999; Boeckx, Hornstein, & Nunes, 2010) that is better able to handle most of the strict OC adjuncts, although I note two cases where it struggles.

Part II is focused on the real-time processing of adjunct control. Chapter 5 reviews some of the previous literature, focusing on what types of questions processing measures have been used to ask. In Chapter 6, I present two visual-world eyetracking experiments investigating the timecourse of interpretation of PRO and overt pronouns in temporal adjuncts. Results show that listeners are just as fast to interpret PRO as an overt pronoun once the relevant bottom-up input is received. This chapter serves as foundational work for future research on the interpretive biases involved in adjunct control. Its two main contributions to this line of research are that it shows that the visual-world paradigm can be successfully used to track the interpretation of PRO, and that it provides baseline evidence on how long it

takes to interpret PRO in the most basic constructions. This chapter also provides evidence for the effect of structural predictions in the interpretation of PRO.

Chapter 7 concludes the dissertation with a summary and a look forward to outstanding issues.

Chapter 2: Temporal adjuncts

Much of the evidence that has been used to classify adjunct control as OC involves gerunds in temporal adjuncts such as the one in example (1) (Clark, 1990; Hornstein, 1999, 2001; Pires, 2007), although it is far from clear that all instances of adjunct control behave in the same way (Landau, 2013).

- (1) Ron₁ talked to Harry₂ [before PRO_{1/*2} leaving the room].

In this chapter, I discuss temporal adjuncts as one construction that challenges the traditional complementarity of OC and NOC. I will demonstrate, expanding on previous evidence from Landau (2013, 2017) and others, that both OC and NOC are allowed by the grammar for temporal adjuncts, the former illustrated in (2a) and the latter in (2b). I argue that the choice for one or the other is influenced by non-structural factors.

- (2) a. The pizza₁ tasted better [after PRO₁ being heated in the microwave].
b. The pizza tasted better [after PRO drinking root beer].

After a detailed discussion of the distribution of non-subject control of tem-

poral adjuncts, I will propose that both OC and NOC are allowed by the grammar for these adjuncts. OC will always involve control by the matrix subject, as it is the only syntactically accessible potential antecedent PRO in temporal adjuncts. Although NOC may in principle also include control by the subject, it will be illustrated by having PRO refer to an individual other than the referent of the matrix subject in order to more clearly distinguish it from OC. I will also discuss evidence that at least some instances of subject control in fact must be OC, and not just a possible interpretation of PRO under NOC. I will argue that under NOC readings, PRO is resolved to a logophoric perspective holder, and under OC to the potentially non-logophoric referent of the matrix subject. Although both OC and NOC are possible for temporal adjuncts, factors including potential performance biases in comprehension lead to a preference for OC, with PRO referring to the subject of the next higher clause.

The chapter is organized as follows. In §2.1, I outline some general properties of temporal adjuncts. Then, in §2.2, I discuss why temporal adjuncts have generally been classified as OC. In §2.3, I provide evidence on non-subject control of temporal adjuncts, concluding that structural factors alone cannot predict its distribution. Section 2.4 outlines details of the proposal that both OC and NOC are possible for temporal adjuncts, as well as reasons for why OC is often strongly preferred. Section 2.5 discusses the implications of this proposal for the data discussed and for broader theories of control.

2.1 General properties of temporal adjuncts

Temporal adjuncts are those headed by prepositions¹ such as *before*, *after*, *while*, and *when* (Landau, 2013), as in (3). Adjuncts headed by *without* are also sometimes included, and although they are not semantically temporal, I will also include them here. Temporal adjuncts can appear sentence finally (3a), sentence initially (3b), extraposed (as marked by an intonational break) (3c), or they can be adjoined medially (3d), similar to the distribution of S-level adverbials (Jackendoff, 1972).

- (3) a. Harry left the room [before/after/while/without talking to Ron].
b. [Before/after/while/without talking to Ron], Harry left the room.
c. Harry left the room—[before/after/while/without talking to Ron].
d. Harry, [before/after/while/without talking to Ron], left the room.

Temporal adjuncts modify the event time of the clause to which they attach, with the exception of those headed by *without*, which describes how the event was performed, not when it happened. Below the preposition heading the temporal adjunct is a null operator that binds an empty category lower in the structure of the adjunct (Larson, 1987; Williams, 1992). According to Haegeman (2010), the moving operator is the preposition itself, as illustrated in (4). Whether the operator is the preposition or a separate null element, where it moves from can result in ambiguity of interpretation ((4a) vs. (4b)).

¹ Or possibly complementizers (Hornstein, 1999).

- (4) a. Harry left [after₁ [Ron said [he would leave t_1]]].
 ‘Harry left after the time of departure predicted by Ron.’
 b. Harry left [after₁ [Ron said [he would leave] t_1]].
 ‘Harry left after Ron’s statement about his departure.’

2.2 Temporal adjuncts classified as OC

Temporal adjuncts have been classified as strictly OC in both theoretical (Clark, 1990; Hornstein, 1999, 2001; Pires, 2007; Boeckx et al., 2010) and psycholinguistic (Parker, Lago, & Phillips, 2015; Gerard, 2016) literature. Several reasons have been given to justify this classification. First, PRO in temporal adjuncts can be controlled by the local subject of the matrix clause, but not the object (5a) (Hornstein, 1999; Boeckx et al., 2010), non-c-commanding matrix arguments (5b) (Pires, 2007; Boeckx et al., 2010), or non-local arguments (5c) (Clark, 1990; Pires, 2007; Boeckx et al., 2010).

- (5) a. Harry₁ saw Ron₂ [before/while/after PRO_{1/*2} leaving the room].
 b. *Ron₁’s sister left [without PRO₁ having shaved himself].
 c. Harry₁ said [that [Ginny₂’s brother]₃ left [after PRO_{3/*1/*2} eating a bagel]].²

Second, because the reflexive *oneself* is not licensed in (6a), Clark (1990) used the

² Note that *Harry* is only precluded from being the antecedent in (5c) when the adjunct adjoins to the lower clause, i.e. when what Harry reported was that Ginny’s brother left after eating a bagel. If the adjunct attaches high, i.e. if Ginny’s brother left, and Harry reported that after eating a bagel, then *Harry* must be the antecedent.

example to argue that PRO in temporal adjuncts cannot have an arbitrary interpretation (compare to (6b), where arbitrary interpretation and *oneself* are possible).

- (6) a. Ron₁ felt old after [PRO₁/_{*arb} seeing himself/_{*oneself} in the mirror].
 b. Ron₁ said that [[PRO₁/_{arb} to hurt himself₁/oneself] would be a bad idea].

Third, PRO in temporal adjuncts only allows a “sloppy” interpretation (Ross, 1967, 1969) under ellipsis (Pires, 2007; Boeckx et al., 2010). The elided PRO in the second conjunct of (7a) does not receive an identical interpretation to PRO in the first conjunct (i.e. it does not refer to Ron), but instead must be bound by the local subject (*Harry*). If PRO were not locally bound, but instead was referring to the referent of the first subject as a free pronoun, this would be unexpected (compare (7a) to (7b)).

- (7) a. Ron₁ left [before PRO₁ dancing], and Harry did too.
 ‘And Harry₂ left before he₂/_{*Ron} danced.’
 b. Ron₁ left [before he_{1/2} danced], and Harry did too.
 ‘And Harry₂ left before he_{1/2/3} danced.’

Fourth, PRO can only have a bound interpretation when controlled by *only*-DPs.

- (8) Only Harry₁ survived [after PRO₁ being hit with the killing curse].
 ‘[Nobody else]₁ survived after he₁/_{*Harry} was hit with the killing curse.’

Fifth, Pires (2007) argues that because PRO in (9) does not allow split antecedents, it must be obligatorily controlled by the matrix subject alone.

- (9) *Peter₁ expected Susan₂ to break up with him [without PRO₁₊₂ hurting themselves/each other].

Finally, it has been argued based on examples such as (10a) that NOC requires a [+human] interpretation (Clark, 1990; Landau, 2013).³ Because PRO in temporal adjuncts can take an inanimate antecedent (10b–c), it must not be NOC, at least in those cases.⁴

- (10) a. *[PRO Raining] would be a disaster right now.
 b. It₁ never snows [after PRO₁ raining in this part of the world].
 c. The dishwasher₁ finally broke [after PRO₁ working well for many years].

Under the assumption that OC and NOC are grammatically complementary,

³ Landau (2001, 2017) explains this restriction by assuming that NOC is logophoric in nature. Because only humans can be logophoric centers, it follows that NOC would require a [+human] antecedent. A similar effect is discussed by Charnavel and Sportiche (2016), who argue that animate reflexives may sometimes actually be logophors, while inanimate reflexives are always true anaphors subject to Condition A of the binding theory. Logophoricity effects in temporal adjunct control will be discussed in §2.3.2.4.

⁴ This argument only follows, of course, if the premise is accepted that NOC must be [+human]. Norbert Hornstein (p.c.) gives the following example with apparent remote control (see §3.1.2) of an inanimate PRO.

- (i) Jon framed the portrait₁ in a black frame. [PRO₁ Being framed in a light color] dulled its₁ natural colors.

But it is not clear that is actually NOC. Hornstein and Kiguchi (2003) and Boeckx and Hornstein (2007) argue that (ii) involves OC (see §4.3). Perhaps PRO in (i) is also in an OC dependency with *its*.

- (ii) John said that [[PRO₁ washing herself₁] delighted Mary₁]

if these temporal adjuncts have properties of OC, then all adjuncts with the same syntactic structure would also have to be OC. However, there are cases where PRO appears to refer to a non-local or non-c-commanding antecedent. A few examples from previous literature are given in (11). In each of these, PRO is understood as referring to someone other than the subject of the next higher clause. If control of temporal adjuncts were always OC, this would be unexpected, as the controller should always be the matrix subject, being the only local and syntactically accessible antecedent, as was seen in the examples above.

- (11) a. John₁'s fears always go out of control, [when PRO₁ listening to Larouche].

(Williams, 1992, p. 307)

- b. Potatoes are tastier [after PRO boiling them]

(Ackema & Schoorlemmer, 1995, p. 182)

- c. That oasis was a vision [after PRO dragging ourselves through the desert all day].

(Landau, 2017, p. 7)

- d. The stairs were washed [before PRO entering the basement].

(Landau, 2013, p. 228)

- e. The president was elected [without PRO considering his competence].

(Roeper, 1987, p. 297)

- f. There will be no progress [without PRO investing economic and human resources]

(Landau, 2013, p. 232)

- g. [After PRO collecting some money], a bank account was opened.

(Kawasaki, 1993, p. 165)

- h. [Before PRO entering the basement], the stairs were washed.

(Landau, 2000, p. 22)

- i. [After PRO pitching the tents], darkness fell quickly.

(Kawasaki, 1993, p. 173)

One might argue, as did Roeper (1987) for (11e), that these types of examples still constitute OC. The matrix clauses in (b-e,g-h), for instance, all arguably contain some sort of implicit argument that could be serving as an obligatory controller for PRO: an implicit agent in (d,e,g,h) and an implicit experiencer in (b,c). However, this cannot be the case in (a,f,i). In addition, one might argue that because the adjuncts in (g-i) are fronted, their apparent NOC should not be compared with the OC behavior of right-adjoined adjuncts. In the next sections, however, I will demonstrate why any account that relies on implicit argumenthood or on structural differences between the examples in (11) and the OC examples above cannot adequately predict when NOC readings of temporal adjuncts will be available.

2.3 The distribution of NOC in temporal adjuncts

The accounts above that classify control of temporal adjuncts as OC and that assume grammatical complementarity between OC and NOC predict that non-subject control should be available only if there is some structural feature that rules out the normal OC reading. This section explores the distribution of non-subject control of temporal adjuncts and demonstrates that it cannot be reduced

to structural properties alone. Instead, discourse factors, especially logophoricity, affect when NOC is possible.

2.3.1 Structural effects

I will argue that structural features alone cannot delineate the availability of OC by the matrix subject and NOC by non-subjects, although they can have an affect on how PRO in temporal adjuncts is interpreted. Here I discuss the effect of the adjunction site, of structural properties of the matrix clause, and of the structure of the adjunct.

2.3.1.1 *Attachment site of the adjunct*

Several authors have noted that the attachment site of a temporal adjunct affects the likelihood of its receiving an OC or NOC interpretation. For example, an adjunct is more likely to have an NOC reading when it is adjoined to the left than the right (Williams, 1992; Lyngfelt, 2009a, 2009b; Landau, 2000, 2013). Although a non-subject NOC reading is available for each of the preposed adjuncts in (12), when the adjunct is not preposed (and when there is no intonational break before the adjunct), only subject control appears to be available (13).

- (12) a. [After PRO_{arb} pitching the tents], darkness fell quickly.

(Kawasaki, 1993, p. 173)

- b. [Before PRO_{1/arb} entering the basement], the rain₁ washed the stairs.

(Landau, 2000, p. 22)

- c. [After PRO_{1/2} being sick in bed all day], Ginny₁ brought me₂ a nice surprise.
 - d. [After PRO_{arb} bewitching his broom], Harry₁ broke his arm.
- (13) a. #Darkness₁ fell quickly [after PRO_{1/*2} pitching the tents].
- (Landau, 2000, p. 178)
- b. The rain₁ washed the stairs [before PRO_{1/*2} entering the basement].
- (Landau, 2017, p. 4)
- c. Ginny₁ brought me₂ a nice surprise [after PRO_{1/*2} being sick in bed all day].
 - d. Harry₁ broke his arm [after PRO_{1/*2} bewitching his broom].

Landau (2000) and Lyngfelt (2001, 2009b) both suggest that the restrictions on interpretation seen in examples such as (13) as compared to (12) are due to configurational properties of preposed adjuncts. They suggest that clause-initial adjuncts are attached higher than clause-final ones, and that they lie outside the syntactic domain of the matrix subject. If OC requires c-command, as is generally assumed (Williams, 1980; Chomsky, 1981; Landau, 2000, 2015), then the matrix subject would not be able to bind PRO in a high clause-initial adjunct. Similarly, when the adjunct is extraposed, NOC is more available (Williams, 1992; Landau, 2013).

- (14) a. Darkness₁ fell quickly—after PRO_{1/arb} pitching the tents.

- b. The rain₁ washed the stairs—before PRO_{1/?arb} entering the basement
(Landau, 2013, p. 252)
- c. Ginny₁ brought me₂ a nice surprise—after PRO_{1/2} being sick in bed all day.
- d. Harry₁ broke his arm—after PRO_{1/arb} bewitching his broom.

This data suggests a first attempt to reduce non-subject control of temporal adjuncts to something structural. Perhaps NOC in temporal adjuncts is available if and only if the adjunct is attached outside the c-command domain of the subject. This explanation would allow us to keep structural complementarity between OC and NOC. However, examples that counter this explanation can easily be found. Landau (2013) notes, in fact, that the preference for clause-initial temporal adjuncts to be NOC and for clause-final ones to be OC is just that: a preference. Again under the assumption that NOC requires a human antecedent, the examples in (15) and (16) show that both sentence initial and extraposed adjuncts allow OC.

- (15) a. [After PRO₁ causing a lot of trouble], the dishwasher₁ finally broke down.
(Kawasaki, 1993, p. 31)
- b. [After PRO₁ snowing a lot in February], it₁ never rains heavily in March in this area.
(Kawasaki, 1993, p. 31)
- (16) a. The dishwasher₁ finally broke down—after PRO₁ causing a lot of trouble.

- b. It₁ never rains heavily in March in this area—after PRO₁ snowing a lot in February.

Perhaps in these cases, the adjunct reconstructs to a position c-commanded by the matrix subject, and it is in fact in a location amenable to OC. If so, one could still argue that NOC only obtains when the adjunct is not c-commanded by the subject. However, even with a low, local adjunct, NOC is still sometimes possible. The most salient reading of (17), indeed the only reading possible if the pronoun *them* is taken to refer to the potatoes, is one in which PRO has an arbitrary interpretation; PRO cannot corefer with the matrix clause subject.

- (17) Potatoes are tastier [after PRO boiling them₁].

(Ackema & Schoorlemmer, 1995, p. 182)

Still, one could argue that in (17) it is still the case that the adjunct is attached higher than the matrix subject, and it is this that allows NOC. One final piece of evidence that attachment site does not strictly determine control type is (18). Here the adjunct is attached medially, which arguably must be below the matrix subject. Yet even in this case, OC is possible in both (18a,b), again assuming that NOC requires a [+human] antecedent, and that an inanimate controller is therefore indicative of OC.

- (18) a. Lemons₁, [after PRO₁ being left on the counter for too long], tend to go moldy.

- b. Lemons, [after PRO_{arb} eating sugar], taste especially sour.

Because both OC and NOC are possible in at least some temporal adjuncts, regardless of where they are attached, the distribution of obligatory subject control and NOC by some other entity cannot be reduced to this structural feature. With respect to attachment site, OC and NOC temporal adjuncts appear in overlapping distribution, which means that other factors (as will be discussed below) determine which reading will be most salient. This is not to say that attachment site does not play a role; as several authors have observed, temporal adjuncts adjoined clause-finally are less likely to allow NOC readings. But, I will argue, this is not due to syntactic requirements, but instead to performance biases. This will be discussed in more detail in §2.4.

2.3.1.2 *Structural properties of the matrix clause*

Since attachment site cannot adequately predict the availability of OC and NOC in temporal adjuncts, another place to look for a structural distinction between the two may be in the properties of the matrix clause. Lyngfelt (2002), as cited in Lyngfelt (2009a), suggests that NOC is more likely to be available when the matrix clause is either a passive (19a) or is headed by an expletive (19b).⁵ This is, he

⁵ A reviewer suggests that in (19b) the adjunct is actually adjoined to the embedded clause, and its PRO is controlled by a higher PRO, as in (i). However, it seems at least possible to me for the temporal adjunct to modify the matrix clause, as in (ii), with the meaning that it was hard for a while after finishing the book to eat meat. And even in this case, PRO may be understood to refer to the speaker, which interpretation can only be NOC.

- (i) It was hard [PRO₁ to eat any kind of meat for a while [after PRO₁ finishing this book]].
- (ii) It was hard [PRO to eat any kind of meat] for a while [after PRO finishing this book].

claims, especially true for sentence-final adjuncts; in all cases of non-subject control of clause-final adjuncts found in a corpus study of Swedish infinitives, the matrix clause had at least one of these two properties. I will examine the effect of the passive here, and the effect of expletive subjects in §2.3.2.

- (19) a. The president was elected [without PRO considering his competence].
(Roeper, 1987, p. 297)
- b. It was hard (for me₁) to eat any type of meat for a while [after PRO₁ finishing this book]. (Modified from Lyngfelt, 2009a, p. 39)

The most natural interpretation of (19a) is that the people who elected the president are the ones who did not consider his competence. Therefore, as mentioned above, it has been argued that (19a) does not actually involve NOC, but that PRO is controlled by an unexpressed but syntactically present agent of the matrix clause. This explanation could also apply to each of the examples in (20), which allow PRO to refer to the understood matrix agent.

- (20) a. The bank was robbed [while PRO masquerading as security guards].
(Landau, 2017, p. 6)
- b. All preparations were made [before PRO inviting the senator to the hearing].
(Landau, 2017, p. 6)
- c. All the preparations were made [before PRO arriving to court].
(Landau, 2017, p. 7)
- d. The pizza was eaten [after PRO ordering it].

- e. This dissertation was written [without PRO drinking any coffee].
- f. The war was won [without PRO firing a shot].
- g. The ship was sunk [before PRO collecting the insurance].

Furthermore, this explanation could also potentially extend to any case of non-subject control of a temporal adjunct where the matrix clause involves some sort of implicit argument. Ackema and Schoorlemmer (1995) claim, for example, that (21a) involves OC by the implicit taster. Similarly, (21b) could involve control by an implicit experiencer, since the most salient and perhaps only possible interpretation is that the oasis was a vision to the same people who dragged themselves through the desert.

- (21) a. Potatoes₁ are tastier [after PRO boiling them₁].

(Ackema & Schoorlemmer, 1995, p. 182)

- b. That oasis was a vision [after PRO dragging ourselves through the
desert all day.]

(Landau, 2017, p. 7)

However, there are at least three challenges for this explanation. First, Landau (2017), following Manzini (1986) and Kawasaki (1993), has argued that control by the implicit agent of a passive is NOC based on the examples in (22) and (23). In (22c), if the hitter is understood to be the one rolling down the hill (an interpretation that already is marginal), then that hitter must be human. This is true even though an inanimate argument can control PRO when it is the subject of an active matrix clause (22a), or can be the passive agent without control (22b). The same is true

for (23). If control of PRO in a temporal adjunct by a passive agent was due to syntactic binding, a [+human] requirement would be surprising.

- (22) a. The avalanche₁ hit the house [before PRO₁ rolling down the hill].
b. The house was hit.
c. Mary said the house was hit [before PRO rolling down the hill].
- (23) a. The rain₁ washed the stairs [before PRO₁ entering the basement].
b. The stairs were washed.
c. The stairs were washed [before PRO entering the basement].

Second, there are cases of non-subject control where PRO can be interpreted as someone other than the agent of the passive matrix clause or other implicit arguments, as is the case for the examples in (23c) and (24). Example (23c) can easily mean that some person entered the basement after some other person or thing washed the stairs. This is especially true if we understand the sentence as representing the perspective of the person entering the basement. Example (24a) would be naturally uttered in a situation where sailors undocked the ship, and then were surprised by someone else sinking it. Example (24b) is a more subtle case. Although it does seem to mean that the winners of the war did not fire a shot, it would sound false in a situation where the losers fired lots of shots, even if the winners fired none. What (24b) implies, then, is that the war was won without anyone firing a shot; in this case, PRO does not refer exclusively to the understood agent of the matrix verb. In (24c), PRO still refers to some person boiling the

potatoes, even though that person cannot be represented as an implicit experiencer, in contrast to (21a). But even (21a) does not require the boiler and the taster to be the same individual (Landau, 2013).

- (24) a. The ship was sunk [immediately after PRO undocking it].
 b. The war was won [without PRO firing a shot].
 c. The potatoes₁ got softer [after PRO_{arb} boiling them₁].

This point is even more clear for the passive cases when the agent is represented in a *by*-phrase, removing the possibility of an implicit agent (Lasnik, 1988). In each of the examples in (25), PRO still can refer to some person that no argument in the matrix clause refers to. Similarly, in (26), PRO can still refer to the chef who prepared the food, even though the tasters are his guests.

- (25) a. The stairs were washed by the rain [before PRO entering the basement].
 b. The ship was sunk by enemy torpedoes [immediately after PRO undocking it].
 c. The ship was sunk by a hired crook [before PRO collecting the insurance].
- (26) The potatoes tasted better to the guests [after PRO boiling them].

Finally, having a passive matrix clause does not guarantee that control by the unexpressed agent will be possible. In each of the examples in (27), the only possible reading seems to involve control by the matrix subject. Interpretations where PRO

refers to any other entity, including the matrix agent, are unavailable. Combined with the previous two points, this suggests that other factors, not just the presence of an implicit argument, are what is important.⁶

- (27) a. My wallet₁ was stolen [while PRO_{1/*2} distracting me].

(McCourt, Green, Lau, & Williams, 2015, p. 3)

- b. The tents₁ were set up [after PRO_{1/*2} being locked in the trunk all day].

- c. The bank₁ was robbed [while PRO_{1/*2} being caught on camera].

(Landau, 2017, p. 7)

- d. #The bank₁ was robbed [while PRO_{1/*2} being smart not to raise the alarm].

(Landau, 2017, p. 7)

Non-subject control in temporal adjuncts cannot be reduced to OC by an implicit argument. Their presence or absence cannot account for the availability of non-subject control. It is also not the case that the passive transformation itself blocks OC and thus allows NOC. The examples in (27) clearly demonstrate that OC is not only possible with a passive matrix clause, but is at least sometimes required.

Why, then, did Lyngfelt (2002, 2009a) find NOC to be more likely with a passive matrix clause, if passives themselves do not block OC? Additional evidence can potentially be found in other constructions that share properties of the passive.

For example, perhaps something about having a derived matrix subject makes NOC

⁶ Landau (2017) states that one of those factors is the voice of the adjunct, claiming that passive or similar adjuncts do not allow non-subject control. That hypothesis would apply to (b-d), but not (a). I will return to this idea in §2.3.1.3

more likely. If that were the case, then we would expect not only passives, but all matrix clauses with derived subjects to allow NOC of temporal adjuncts adjoined to them. This prediction seems to be supported by comparing the availability of non-subject control in unaccusatives, which have a derived subject, and unergatives, which do not (Levin & Rappaport Hovav, 1995). Each of the examples in (28) contains an unaccusative predicate in the matrix clause, and NOC is available. This is especially evident for (a-d), in which it is easy to interpret the pronoun in the embedded clause as coreferential with the subject of the matrix clause. If PRO is controlled by the matrix subject, this would result in a Condition B violation (Chomsky, 1981). But NOC is also possible in (e-f), in which control by the matrix subject would not result in a binding condition violation. The examples in (29), on the other hand, have unergatives in the matrix clause, and the only possible reading is OC.

(28) Unaccusatives:

- a. The clock broke [after PRO dropping it].
- b. The cheese melted [after PRO putting it in the microwave].
- c. The ship sank [after PRO hitting it with a torpedo].
- d. Aladdin sank to the bottom of the sea [after PRO weighing him down with a cannon ball].
- e. The glass broke [after PRO singing the right high note].
- f. The box closed [after PRO letting go of the lid].

(29) Unergatives:

- a. *Peter₁ dined at the café every morning [after PRO pointing it out to him₁].
- b. *Mary₁ resigned [after PRO finding the scandal about her₁].
- c. *The shepherds₁ rejoiced [after PRO telling them₁ about Jesus].

However, the difference in acceptability of the examples in (28) and (29) may be confounded by other features of the subject. Aside from (28d), the examples in (28) all have non-human subjects and (29) human ones. Indeed, unergatives in general often have animate or human subjects and unaccusatives often have inanimate, non-human ones. This confound is highlighted by the contrasts in (30), which contains unaccusative main-clause predicates, and (31), which has unergatives. In both cases, non-subject control is more likely with an inanimate subject than a human one. For the unergative in (31) specifically, when the baby is referred to with a gendered pronoun in (31a), non-subject control is not available. But the NOC reading becomes much better when the baby is referred to with the neuter [-human] pronoun in (31b). The effect of humanness will be discussed more in §2.3.2.

- (30) a. The clock₁ fell down [after PRO kicking it₁/the table].
b. Joseph₁ fell down [after PRO₁/*₂ kicking *him₁/the table].
- (31) a. ??The baby₁ slept well [after PRO feeding her₁].
b. The baby₁ slept well [after PRO feeding it₁].

There are many other cases of OC in temporal adjuncts where the matrix clause has a derived subject. The examples in (32) contain passive matrix clauses and allow OC by the derived subject, and (33) has additional unaccusatives with the same property. That this is in fact OC can be diagnosed by the inanimacy of the controlling subject. These examples demonstrate that the cases of NOC above cannot be due to OC being unavailable, since having a derived subject does not block OC.

(32) Passives:

- a. The tomatoes₁ were eaten [only after PRO₁ fermenting/being pickled in brine for a few days].
- b. ?My phone₁ was stolen [while PRO₁ sitting in my locker].
- c. The cake₁ was destroyed [after PRO₁ being sat on].

(33) Unaccusatives:

- a. The ship₁ sank [after PRO₁ running into an iceberg].
- b. The snow₁ thankfully stopped [after PRO₁ falling non-stop for a week].
- c. The glass₁ broke [after PRO₁ falling off the table].
- d. The train₁ departed [after PRO₁ filling up with passengers].
- e. The ball₁ dropped [after PRO₁ hanging in the air for 10 seconds].

Finally, not only is having a derived subject in the matrix clause not sufficient for allowing NOC, it is also not necessary. Examples (34) and (35) provide exam-

ples of transitives and unergatives, which do not have derived subjects, but which nevertheless allow NOC.

(34) Transitives:

- a. My arrow finally hit the target [after PRO practicing for hours and hours].
- b. The rain ruined my bike [after PRO leaving it outside overnight].

(35) Unergatives:

- a. The clock worked well [after PRO putting in new batteries].
- b. Peter talked for hours [after PRO giving him the microphone].
- c. Strangely the candidates talked avidly when we asked them where they were from, but they hesitated [after PRO asking them about their work].
- d. The doorbell buzzed [after PRO pushing a little button].

Both implicit argumenthood and derived subjecthood fail to sufficiently delineate the distribution of OC and NOC in temporal adjuncts. Note that an interaction between the structure of the adjunct and its attachment site is also insufficient. As was demonstrated in §2.3.1.1, right-adjoined adjuncts with no prosodic break were the least likely to allow NOC. Each of the examples in this section, both those that allowed NOC and those that did not, used right-adjoined adjuncts. Therefore, we cannot even form a disjunctive generalization stating that NOC is only allowed if the

adjunct is attached high or the matrix clause has an implicit argument or derived subject.

2.3.1.3 Structural properties of the temporal adjunct

We have just seen that the structure of the matrix clause cannot sufficiently determine the distribution of OC and NOC in temporal adjuncts. It has also been proposed that the structure of the adjunct itself plays a role. Landau (2017, pp. 6-7) provides evidence suggesting that when the adjunct clause is in the passive voice, as with the (b) and (c) examples in (36)–(38), only OC by the matrix subject is possible. NOC is blocked, even though it is available in similar sentences with active adjuncts, as seen in the (a) examples.

- (36) a. All preparations were made [before PRO inviting the senator to the hearing].
b. The senator₁ was warned [before PRO₁ being invited to the hearing].
c. *All preparations were made [before PRO being invited to the hearing].
- (37) a. That oasis was a vision [after PRO dragging ourselves through the desert all day].
b. We₁ finally found water [after PRO₁ being dragged through the desert all day].
c. *That oasis was a vision [after PRO being dragged through the desert all day].

- (38) a. There won't be any progress [without PRO insisting on guidance from the outside].
- b. They₁ will make no progress [without PRO₁ being guided from the outside].
- c. *There won't be any progress [without PRO being guided from the outside].

Landau notes that the generalization that passive adjuncts only allow OC also seems to be true of copular adjuncts (39), but not of unaccusatives (40). Only the latter allows both OC and NOC. Although he does not provide a an explanation of this generalization, he hints that it might be due to the syntactic structure of the adjunct, suggesting that perhaps the generalization does not apply to unaccusatives because they can sometimes have agentive readings and perhaps agentive syntax.

- (39) a. The robbers₁ filled their bags [while PRO₁ being smart not to raise the alarm].
- b. *The bank was robbed [while PRO being smart not to raise the alarm].
- (40) a. My lawyer₁ made all the preparations [before PRO₁ arriving to court].
- b. All the preparations were made [before PRO arriving to court].

Again, this generalization is insufficient. Although it does appear that having a passive or copular adjunct makes it less likely that NOC will occur, this is not a hard restriction. Example (41a), which is quite similar to (37c), allows a logophoric

interpretation of PRO, despite its being the subject of a passive adjunct. The same is true for (41b), in which PRO can easily refer to the speaker (suppose the speaker dislikes mushrooms, but hates celery even more), and for (41c), which allows PRO to refer to a non-c-commanding argument embedded within the matrix subject. Similarly, Example (41d), which contains a copular clause in the adjunct, also allows non-subject control, at least for some speakers.

- (41) a. That Gatorade was a vision [after PRO being worked to exhaustion by my coach today].
- b. Mushrooms aren't too bad [after PRO being forced to eat celery].
- c. ?The prisoner₁'s sentence was finally released [after PRO₁ being forced to wait for over week while the judge made his decision].
- d. ?The house stayed dry during the storm [after PRO being smart not to leave the windows open].

Even if it were true that passive adjuncts only allowed OC, that would still not be sufficient to determine the full distribution of OC and NOC. Something more would still need to be said about adjuncts in active voice, which allow both types of control. It is of course possible that OC and NOC adjuncts differ structurally due to inherent syntactic differences in derivation of OC and NOC themselves, as is the case in the Two-tiered Theory of Control (TTC) (Landau, 2017, see §4.1). But other structural features of the adjunct cannot determine whether OC or NOC will be possible. That the distribution of OC and NOC in temporal adjuncts cannot

be reduced to structural properties of either the embedded or matrix clause is best illustrated by examples such as the following. Each of the examples in (42), (43), and (44b) can be interpreted as either OC by the local subject or NOC by a non-local antecedent without changing the structure of the sentence at all (again, modulo changes in the representation of OC and NOC themselves).

- (42) Chickens₁ taste better [after PRO_{1/2} being forced to eat celery].
- (43) The pool₁ was the perfect temperature [after PRO_{1/2} being in the hot sun all day].
- (44) a. (i) At some point yesterday, the dishwasher broke. Also yesterday, Peter came home for a 2-week visit. Mom thought that Peter broke the dishwasher.
- (ii) Peter ordered a new dishwasher, and the store had it delivered. It is not working, and the store manager doesn't want to replace it. He said that Peter must have broken it.
- b. Peter₁ says [the dishwasher₂ broke [before PRO_{1/2} even arriving at the house]].⁷

2.3.2 Non-structural effects

We have just seen that structural properties can influence whether NOC is more likely to be available, but they cannot be used to fully delineate the distribu-

⁷ This sentence has a potential structural ambiguity similar to the one in (5c), discussed in Footnote 2. The key is that PRO may refer to Peter even when the adjunct attaches low. That is, PRO may refer to Peter even if Peter is saying this long after he arrived.

tion of OC and NOC in temporal adjuncts. This section examines non-structural properties of the sentences and discourses in which these temporal adjuncts occur and the effect they have on control.

2.3.2.1 Availability of subject-control reading

At least three authors (Williams, 1992; Lyngfelt, 2001, 2009a, 2009b; Landau, 2017) have noted that non-subject control into adjuncts is more available when subject control would make the sentence denote a bizarre or impossible situation, or in the terms of Landau (2017), a semantic anomaly. In (45a), for example, John’s fears, being inanimate, cannot listen to anything. And in (45b), it seems odd for stairs to enter the basement after being washed. Williams (1992) and Landau (2017) argue that NOC interpretations of these sentences are only possible because of the anomaly that OC would have produced. Although not relying on a grammatical distinction between the two, this maintains a spirit of OC/NOC complementarity; NOC is only available because OC is not.

- (45) a. John₁’s fears₂ always go out of control, [when PRO_{1/#2} listening to Larouche]. (Williams, 1992, p. 307)
- b. The stairs₁ were washed [before PRO_{#1} entering the basement]. (Landau, 2013, p. 228)

The same is true of the examples from Lyngfelt in (46). Although these have the confounding attribute that the adjunct is fronted, which we have already seen

makes NOC more likely, the same NOC reading seems to persist even when the adjuncts are moved to the right in (47).

- (46) a. [After PRO_{1/#2} finishing her₁ studies], an overseas job₂ was a welcome change. (Lyngfelt, 2009a, p. 39)
- b. [After PRO_{#1} flying from Europe to California], the jetlag₁ was tough, but not unbearable. (Lyngfelt, 2009b, p. 155)
- (47) a. An overseas job₂ was a welcome change [after PRO_{1/#2} finishing her₁ studies].
- b. The jetlag₁ was tough [after PRO_{#1} flying from Europe to California], but not unbearable.

Lyngfelt (2009a) makes the similar observation that NOC is more likely when the matrix clause has an expletive subject, as in (48). For the expletive to control PRO in these examples would require it to take the external θ -role of the embedded verb. Since expletives cannot hold any thematic relation, this would be impossible. When OC is blocked for this reason, NOC becomes available.

- (48) a. It was hard (for me₁) to eat any type of meat for a while [after PRO₁ finishing this book]. (Modified from Lyngfelt, 2009a, p. 39)
- b. There₁ will be no progress [without PRO_{*1} investing economic and human resources] (Landau, 2013, p. 232)

This may explain why non-subject control is more available when the matrix

clause is a passive or unaccusative, as noted above. Because passive and unaccusative subjects are often inanimate, if the verb in the adjunct requires an animate subject, OC by the matrix subject would be ruled out. In the examples in (49) and (50), repeated from (20) and (28), the external θ -role of the embedded verb requires an animate argument. Because the matrix subject is inanimate, OC by it is semantically anomalous, and NOC becomes more readily available.

- (49) a. The bank was robbed [while PRO masquerading as security guards].
(Landau, 2017, p. 6)
- b. All preparations were made [before PRO inviting the senator to the hearing].
(Landau, 2017, p. 6)
- c. This dissertation was written [without PRO drinking any coffee].
- d. The ship was sunk [before PRO collecting the insurance].
- (50) a. The clock broke [after PRO dropping it].
- b. The glass broke [after PRO singing the right high note].
- c. The cheese melted [after PRO putting it in the microwave].
- d. The ship sank [after PRO hitting it with a torpedo].
- e. The box closed [after PRO letting go of the lid].

Subject control is further discouraged in many of the examples seen here by the binding conditions (Chomsky, 1981). In (51a), for example, subject control would induce a Condition A violation at the reflexive *ourselves*. Similarly, in (51b),

if the pronoun *them* in the embedded clause is understood to refer to the potatoes, then subject control of PRO would cause a Condition B violation.

- (51) a. That oasis₁ was a vision [after PRO*₁ dragging ourselves through the desert all day]. (Landau, 2017, p. 7)

- b. Potatoes₁ are tastier [after PRO*₁ boiling them₁]
(Ackema & Schoorlemmer, 1995, p. 182)

However, although I have used these violations to more clearly demonstrate that non-subject control is taking place, they are not necessary. Non-subject control is just as possible in the similar examples in (52), in which subject control would not cause binding condition issues, but would still lead to semantic anomaly.

- (52) a. The potatoes₁ were tastier [after PRO_{#1} eating carrots].
b. That oasis₁ was a vision [after PRO_{#1} dragging our luggage through the desert all day].

But once again, although the unavailability of subject control may contribute to the possibility of non-subject control, it is neither necessary, as Landau (2017) claims, nor sufficient. Several of the examples above, some of which are repeated in (53), only allow subject control, even though this reading leads to semantic anomaly or binding violations. This is further illustrated by (54)

- (53) a. *Ron₁'s sister left [without PRO₁ having shaved himself].

- b. Darkness₁ fell quickly [after PRO_{1/*2} pitching the tents].

(Landau, 2000, p. 178)

- c. The bank₁ was robbed [while PRO_{1/*2} being smart not to raise the alarm].

(Landau, 2017, p. 7)

- (54) The toy₁ broke [before PRO_{1/*2} feeling very sad].

That semantic anomaly of the subject-control reading is not required is demonstrated by the examples repeated in (55). In each of these sentences, the subject of the matrix clause makes a perfect, non-anomalous OC controller, and yet PRO can also be understood to refer to someone else through NOC.

- (55) a. The president₁ was elected [without PRO_{1/2} considering his competence].

(Roeper, 1987, p. 297)

- b. Chickens₁ taste better [after PRO_{1/2} being forced to eat celery].
- c. The pool₁ was the perfect temperature [after PRO_{1/2} being in the hot sun all day].
- d. At some point yesterday, the dishwasher broke. Also yesterday, Peter came home for a 2-week visit. Mom thought that Peter broke the dishwasher.

Peter₁ says [the dishwasher₂ broke [before PRO_{1/2} even arriving at the house]].

2.3.2.2 “Initiator” status

As discussed above, Landau (2017) claimed that NOC in adjunct control is only available if the adjunct is in active voice and if OC would lead to “semantic anomaly.” We have seen that neither of these generalizations is entirely correct. In a recent talk, Landau (2018) attempted to reduce these effects to a single generalization: NOC is only available if PRO and its potential OC controller mismatch in [init] features, where an argument is [+init] if it is the “initiator” who intentionally brings about a situation (see Farkas, 1988). In (56), for example, NOC is only possible because the potential OC controller (the matrix subject) and PRO mismatch in [init] features.

- (56) The president_[-init] was elected [without PRO_[+init] considering his competence].

In (57), repeated from (54), on the other hand, both the potential OC controller and PRO are [-init]. Because these values match, only OC is possible, despite the fact that OC results in the sentence denoting an unlikely situation. Landau’s (2018) account thus fares better than Landau’s (2017) semantic anomaly generalization described in the previous section.

- (57) #The toy_[-init] broke [before PRO_[-init] feeling very sad].

However, the [init] account is still insufficient. In the sentences in (58), for

example, PRO and its potential OC controller mismatch in [init] values, and yet NOC still appears to be possible.

- (58) a. Mushrooms_[-init] aren't too bad [after PRO_[-init] being forced to eat a whole plate of celery].
- b. The pool_[-init] was the perfect temperature [after PRO_[-init] being in the hot sun all day].

2.3.2.3 *Topichood*

Kawasaki (1993) argued that NOC of PRO in adjuncts is really control by the topic of the sentence.⁸ This means that non-subject control into adjuncts should be available just in those cases where the sentence can be understood as having as its topic someone other than its subject. Kawasaki's account is situated in the framework of File Change Semantics (Heim, 1983). When PRO in an adjunct refers to someone other than the matrix subject, the sentence is understood to be making a comment on that individual, and the proposition expressed by the sentence is stored on their file card. The adjunct is understood to be a predicate of the topic under which it is filed. For example, the sentence in (59) is in some sense about the person working on the problem sets and the ease with which they finish them. Because of

⁸ This is similar to aspects of Centering Theory (Grosz, Weinstein, & Joshi, 1995), which argues that if anything is going to be referred to with a pronoun, then it will be the "Backward Looking Center", which is the discourse referent evoked by an utterance that is the most "highly ranked" of those also evoked by the prior utterance, according to a ranking of accessibility to anaphora. Thus the Backward Looking Center is a kind of topic, in that it is the referent most likely to have been continued from the prior utterance.

that, the proposition is filed on the file card corresponding to that person, and PRO can refer to them instead of to Problem Set 2, the referent of the matrix subject.

- (59) [After PRO₁ working on Problem Set 1], Problem Set 2 shouldn't take (you₁) much time. (Kawasaki, 1993, p. 163)

Kawasaki bases her claim on three main observations. First, PRO in adjuncts never introduces a new referent in the discourse. Instead, it often is coreferential with the DP subject of either the current or previous sentence. This is expected if the adjunct is a predicate serving to comment on a previously-established topic. For example, in (60a), the topic of the first sentence is easily understood to be the women who were harassed, and PRO in the adjunct can easily refer to them. In (60b), on the other hand, the first sentence favors John as its topic, and so PRO is more likely to refer to him.

- (60) a. Many women were harassed by John. [After PRO₁ talking to the manager], complaints were filed.
b. ??John harassed many women. [After PRO talking to the manager], complaints were filed. (Kawasaki, 1993, p. 177)

Second, Kawasaki observes that in adjunct control sentences, the matrix clause must provide some information on the understood referent of PRO, such that the sentence can be understood as having that referent as its topic. For example, in (61a), the final clause can be understood to be a comment about the pirates in

virtue of their being the passive agent, and PRO in the adjunct can refer to them. When the intransitive *sank* is substituted for the passive verb in (61b), however, this is not the case. Kawasaki claims that in this case, PRO can only refer to the pirates if it is their ship that sank, such that the matrix clause can still be understood as a comment about the pirates.

- (61) a. Suddenly the pirates₁ showed up from behind the rocks. [After PRO₁ robbing the passengers], the ship was sunk.
- b. Suddenly the pirates₁ showed up from behind the rocks. [After PRO₁ robbing the passengers], the ship sank. (Kawasaki, 1993, p. 172)

Kawasaki's third observation is that the acceptability of the sentence decreases where the referent of the missing subject is not the best candidate for the sentence topic. For example, in (62a), PRO cannot refer to the passive agent of the matrix clause, because the topic of the sentence is much more likely to be the human subject, despite the fact that PRO can refer to a passive agent in other instances (62b). According to Kawasaki, this is partly due to the fact that subjects, especially when human, are more likely to be sentence topics (Reinhart, 1981; Comrie, 1989).

- (62) a. *[Before PRO₁ leaving for New York], Mary was criticized by John₁.
(Kawasaki, 1993, p. 165)
- b. [After PRO₁ sinking the ships], many houses were destroyed by the soldiers₁.
(Kawasaki, 1993, p. 163)

Kawasaki's examples all contain fronted adjuncts, which we have seen are more permissive with respect to non-subject control. But her account may also shed light on why NOC is less likely for right-adjoined adjuncts. NOC is available in (63a), according to Kawasaki, if the matrix clause is taken to be about the people who pitched the tents (i.e. if it talks about what happened to them, not what happened somewhere else). Although she does not discuss the right-adjoined counterpart in (63b), it seems likely that when the matrix clause is introduced first, the sentence will be understood to be about the darkness itself; for this reason, the most likely interpretation is one where *darkness* controls PRO.

(63) a. [After PRO pitching the tents], darkness fell quickly.

(Kawasaki, 1993, p. 173)

b. #Darkness fell quickly [after PRO pitching the tents].

However, Kawasaki's control by sentence topic cannot account for all the data. One example is (64), repeated from (24c). This sentence allows NOC control by some unnamed person, but the strongest candidate for the topic of the sentence is the potatoes. Kawasaki's account may apply if one assumed that the potatoes had to belong to the boiler, similar to the way the sinking ship had to belong to the pirates in (61b), but this is problematic. In (61b) it is possible to imagine that the sentence is describing what happened to the pirates, but it seems like a stretch to say that (64) describes what happened to the person who boiled the potatoes.

(64) The potatoes got softer [after PRO boiling them].

2.3.2.4 *Logophoricity*

The effect of logophoricity on adjunct control was noted at least as early as Williams (1992), and was also observed by Landau (2000). Williams argued that there are two types of adjunct control: predicative and logophoric. Logophoric control was said to occur any time the antecedent of PRO was not in the local syntactic domain of PRO, in which case PRO must refer to some perspective holder or source of information, i.e. the logophoric center of the sentence (Sells, 1987; Huang & Liu, 2001). An example from Williams is given in (65). Here PRO can refer to John because the sentence is expressing his emotional state. Similar arguments have been made by Landau (2015, 2017), who states that any case of non-predicative control must be logophoric.

- (65) John₁'s fears₂ always go out of control, [when PRO_{1/#2} listening to Larouche].

This observation seems to be correct. In many if not all of the examples in this chapter, when NOC is available, PRO is understood as referring to some perspective holder. This can often be the speaker, as they are, in the terms of Sells (1987), the SOURCE of the report. In (66), for example, we see that PRO can have a logophoric interpretation in that it refers to a set of individuals containing the speaker.

- (66) That oasis was a vision [after PRO dragging ourselves through the desert all day]. (Landau, 2017, p. 7)

NOC is more difficult in (67a), in which PRO cannot refer to the speaker due to the third person reflexive in the adjunct. But, when a new SOURCE is given in the preceding context, NOC is possible, with PRO referring to that SOURCE, as in (67b). Note that in (67b) the tense has been changed in order to ensure that the adjunct is understood to be adjoined to the embedded clause.

- (67) a. ??That oasis was a vision [after PRO dragging himself through the desert all day].
- b. Sam₁ thinks [that oasis will be a vision [after PRO₁ dragging himself through the desert all day]].

This is further demonstrated in the contrast in (68). When PRO in this adjunct is understood to refer to the speaker, it is not necessary to explicitly state the perspective holder; in (68a), the PP *for me* is optional. In order for PRO to refer to someone other than the speaker, however, the PP is no longer optional, since it is necessary to establish the intended referent of PRO as a logophoric center, unless the sentence is embedded in a larger discourse establishing the perspective holder (68c).

- (68) a. It was hard (for me₁) to eat any kind of meat for a while [after PRO₁ finishing this book].
- b. It was hard *(for Jim₂) to eat any kind of meat for a while [after PRO₂ finishing this book].

- c. Jim₁ used to love steak, but he₁ said that [it was hard (for him₁) to eat any kind of meat for a while [after PRO₁ finishing this book]].

Additional evidence comes from the example repeated in (69). As already discussed, PRO in this example can refer to someone other than the passive agent (the sinker of the ship). At least to me, this sentence best describes a situation seen from the eyes of the people who undocked the ship, i.e. from the perspective of the referent of PRO. It would be strange for the sinkers of the ship to utter (69) unless they were also the undockers.

- (69) The ship was sunk [immediately after PRO undocking it].

The same point can be made with (70). PRO in this example may refer to the tasters of the potatoes, in which case their perspective is at least implied by the predicate “tastier”. But as was already noted, the person boiling the potatoes does not necessarily need to be the same as the person tasting the potatoes in order for (70) to be acceptable. However, using (70) to describe such a situation only seems natural if it is the boilers who are making the report, not the tasters.

- (70) The potatoes were tastier [after PRO boiling them].

Although PRO in temporal adjuncts can in many cases refer to the speaker as a logophoric SOURCE, other factors may restrict this interpretation. We have seen, for example, that NOC is possible for the fronted adjunct in (71a), but not

for the right-adjoined adjunct in (71b). However, it is not the case that (71b) never allows NOC. When additional context is given to explicitly establish a perspective holder, logophoric control becomes available (72). This suggests that NOC is widely and generally available for temporal adjuncts; for some, though, logophoric control requires additional contextual support.

- (71) a. [Before PRO pitching the tents], darkness fell.
 b. #Darkness fell [before PRO pitching the tents].

- (72) Peter₁ and Jon₂ were arguing about when they finally got their tents pitched.
 Peter₁ thought [that darkness fell [*before* PRO₁₊₂ pitching the tents]].

The same is seen in (73). Given the context in (73a), PRO in (73b(i)) can refer to Peter, as the SOURCE. Note that the context on its own, however, is not enough. Given the same context in (73a), NOC is not available in (73b(ii)). Rather than explicitly representing Peter's perspective, thoughts, or feelings, this sentence states the perspective of the speaker. Hence, PRO cannot refer to Peter.

- (73) a. At some point yesterday, the dishwasher broke. Also yesterday, Peter
 came home for a 2-week visit. Mom thought that Peter broke the
 dishwasher.
 b. (i) Peter₁ says [the dishwasher₂ broke [before PRO_{1/2} even arriving
 at the house]].

- (ii) *But it turned out that [the dishwasher₂ broke [before PRO₁ even arriving at the house]]

Effects of logophoricity can also subsume at least some of the effects of topicality noted in Kawasaki (1993). For example, Kawasaki claimed that (74) is only acceptable when the ship belongs to the pirates, and that this is because only through ownership of the ship could the pirates become the topic of the matrix clause. But it could also be that the ship needs to belong to the pirates in order to make the pirates the logophoric PIVOT of the sentence, such that the situation is described from their physical point of view (Sells, 1987).

- (74) Suddenly the pirates₁ showed up from behind the rocks. [After PRO₁ robbing the passengers], the ship sank.

(Kawasaki, 1993, p. 172)

And in (75), PRO can refer to the discourse ADDRESSEE, which Landau (2015) argues can also be a logophoric center.

- (75) [After PRO₁ working on Problem Set 1], Problem Set 2 shouldn't take (you₁) much time.

(Kawasaki, 1993, p. 163)

These examples all demonstrate the importance of logophoricity in NOC of temporal adjuncts. In each case, PRO refers either to the speaker or some other established perspective holder or logophoric center. This is only true, though, for

NOC. In OC, the controller need not be a human logophoric center, or even animate, as has already been shown with examples such as (76).

- (76) a. It₁ never snows [after PRO₁ raining in this part of the world].
b. The dishwasher₁ finally broke [after PRO₁ working well for many years].

The importance of logophoricity has much more to do with the interpretation of PRO in NOC, and less to do with its distribution. Although NOC becomes more available with an established logophoric center, logophoricity tells us nothing about the structural tendencies seen above, such as why right-adjoined adjuncts are less likely to allow NOC than fronted ones.

2.4 Proposal

The preceding sections have demonstrated that the distribution of OC and NOC in temporal adjuncts cannot be determined based solely on the attachment site of the adjunct or structural properties of either the adjunct or the matrix clause. Instead, it was shown that discourse factors such as logophoricity are also important. This suggests that NOC and OC are not strictly complementary, contrary to common views (Williams, 1980; Chomsky, 1981; Manzini, 1983; McFadden & Sundaresan, 2016) on the distribution of the two types of control. I propose that both OC and NOC are available in temporal adjuncts (other types of adjuncts will be discussed in Chapters 3 and 4). OC readings are the result of a syntactic dependency between PRO and its antecedent, while the NOC readings are generally

logophoric, with PRO referring to some perspective holder in the discourse (Sells, 1987; Landau, 2015, 2017), although generic (‘arbitrary PRO’) readings are also possible. Note that it cannot be the case that control of temporal adjuncts is always NOC or logophoric. OC is required at least in cases such as (77) where an inanimate subject controls PRO, since NOC and all cases of logophoric control require human antecedents. Other tests also confirm that these and other cases of subject control are OC. This will be discussed in §2.5.1.

- (77) a. It₁ never snows [after PRO₁ raining in this part of the world].
 b. The dishwasher₁ finally broke [after PRO₁ working well for many years].

The idea that both OC and NOC are available for control of temporal adjuncts is similar to claims made by Williams (1992) and developed by Landau (2015, 2017), who stated that adjunct control can either be predicative (what I have been calling OC) or logophoric (my NOC cases). But instead of claiming that NOC is *only* available when OC is not, either because of the structural relation of the adjunct to the matrix clause or because of other factors, I maintain that both OC and NOC are truly always allowed by the grammar. This is not to say that OC and NOC are equally available. Indeed, we have seen much evidence that OC is often strongly preferred. I will argue that this is due to interpretive biases in processing.

This section will outline the details of this proposal. In §2.4.1, I discuss in further detail the grammatical distinctions between OC and NOC. The preference for OC in temporal adjuncts and its sources will be discussed in §2.4.2, and the

factors that may lead to NOC in §2.4.3. The following section, §2.5, will discuss further implications of the proposal.

2.4.1 Grammar allows both OC and NOC

Previous theories have claimed that OC and NOC are syntactically complementary. What this meant is that it was the structure of the clause of which PRO was a subject or its attachment site that determined control type. For example, when the controlled clause is a verbal complement, as in (78a), OC is required. When it is a clausal subject, as in (78b), it is NOC.

- (78) a. Harry₁ managed [PRO₁ to win the tournament].
 b. [PRO_{arb} To win the tournament] would be very impressive.

I have argued that temporal adjuncts cannot be classified as OC or NOC based on structural properties in the same way. The type of control obtained is not determined by attachment site or internal structural properties of the adjunct or the matrix clause. Depending on which theory of control is taken to be correct, though, there may still be syntactic differences between OC and NOC. Under the MTC (Hornstein, 1999; Boeckx et al., 2010), for example, OC entails that PRO is in reality the trace of movement, while in NOC it is a null pronominal. According to the TTC (Landau, 2015), NOC has an additional layer in the clausal structure of the controlled constituent compared to OC.⁹ But these differences simply reflect

⁹ The TTC does not actually distinguish between OC and NOC. Instead, the readings that I have been calling OC would be classified as predicative control, and those that I have called NOC would be logophoric control. Although the distinction is important, as predicative and logophoric

the definition of OC and NOC in those theories. What I mean when I say that the two types of control are not grammatically complementary in temporal adjuncts is that structural factors other than those that are definitional to OC and NOC do not determine whether OC or NOC will occur. In other words, both a trace and a pronominal, in terms of the MTC, or both predicative and logophoric structures, in terms of the TTC, can appear in the same place. In this sense, OC and NOC are in overlapping distribution syntactically.

This distinction is an important step in explaining the data above. To repeat examples given above, (79)–(81) can be interpreted as OC or NOC, without, arguably, changing the structure (modulo possible differences between OC and NOC themselves), but based on context. This is only possible if structural factors alone do not determine the type of control a given construction will have. Other factors must be involved.

(79) Chickens₁ taste better [after PRO_{1/2} being forced to eat celery].

(80) The pool₁ was the perfect temperature [after PRO_{1/2} being in the hot sun all day].

(81) a. (i) At some point yesterday, the dishwasher broke. Also yesterday, Peter came home for a 2-week visit. Mom thought that Peter broke the dishwasher.

(ii) Peter ordered a new dishwasher, and the store had it delivered.

control do not map directly to OC and NOC in all cases, it is sufficient at this point to assume that the terms are roughly equivalent, at least for the cases of adjunct control discussed here. This will be discussed in greater detail in Chapter 4.

It is not working, and the store manager doesn't want to replace it. He said that Peter must have broken it.

- b. Peter₁ says [the dishwasher₂ broke [before PRO_{1/2} even arriving at the house]].

2.4.2 Preference for OC

Although both OC and NOC in temporal adjuncts are allowed by the syntax, this does not mean that both are equally available. Especially for right-adjoined adjuncts, NOC readings are acceptable only in particular contexts. On its own, (81b), for example, only allows PRO to refer to the dishwasher. Having a logophoric controller requires a strong supporting context like (81a(i)), and even then, the reading is difficult or marginal for some speakers. This suggests, as has been noted by Landau (2017), that there is a strong preference for OC. This preference exists despite the fact that both OC and NOC are allowed by the grammar. It is this preference for obligatory subject control that led previous researchers to classify adjunct control as strictly OC. There are several potential reasons for this preference. As will be seen, most if not all of these factors necessarily involve processing biases, rather than grammatical preferences. I discuss a few here.

2.4.2.1 *Preference for local antecedent*

First, the preference for OC over NOC may reflect a general preference for local antecedents in online processing. When a comprehender looks for an antecedent to PRO, the OC reading requires a search of the local syntactic context. Perhaps

searching this context is less difficult than searching the surrounding discourse. This preference for local antecedents would not be unique to adjunct control. There is evidence that it also exists for picture NPs. Cunnings and Sturt (2014) used eyetracking while reading to investigate the processing of sentences such as (82). They found slower reading times when the reflexive matched the gender features of the more distant antecedent compared to when it matched the more local one, suggesting that it was more difficult to establish the non-local anaphora. This was true despite the fact that in offline measures, participants readily accepted both local and non-local antecedents for the reflexives.

(82) Mary heard about the soldier's picture of herself/himself.

With PRO in temporal adjuncts, the picture is somewhat different. Unlike the picture NPs in Cunnings and Sturt's experiments, which allowed both readings in offline judgments, the strong preference for the local antecedent (OC) reading seen in many examples in this chapter does not seem like a temporary processing effect, since the judgments reported are for offline interpretations. Thus, although the preference for a local antecedent may be a contributing factor for the strong predominance of OC, it is likely not the whole story. Still, it is possible that establishing a non-local logophoric dependency is more difficult than forming a local syntactic one, adding to the preference for OC over NOC in most cases.

2.4.2.2 *Preference for syntactic relations*

As a similar, and perhaps not unrelated, possibility, Landau (2017) cites a common observation that “wired-in” operations take priority over grammar-external ones. This means that when a syntactic control relation (OC) is possible, it will be preferred over non-syntactic control by a discourse entity (NOC) (see also Lebeaux, 1984; Williams, 1992; Kawasaki, 1993).

This idea is similar to the proposal from Reinhart (1983) discussed in Heim and Kratzer (1998), in which it is stated that if the same meaning can be expressed by two minimally different LFs, one of which has a bound variable and the other a free pronoun ((83a) and (83b) respectively), then the form with a bound variable (83b) will be preferred by both speakers and hearers.¹⁰ For adjunct control, this translates to OC being preferred over NOC because the former relies on PRO being syntactically bound by its antecedent, while in the latter, PRO receives its interpretation through the discourse.

- (83) a. Felix voted for him₁. $g_c = [1 \rightarrow \text{Felix}]$
 b. Felix 1 [t₁ voted for himself₁] (Heim & Kratzer, 1998, p. 271)

Under such proposals, OC would be preferred over NOC because of a preference for syntactic relations over non-syntactic ones at an interface outside of the syntax proper.¹¹ But contrary to what Landau (2017) claims, it is not always nec-

¹⁰ Although see Lasnik (1991), Fox (2000), Reinhart (2006), Roelofsen (2008), Heim (1998, 2009), Drummond (2011), a.o., for alternative theories and discussions on problems with Reinhart’s (1983) proposal.

¹¹ These proposals are often discussed in such a way that the comparison of different LFs is at an

essary to rule out the bound variable reading (e.g. through semantic anomaly) in order for NOC to occur, as has been illustrated already with the examples in (55) (see §2.3.2.1).

2.4.2.3 *Theory-internal preferences*

The previous preferences could apply regardless of what theory of control one subscribes to. Within individual control frameworks, there may be additional factors that would favor OC over NOC. According to the TTC, for example, predicative control, which corresponds to what I have labeled OC, is structurally simpler than logophoric control (NOC).¹² As illustrated in (84), adjuncts with NOC would have an additional clausal projection above that which is found in OC adjuncts (Landau, 2017).

(84) Clausal structure for OC and NOC under the TTC

- a. [before [_{FinP} Fin [_{TP} PRO...]]] (OC)
- b. [before [_{CP} C_{+log} [_{FinP} Fin [_{TP} PRO...]]]] (NOC)

Based on this difference, Landau (2017) argues (following Grimshaw, 1994; Bošković, 1996; Speas, 2006) that OC is preferred to NOC due to a preference to assign strings the simplest possible structure. Because the NOC reading would require an additional layer of structure in the clausal projection of the adjunct, it is disfavored when the simpler OC structure is possible. Note that this would be a

interface between two components of the grammar, but it may also be possible for the comparison to happen outside the grammar, at an interface with the processor.

¹² See Footnote 9.

processing preference, rather than one enforced by the grammar. In order for the grammar to distinguish between the two structures in (84), it would have to compare derivations that can lead to different interpretations. This would be problematic, as it would be unclear why the grammar would not similarly prefer (85a) to (85b), since the former has a simpler structure than the latter.

- (85) a. John left.
b. John left yesterday.

Under the MTC, instead of OC and NOC differing in clausal structure, they differ in the representation of PRO. In OC structures, PRO is a deleted copy in a chain, i.e. it is the trace of movement of the antecedent from the embedded clause to the matrix clause. In NOC, PRO is simply the null pronominal *pro*, and its interpretation is more free. According to Hornstein (1999), using this *pro* is a “costly” operation akin to *do*-support, and is therefore dispreferred to OC through movement. As such, NOC via pronominalization should only be available when OC via movement is not.¹³

For temporal adjuncts, this would mean that OC is preferred over NOC because the operation to introduce the null pronoun allowing NOC readings is “costly.” NOC should only be possible when other factors either reduce the relative “cost” of pronominalization, or when OC via movement is blocked. What is not clear is what this “cost” is. Is it another processing preference, or is there something in

¹³ It was later argued that this generalization is a bit too strong, and it was clarified that NOC should be ruled out in cases where OC could have established the same interpretation (Boeckx & Hornstein, 2007; Boeckx et al., 2010). See Chapter 4.

the derivation of NOC that makes it dispreferred in the syntax? Formulations of *do*-support (e.g. Chomsky, 1991) place the preference squarely in the grammar by stating that *do* is only inserted to rescue a derivation that would otherwise crash. If NOC via pronominalization is akin to *do*-support, then OC would also be preferred in the grammar. However, this results in complementarity of OC and NOC, which we have established is not the case for temporal adjuncts. Therefore, it may be more likely that the preference for movement over pronominalization is due to processing biases, and may even be reducible to other factors, such as a processing preference for syntactic versus discourse dependencies more generally.

I will return to this issue in Chapter 4, which includes a more detailed discussion of both the MTC and the TTC.

2.4.3 Factors favoring NOC

There are many reasons that OC may be preferred over NOC, some of which depend on which broader theory of control is assumed. The fact that preferences of this type have been proposed in both the MTC and the TTC, as well as in other domains such as variable binding, suggest that some sort of OC preference is on the right track. But this is only a preference, not a strict requirement—otherwise, no NOC reading would ever be possible for temporal adjuncts or any other sentence. This section returns to several factors introduced in §2.3 that may lead to an increased availability of NOC readings and discusses why these factors may help overcome the OC preference. Although none of these factors on their own

can guarantee that NOC will be available in a given sentence for any given speaker, each can contribute to that possibility.

2.4.3.1 *Attachment site*

As noted above, the preference for OC is much stronger for right-adjoined and medially-adjoined adjuncts than for fronted or extraposed adjuncts. There are at least two possible explanations for this effect. First, temporal adjuncts may optionally be able to base-generate in the fronted or extraposed position. In such a derivation, the matrix subject would never c-command PRO in the adjunct, and could therefore not bind it. OC would thus not be available, and NOC would not need to compete with it. Note that high base-generation would be an option, but not the only possible derivation, as even fronted and extraposed adjuncts can exhibit OC, as the examples repeated in (86) and (87) demonstrate.

- (86) a. [After PRO₁ causing a lot of trouble], the dishwasher₁ finally broke down. (Kawasaki, 1993, p. 31)
- b. [After PRO₁ snowing a lot in February], it₁ never rains heavily in March in this area. (Kawasaki, 1993, p. 31)
- (87) a. The dishwasher₁ finally broke down—after PRO₁ causing a lot of trouble.
- b. It₁ never rains heavily in March in this area—after PRO₁ snowing a lot in February.

If c-command is required for OC, as most theories of control agree,¹⁴ then these adjuncts must have originated low, and it is plausible that OC would still be preferred. However, this is not necessarily the case. Suppose that the OC readings in (86) and (87) require reconstruction of the adjunct from its surface position to a lower position c-commanded by the subject, as proposed by Borer (1989). If there is a processing cost associated with reconstruction, then it may balance the extra cost associated with NOC, negating the basic preference for OC. Artstein (2005) provided evidence that when temporal adjuncts are preposed, they tend to take wide scope over the matrix clause. While (88a) is ambiguous with respect to the scope of the two quantifiers, (88b) only has a wide-scope reading for the adjunct. This is compatible with reconstruction being dispreferred.

- (88) a. A secretary cried [after each executive resigned].
 b. After each executive resigned, a secretary cried.

Anderson (2004) similarly notes that surface scope is generally preferred over inverse scope in the online comprehension of sentences such as (89). This cannot be a direct comparison, since it involves quantifier raising instead of reconstruction, but it does give further support that surface scope is preferred in online processing.

- (89) A climber scaled every cliff.

If there is indeed a cost for OC in fronted and extraposed adjuncts, then even

¹⁴ Hornstein and Kiguchi (2003) argue that c-command is not actually required for OC under the MTC. See §4.3.3.2.

a derivation where the adjunct starts low and moves to the fronted or extraposed position would not favor OC as strongly as with right-adjoined adjuncts remaining in the lower position. Therefore, even if temporal adjuncts cannot base-generate high, there would be reason to expect the preference for OC to be reduced and the potential for NOC to be correspondingly strengthened.

A separate possible source of the greater availability of NOC at least in left-adjoined adjuncts is mentioned in Boeckx and Hornstein (2007), though to different effect. It is likely that comprehenders prefer to resolve referential expressions as soon as possible upon encountering them (see, e.g. Nicol & Swinney, 1989; Badecker & Straub, 2002). In right- and medially-adjoined adjuncts, this would be possible through syntactic OC immediately upon encountering PRO. But in left-adjoined adjuncts, PRO is encountered before any relevant potential OC controller. However, if NOC is assumed, PRO may in many instances be immediately resolved to a relevant logophoric antecedent, if one has been previously established in the discourse or to the speaker as the SOURCE. The preference for immediate resolution of reference would thus be in competition with the OC preference, which would lead to greater availability of NOC. However, a separate explanation would still be needed for extraposed adjuncts.

2.4.3.2 Unavailability of subject control

Another factor that can decrease the likelihood of OC is the unavailability of subject control. As many authors have noted, and as discussed above, NOC readings often occur when OC would produce a sentence that describes a bizarre situation.

Since listeners are generally charitable and try to maximize the coherence of what their interlocutors say (Davidson, 1967; Hobbs, 1979), they may be more likely to ignore their preference for OC in such cases. However, as noted above, having a sentence where OC would result in a reading describing a strange situation is not always sufficient to allow NOC. Evidently, even when the interpretation is unlikely to be true in the real world, the preference for OC is sometimes strong enough to rule out NOC.

2.4.3.3 *Implicit arguments*

It was also seen that temporal adjuncts adjoined to passive matrix clauses and other clauses that have been argued to contain implicit arguments are more likely to permit NOC. This may be because often the implicit arguments, especially implicit experiencers as in (90), can serve as logophoric perspective holders.

- (90) Those lemons tasted especially sour [after PRO eating sugar].

Since the matrix clause in (90) facilitates the establishment of an implicit logophoric center, it may reduce the overall processing cost associated with establishing an NOC referential dependency. This reduction would help explain the greater availability of NOC in at least some cases involving implicit arguments.

2.4.3.4 *Humanness of subject*

We have also seen that when the subject of the matrix clause is human, non-subject control is less likely. This was true for many of the examples with unergatives

in their matrix clauses seen above, which often have human subjects and are less likely to exhibit NOC than examples with unaccusatives, which often have inanimate subjects. In addition, studies in the processing literature have found that sentences containing temporal adjuncts are generally more acceptable when the matrix-clause controller is animate (see, e.g. Parker et al., 2015).¹⁵ One possible explanation for this is that since NOC interpretations are logophoric, they require a human subject. When the matrix clause is human, it is possible for its referent to serve as a logophoric center. Therefore, if NOC were to occur, the matrix subject could still be chosen as a logophoric center. Because of this, even if NOC were to be allowed, it would not always be detected, since it would result in the same interpretation as OC.

2.4.3.5 *Logophoricity in context*

If, as I have argued, NOC in temporal adjuncts is logophoric in nature, then it is unsurprising that aspects of logophoricity in the surrounding context would affect whether NOC is likely to occur. When the context establishes a salient perspective holder, the potential difficulty with forming logophoric dependencies would be diminished, which in turn would reduce the preference for OC. This was seen in the contrast between (91) and (92). On its own, (91) for many speakers seems to only have the strange reading resulting from OC where darkness itself pitched the tents.

¹⁵ Parker et al. (2015) classify control of temporal adjuncts as OC. If this were always the case, then the preference for animate subjects that they found would be somewhat surprising. However, under the current proposal, because temporal adjuncts can also have logophoric interpretations, the preference for an animate controller is more expected, since logophoric interpretations must involve human, and therefore animate, antecedents.

But NOC is more available if the same sentence is set in a context that establishes a potential logophoric antecedent (92).

(91) #Darkness fell [before PRO pitching the tents].

(92) Peter₁ and Jon₂ were arguing about when they finally got their tents pitched.

Peter₁ thought [that darkness fell [*before* PRO₁₊₂ pitching the tents]].

2.5 Implications

Classifying control of temporal adjuncts as strictly OC only accounts for instances of control by the matrix subject. But non-subject control of temporal adjuncts is also possible, although it is less common and its acceptability may vary from speaker to speaker (Kawasaki, 1993). The above proposal provides a way to account for these facts. First, it is able to account for non-subject control examples, as it allows for the possibility of logophoric NOC. The fact that NOC is less common may stem from a number of different factors favoring OC. The account also leaves room for speaker variation. NOC in temporal adjuncts is dependent on a number of interpretive biases, and individual speakers may assign different weights to those biases. Finally, in allowing for both NOC and OC, the proposal can still account for the data that was previously used to classify control of temporal adjuncts as OC.

This section first returns to the evidence for OC in temporal adjuncts outlined in §2.2. I will then briefly discuss the implications of the above proposal for other types of adjunct control and for complement control.

2.5.1 Addressing original evidence of OC

Although we have seen much evidence that NOC is possible in temporal adjuncts, there were good reasons for classifying it as OC. In many instances, temporal adjuncts display properties known to be associated with OC. This is completely consistent with the current proposal. If temporal adjuncts can be either OC or NOC, it is predicted that the properties associated with OC will hold, but only for OC adjuncts, not for those that have logophoric NOC. I will now show that this is the case for each of the OC properties discussed in §2.2.

The first piece of evidence that was used to argue for OC in temporal adjuncts is that often, only the local subject can control PRO, not the object, other non-c-commanding elements, or non-local arguments. This was seen in the examples repeated in (93).

- (93) a. Harry₁ saw Ron₂ [before/while/after PRO_{1/*2} leaving the room].
b. *Ron₁'s sister left [without PRO₁ having shaved himself].
c. Harry₁ said [that [Ginny₂'s brother]₃ left [after PRO_{3/*1/*2} eating a bagel]]

Beside the fact that one could potentially rule out non-c-commanding controllers in (93) for independent reasons (e.g. perhaps for (93a), Harry but not Ron is a good logophoric antecedent), we have seen several examples where PRO does corefer with a non-c-commanding element (94a) or with a non-local argument (94b).

In the example in (94c), suggested by a reviewer, it appears that control by the object may also be possible.¹⁶

- (94) a. John₁'s fears always go out of control, [when PRO₁ listening to Larouche].
 (Williams, 1992, p. 307)
- b. Peter₁ said [the dishwasher broke [before PRO₁ getting home]].
- c. The security guard stopped the woman₁ [before PRO₁ boarding the plane].¹⁷

Second, OC adjuncts do not license arbitrary interpretations. In (95), for example, *oneself* is not licensed. However, when the sentence allows an NOC interpretation, arbitrary control is possible, and *oneself* is licensed (96).

- (95) Ron₁ felt old after [PRO₁/*arb seeing himself/*oneself in the mirror].
- (96) Adrenalin always kicks in [after PRO_{arb} putting oneself in danger].

Third, OC only allows sloppy interpretation under ellipsis, as in the OC example in (97). However, if the antecedent to the ellipsis site contains an NOC adjunct,

¹⁶ Nunes (2014) discusses examples of object control of temporal adjuncts in Portuguese such as (i). In contrast to (94c), object control occurs in Portuguese only when the object undergoes *wh*-movement, and Nunes argues that such cases are still OC.

- (i) [Que mulher]₂ é que [o João]₁ cumprimentou *t*₂ depois de [*ec*_{1/2} entrar na sala]
 which woman is that the João greeted after of enter in-the room
 'Which woman did João greet after he/she entered the room?'

¹⁷ Although this example seems acceptable, Norbert Hornstein (p.c.) notes that when a reflexive is placed in the adjunct, the example seems to get worse (i). This could suggest that object control is not really possible, but it could also be that (i) is unacceptable for other reasons.

- (i) *The security guard stopped the woman₁ [before PRO₁ printing herself₁ a boarding pass].

strict identity should be possible. In (98a), the sentence can be understood to mean in part, that the chef will be the one to salt both the potatoes and the carrots. And in in (98b), insofar as the logophoric control reading is acceptable in the first conjunct, strict identity in the second conjunct is also possible.

- (97) Ron says [Ginny₁ left [before PRO₁ dancing], and Harry thinks [Hermione did, too].

‘And Harry thinks Hermione₂ left before she₂/*Ginny danced.’

- (98) a. The chef₁ thinks [the potatoes will sell better [after PRO₁ adding more salt]], and his wife₂ thinks [the carrots will, too].

‘... the carrots will sell better after he₁/she₂ adds more salt.’

- b. Peter₁ says [his dishwasher broke [before PRO₁ getting home]], and Sara thinks [his₁ bed did, too].

‘And Sara thinks Peter₁’s bed broke before he₁ got home.’

Fourth, PRO in OC can only have a bound interpretation when controlled by *only*-DPs. This property holds when the adjunct is OC (99), but as predicted, it is not present for NOC adjuncts (100).

- (99) Only Harry₁ survived [after PRO₁ being hit with the killing curse].

‘[Nobody else]₁ survived after he₁/*Harry was hit with the killing curse.’

- (100) ?Only Peter said [his dishwasher broke [before PRO getting home]]. (Ev-

everyone else thinks that he broke it.)

‘Nobody else said that Peter₁’s dishwasher broke before he₁ got home.’

Finally, it was demonstrated that PRO in OC contexts does not allow split antecedents (101); it must be controlled by the matrix subject alone. If this is a property of OC, then it may not hold in NOC contexts, although split antecedents may still be ruled out in NOC for other reasons. The examples in (102) are acceptable to some speakers, but are marginal to others. However, the speakers who do not accept them may only have allowed OC readings in these contexts. When the NOC reading is facilitated by preposing the adjunct (103), it becomes more acceptable for PRO to have a split antecedent and to license *each other* or *themselves*.

(101) *Peter₁ expected Susan₂ to break up with him [without PRO₁₊₂ hurting themselves/each other].

(102) a. ??Peter₁ told his pen pal₂ [he thought [the world might end [after PRO₁₊₂ meeting each other₁₊₂]]].

b. ??Peter₁ promised Susan₂ [that the alarm would go off [after PRO₁₊₂ killing themselves₁₊₂]].

(103) a. ?Peter₁ told his pen pal₂ [he thought [that [after PRO₁₊₂ meeting each other₁₊₂], the world might end]].

b. ?Peter₁ promised Susan₂ [that [after PRO₁₊₂ killing themselves₁₊₂], the alarm would go off].

The authors who classified control of temporal adjuncts as OC were correct for the majority of the data. When the adjunct is controlled by the subject of the next higher clause, as is the case for most temporal adjuncts, all the properties of OC are displayed. However, in other examples, where PRO in temporal adjuncts may refer to someone other than the referent of the next highest subject, none of these properties hold. This is consistent with the proposal that the grammar allows both OC and NOC dependencies in the same type of adjunct.

2.5.2 Other types of control

Although this chapter has only dealt with temporal adjuncts, this proposal may also apply to other types of adjuncts. For example, although rationale clauses (RatCs) such as those in (104) have been argued to involve OC (Roeper, 1987; Mauner, Tanenhaus, & Carlson, 1995), (105) gives examples where NOC has also been argued to be possible (A. Williams, 2015; A. Williams & Green, 2017; Landau, 2017). It is possible, as Landau (2017) has argued, that cases such as (104) are indeed OC and (105) NOC. RatCs will be discussed more in Chapter 3.

- (104) Harry₁ went into the shop [in order PRO₁ to purchase a broom].
- (105) a. Harry₁ went into the shop. The goal was [PRO₁ to purchase a broom].
 b. A young girl cut the ribbon, [just PRO to acquire the votes of local women]. (A. Williams & Green, 2017)

There are many other types of adjunct control, some of which can involve con-

trol by a non-subject. A broader discussion of these adjuncts is found in Chapter 4; it will be shown that many of them, but not all, also allow both OC and NOC.

Besides its potential application to other types of adjunct control, this proposal must be situated within some broader theory of control. I have argued that both OC and NOC are possible in at least some types of adjuncts. But the same is not true for complement control, illustrated in (106), which always requires a local syntactic controller (Chomsky, 1981; Hornstein, 1999, 2001; Boeckx et al., 2010; Landau, 2000, 2015). In contrast to adjunct control, only OC is possible for complement control.

- (106) a. Harry₁ managed [PRO_{1/*2} to win the tournament].
b. Ron₂ persuaded Harry₁ [PRO_{1/*2/*3} to win the tournament].
c. Harry₁ promised Ron₂ [PRO_{1/*2/*3} to win the tournament].

There are several possible reasons for this difference, dependent on the broader theory of control chosen. In semantic theories of control, complement control is OC because controller choice is an entailment of the verb whose arguments are the controller and the controlled clause. According to Sag and Pollard (1991), for example, the meaning of the verb *promise* entails that the implicit subject of the promise clause will refer to the promiser (or the “committor” in Sag and Pollard’s terms), resulting in OC by the argument corresponding to the promiser. The same kind of controller choice cannot be applied to adjuncts, though, since they are not

coarguments with their controller. Chapter 4 will discuss why complement and adjunct control differ within the MTC and the TTC.

2.6 Conclusion

In this chapter, I have argued that the grammar allows both OC and NOC into temporal adjuncts. The strong preference for OC by the matrix subject that previously led researchers to classify it as OC is not due (solely) to syntactic constraints against NOC, but to performance biases in comprehension and/or production, which may include preferences for bound over free variables, for movement over pronominalization, and/or for assigning the simplest possible structure to a string.

This proposal is an important step to understanding syntactic and pragmatic constraints on adjunct control, but it does leave several important questions. First, I have sketched several possible interpretive biases leading to a preference for OC. These biases all have at least some grounds in previous research, but it is unclear which of them are actually at play for the interpretation of temporal adjuncts. Especially useful would be studies on the online processing of adjunct control. Part II of this dissertation is an important first step in that direction.

A second remaining question involves the constraints on the interpretation of NOC. I have assumed, following Landau (2017), that NOC of temporal adjuncts is generally logophoric, meaning that PRO must refer to some logophoric center or perspective holder in the discourse. One argument for this assumption is the requirement for NOC to involve a [+human] antecedent. This feature comes for

free in a logophoric account, as only humans can be logophoric perspective holders. If the interpretation of NOC is more free, and can refer to the discourse topic, for example, as Kawasaki (1993) argued, the [+human] restriction is left without a complete explanation.

However, Lyngfelt (2000) provides (107) in Swedish, which he argues is an example of control by the discourse topic. It would be somewhat difficult to reduce this example to logophoric control, since the understood antecedent to PRO is not clearly the perspective holder. The English counterpart has the same NOC interpretation.

- (107) Tiger Woods₁ var i praktiken bortrånad från segerstriden, efter två “mänskliga” inledningsronder. Men efter att PRO₁ igår ha tangerat banrekordet vågar ingen₂ räkna bort golfens nye “Golden Boy”₁.

‘Tiger Woods₁ was in practice dismissed from the winning competition, after two “human” starting rounds. But after PRO₁ having touched the record for the course yesterday, no one₂ dares to disregard golf’s new “Golden Boy”₁.’ (Lyngfelt, 2000, p. 32)

In addition, examples with a generic statement favor arbitrary interpretations for PRO, and these interpretations do not require a specific perspective holder. It is not clear that (108), for example, represents the perspective of the boilers of the potatoes. But generic interpretations may be a principled exception to the perspective requirement (see Bhatt & Izvorski, 1998).

- (108) Potatoes get softer [after PRO boiling them].

One final remaining question is whether the preference for OC holds equally across different types of temporal adjuncts. For example, NOC may be more available for adjuncts headed by *while* compared to those headed by *before* or *after* (Maria Polinsky, p.c.). The source of such a difference, if robust, remains unexplained.

- (109) a. ?The dishwasher₁ finally broke [while PRO₂ entertaining a big party
for Thanksgiving].
b. *The dishwasher₁ finally broke [before PRO₂ entertaining a big party
for Thanksgiving]

Although the analysis in this chapter is preliminary, it highlights some of the difficulties associated with adjunct control, and is an important step to understanding how syntactic and pragmatic constraints on reference are deployed in comprehension. In addition, it provides support for theories of control that do not rely on strict complementarity between syntactic and non-syntactic forms of control.

Chapter 3: Rationale clauses

The previous chapter argued that both OC and NOC are available for temporal adjuncts. This chapter argues, following Landau (2017), that the same is true for rationale clauses (RatCs), alternatively called In-Order Clauses or a Reason Clauses (Faraci, 1974; Jones, 1985; Whelpton, 2002; A. Williams, 2015), as illustrated in (1).

- (1) Rita₁ interviewed Harry₂ [in order PRO_{1/*2/*3} to feel better about herself/
*himself/*oneself].

In this example, PRO is understood to be coreferential with *Rita*; it cannot be coreferential with the matrix object *Harry*, and it cannot receive an arbitrary interpretation. As was the case for temporal adjuncts, some authors have claimed that this is due to a syntactic dependency between the two (Roeper, 1987; Whelpton, 2002), or in other words, that control in RatCs is OC. Others reject grammatical accounts of control in RatCs, arguing for a discourse-based NOC approach (Farkas, 1988; Landau, 2000; A. Williams, 2015; A. Williams & Green, 2017). Continuing in the traditional assumption that OC and NOC are complementary, these authors have found evidence that at least some RatCs display properties of one type of control, and have extrapolated that all RatCs must therefore also be of that type.

However, at least two authors have previously argued that both OC and NOC are possible in RatCs: Español-Echevarría (2000) and Landau (2017). I provide evidence in this chapter for that view, just as was argued to be the case for temporal adjuncts in Chapter 2. However, in contrast to NOC in temporal adjuncts, which required PRO’s understood antecedent to be a logophoric perspective holder, I argue, following A. Williams (2015), that PRO’s interpretation in RatCs is sensitive to notions of responsibility (see also A. Williams & Green, 2017).

This chapter is organized as follows. In §3.1, I discuss general properties of RatCs. In §3.2 I discuss whether control in RatCs may be strict OC, noting both the virtues of such grammatical accounts and their failings. I do the same for NOC accounts in §3.3. I argue in §3.4 that, just like temporal adjuncts, RatCs allow both OC and NOC, and illustrate how this may solve the challenges faced by strict OC or NOC accounts. Section 3.5 concludes the chapter, including a note on the distribution of NOC in RatCs and other remaining questions.

3.1 Background on Rationale Clauses

RatCs provide a teleological explanation for the fact or proposition expressed by their target clause. In (2), for example, the RatC β gives the reason or goal behind the *target*, i.e. the fact expressed by the *target clause* α .

- (2) [Harry₁ went into the forest] _{α} [in order PRO₁ to confront Voldemort] _{β} .

This section will outline the types of examples that have been used in previous

literature to classify control in RatCs as either OC or NOC. This discussion will largely be expository, with analysis of the data coming in later sections. I will demonstrate that PRO in a RatC can be controlled by the explicit subject of the target clause, but not by the object. It can also be controlled by unexpressed entities who can be seen as responsible for the fact expressed by the target clause, or by the target fact itself.

3.1.1 Local RatCs

The majority of the literature on RatCs has focused on what A. Williams and Green (2017) term “local control,” cases where the RatC is adjoined to the target clause, and where PRO has an antecedent in that clause. In (2), PRO is controlled by the subject of the target clause *Harry*, meaning that *Harry* and PRO are coreferential; we understand that Harry is both the person who went into the forest, and also the one who is to confront Voldemort. PRO in a RatC can be controlled, then, by the explicit subject of the matrix/target clause.

Control by the matrix object, on the other hand, is impossible. Given a context where sharks cover themselves with parasites, only (3a) can be used to mean that the sharks are having their gills kept clean. Example (3b) can only mean that the parasites themselves have gills that they intend to be kept clean (A. Williams, 2015; A. Williams & Green, 2017).

- (3) a. These sharks₁ cover themselves with parasites₂ [PRO_{1/*2} to have their gills kept clean.

- b. Parasites₂ cover these sharks₁ [PRO_{2/*1} to have their gills kept clean].

The same effect is seen in (4), where the intended escaper must be understood as Dobby, and that protecting Harry would make it possible for Dobby to escape. Example (4) cannot be used to mean that Dobby protected Harry in order for Harry to escape. This is in contrast to when there is an overt pronoun as the subject of the complement clause. When PRO in (4) is replaced with *him* in (5), it is much more likely to refer to the object Harry than to Dobby.

- (4) Dobby₁ protected Harry₂ [in order PRO_{1/*2} to escape from the Malfoys].

- (5) Dobby₁ protected Harry₂ [in order for him_{2/??1} to escape from the Malfoys].

The restriction against control by the object also extends to other non-commanding arguments. In the examples from Whelpton (2002, p. 187) in (6), the subject DP can control PRO, but a possessor embedded within the subject cannot.

- (6) a. *David₁'s wife₂ brought some articles on reference along (in order) PRO₁
to discuss semantics with her₂.
b. David₁'s wife₂ brought some articles on reference along (in order) PRO₂
to discuss semantics with him₁.

In at least some cases, when the object is promoted to subject position, as in a passive, it can control PRO. In other words, surface subjects can control PRO,

even if that subject was underlyingly an object. In the passive (7a), one possible reading is that Sam got himself arrested so that he (Sam) could get off the streets. This reading, with *Sam* controlling PRO, is only possible when Sam is seen as intending to be arrested and to be somehow responsible for the arrest. In the words of Zubizarreta (1982), he must be viewed as the “secondary agent” of the arrest. Note, though, that the secondary agent reading is only available for the subject of a passive. It is impossible for the object *Sam* to be understood as a secondary agent in the active version in (7b).

- (7) a. Sam₂ was arrested (by the cops₁) [just PRO_{1/2} to get him/himself off the streets].
- b. The cops₁ arrested Sam₂ [just PRO_{1/*2} to get him/*himself off the streets].

PRO in (7a) can refer to Sam, but it can also refer to the agents of the arrest, i.e. the cops. As A. Williams (2015) puts it, PRO can be controlled by a *subject* of the target clause, whether the surface subject, or what he calls the *deep subject*, i.e. the entity that would have been the surface subject had the sentence been active. Control by a surface object is impossible.¹

In addition to control by the explicit subject of the target clause, PRO in a RatC allows implicit control. In (7a), it is not necessary to include *by the cops*

¹ Compare to the seemingly similar object-oriented purpose clause, which allows object control (Faraci, 1974; Jones, 1991; Whelpton, 2002):

- (i) We brought John₁ along [PRO₁ to talk to Mary].

in order to get the reading that whoever arrested Sam was doing it so that they might get him off the streets. Similarly in (8), PRO is controlled by the entity corresponding to the deep subject role of the predicate *sank the boat*, i.e. the sinker. This control relation is *implicit* because PRO is bound by no audible dependent.² Thus, even when the deep subject role is unrealized on the surface, it is available as a controller for PRO in a RatC.

- (8) The boat was sunk [PRO to collect the insurance]. (Roeper, 1987)

Furthermore, RatCs allow what I will call *super-implicit* control, where PRO is understood as referring to an entity not named by any arguments of the target predicate, whether explicit or implicit. In these cases, the controller is not syntactically related to the target clause at any point. For example, the passive in (9a) can be used to describe a situation where a certain political group had a young girl cut a ribbon so that that group could gain support. PRO can refer to the organizers of the event even when they can in no way have been represented syntactically as part of the sentence (A. Williams, 2015; A. Williams & Green, 2017). This is also true for the active form if stress is placed on *a young girl* (9b).

- (9) a. The ribbon was cut by a young girl [just PRO to acquire the support of female voters].

² Whether the controller is still syntactically present is a matter of much debate (Roeper, 1987; Mauner et al., 1995; Lasnik, 1988; Landau, 2000, 2017; McCourt et al., 2015).

- b. *A young girl* cut the ribbon [just PRO to acquire the support of female voters].

However, although superimplicit control is possible in some instances, it is not always. Suppose that Jon hired a crook to burn his house down so that he (Jon) could later collect on the insurance policy. In such a situation, even when Jon is understood as the organizer/responsible party behind the crook's actions, it is difficult or impossible to understand a speaker, in using (10), as meaning that the intended collector of the insurance is Jon, and not the crook he hired.

- (10) A hired crook₁ burned down the house (for Jon₂) [in order PRO_{1/*2} to collect the insurance].

To the same point, Whelpton (2002, pp. 190–191) gives the examples in (11). Even if it is understood that the soldiers in these examples are only following orders, and that their commanding officer is responsible for their actions, PRO cannot refer to the commanding officer; it seems only to allow control by the local subject, *the soldiers*.

- (11) a. *The soldiers₁ unwittingly turned on the water [(in order) PRO₂ to drown the prisoners].
- b. The officer₁ knew that if the prisoners were drowning, the approaching enemy troops would have to stop and save them. . .

- (i) The soldiers₂ therefore turned on the water [(in order) PRO₂ to give themselves₂ time to escape].
- (ii) *The soldiers₂ therefore turned on the water [(in order) PRO₁ to give himself₁ time to escape].

Finally, PRO in a RatC can also refer to the target fact itself. For example, in the famous example from E. Williams (1974) given in (12) (and also discussed in E. Williams, 1985; Lasnik, 1988, a.o.), it is not the *grass* that is promoting photosynthesis. Instead, the promoter of photosynthesis is the fact itself that grass is green.

- (12) [Grass is green]₁ [PRO₁ to promote photosynthesis].

In sum, PRO in a local RatC can be controlled by (i) the surface subject of the target clause, but not the object or other non-c-commanding arguments, (ii) the understood demoted subject of a passive, (iii) other agents who can be understood as responsible for the fact expressed by the target clause, or (iv) the fact expressed by the target clause.

3.1.2 Remote RatCs

RatCs need not be adjuncts to their target clause. They may also occur as the object of specificational copular sentences (Higgins, 1973) with subjects alluding to the target fact such as *the goal*, *the reason*, or a pronoun, as in (13). In these types of sentences, control is *remote*, since the antecedent to PRO is outside of

PRO's syntactic domain (Dowty, 1989; Sag & Pollard, 1991; A. Williams, 2015; A. Williams & Green, 2017).

- (13) a. Harry₁ went into the forest. The reason was [PRO₁ to confront Voldemort].
- b. I don't know why Harry₁ went into the forest. Maybe it was [PRO₁ to confront Voldemort].

In the remote RatCs in (13), PRO is understood as coreferential with *Harry*, just as it would be in a local RatC. Indeed, the same restrictions on reference seen for PRO in local RatCs also seem to apply to the referent of PRO in remote RatCs. Just like in local RatCs, PRO in a remote RatC can be controlled by the subject of the target clause, but not the object or other non-c-commanding arguments, as illustrated in (14a–c). Remote RatCs also allow control by the implicit demoted subject of a passive (14d) and superimplicit control (14e). When superimplicit control is blocked in local RatCs, it also is in remote RatCs (14f). Finally, control by the target fact is still available (14g).

- (14) a. Dobby₁ protected Harry₂. The goal was [PRO_{1/*2} to escape from the Malfoys].
- b. Sam₁ was arrested by the police. The reason was [just PRO₁ to get himself off the streets].
- c. *David₁'s wife₂ brought some articles on reference along. The goal was PRO₁ to discuss semantics with her₂.

- d. The ship was sunk. The reason was [PRO to collect the insurance].
- e. The ribbon was cut by a young girl. The goal was [PRO to acquire the support of female voters].
- f. A hired crook₁ burned down the house. The reason was [PRO_{1/*2} to collect the insurance].
- g. [Grass is green]₁. The reason is [PRO₁ to promote photosynthesis].

However, although the referential constraints on PRO in a remote RatC seem to parallel those in local RatCs, in several other ways, remote RatCs do not behave as if they were local. Elements embedded within the target clause cannot scope over remote RatCs like they do in local RatCs. As demonstrated for local RatCs in (15), negation in the target clause can license a negative polarity item (NPI) in the RatC (15a), and both negative and positive quantifiers in object position of the target clause can bind a variable in the RatC ((15b,c)).

- (15)
- a. The coach did *not* approach the team in order to give them *any* advice.
 - b. The coach approached [no member of the team]₁ in order to give him₁ advice.
 - c. The coach approached [every member of the team]₁ in order to give him₁ advice.

This is only possible for readings where negation scopes over the RatC. In a situation where one is asking why the coach did not approach the team, it is infelicitous to answer with (15a), which can only be used to answer the question “What didn’t the

coach do?” or as a contradiction to a claim that the coach did approach the team to give them some advice. Similarly, (15b) cannot be used to answer a question about why the coach approached no member of the team, in which case variable binding into the RatC is impossible (16).

- (16) *The coach approached [no member of the team]₁ in order not to intimidate him₁.

Remote RatCs do not demonstrate the same scope ambiguities. An NPI in a remote RatC cannot be licensed by negation in the target clause under any context (17a), and negative quantifiers in object position in the target clause cannot bind variables in the RatC (17b). In other words, negation in the target fact can scope over local RatCs, but not remote RatCs. We do see apparent variable binding by *every* into remote RatCs (17c), but this is also possible in local RatCs when the RatC scopes high ((15c) can be used felicitously even in answer to the question “Why did the coach approach every member of the team?”). It is therefore likely that the apparent variable binding by *every member of the team* in (15c) when the RatC scopes high and in (17c) is due to special properties of *every*, rather than something to do with RatCs or remote control.

- (17) a. *The coach did not approach the team. The reason was to give them any advice.
 b. *The coach approached [no member of the team]₁. The reason was to give him₁ advice.

- c. The coach approached [every member of the team]₁. The reason was to give him₁ advice.

Geurts (2011) discusses examples with *every* such as (18) from Karttunen (1976) to introduce what he calls “piggyback anaphora” (these effects have also been called “telescoping” of quantifiers (Roberts, 1987)). One reading of (18) is that Harvey courts a different girl at every convention, and each of them went to a ball with him. *She* behaves like a variable bound by *a girl* within the scope of the universal quantifier. Piggyback anaphora in (17c) would also explain the lack of binding effects in remote RatCs with negative quantifiers (17b). Negative quantifiers do not allow piggyback anaphora, as can be seen in in (19).

- (18) Harvey courts [a girl]₁ at every convention. She₁ always comes to the ball with him.
- (19) a. *Harvey courts [no girl]₁ at every convention. She₁ always comes to the ball with him.
- b. *Harvey courts [a girl]₁ at no convention. She₁ always comes to the ball with him.

If (17c) is an instance of piggyback anaphora, then it is an exception to the otherwise correct generalization that there is no grammatical binding into remote RatCs from elements within the target clause.

3.2 OC accounts of RatCs

Because PRO in RatCs, even in remote RatCs, can be coreferent with the subject, but not the object or other non-c-commanding arguments of the target clause, a grammatical OC account seems particularly suited. A subject/object asymmetry and c-command restrictions are prime candidates for syntactic explanation. This section will discuss what such an OC account would look like. I begin with local RatCs, where syntactic OC accounts have the most success, although I will demonstrate that even here additional stipulations are required. I then outline what would be necessary for an OC account of remote control, demonstrating that remote RatCs present an insurmountable challenge to purely OC theories.

3.2.1 OC and local control in RatCs

Recall that PRO in a RatC can refer to (i) the surface subject of an active or passive target clause — but not the object (20a–c), (ii) what is understood as the demoted subject of a passive (20d), (iii) other agents who can be understood as responsible for the fact expressed by the matrix clause (20e), but only some of the time (20f), or (iv) the target fact itself (20g).

- (20) a. Dobby₁ protected Harry₂ [in order PRO_{1/*2} to escape from the Malfoys].
 b. Sam₁ was arrested by the police [just PRO₁ to get himself off the streets].

- c. *David₁'s wife₂ brought some articles on reference along (in order) PRO₁ to discuss semantics with her₂.
- d. The ship was sunk [in order PRO to collect the insurance].
- e. The ribbon was cut by a young girl [in order PRO to acquire the support of female voters].
- f. A hired crook₁ burned down the house [in order PRO_{1/*2} to collect the insurance].
- g. [Grass is green]₁ [in order PRO₁ to promote photosynthesis].

Theories positing a grammatical OC dependency in local RatCs can easily handle cases of control by the subject of the matrix clause, and are able to rule out object control and control by non-subject arguments with a simple c-command requirement. However, as will be shown, superimplicit control cannot receive an OC account, and allowing an NOC account of it creates problems for positing strict OC in other RatCs, even in describing control by the subject versus the object. Because of this, even local RatCs cannot be classified as strictly OC. Such a classification would both under- and over-generate without additional stipulations such as those that are already required for NOC accounts.

3.2.1.1 Control by the subject, not by the object or non-c-commanding arguments

Syntactic theories of OC maintain that the grammatical dependency between PRO and its antecedent requires that the latter c-command the former (Williams, 1980; Chomsky, 1981; Landau, 2004, 2015). According to Whelpton (2002), a local

RatC adjoins to the matrix clause at the uppermost V' (v' /Voice'/Asp'). Because of this, the subject of the matrix clause would c-command the RatC and the PRO it contains, but the object would not. Under most theories of OC, the position of the adjunct rules out control by any argument other than the subject because the predication/control relation involved itself must involve the most local c-commanding argument (e.g. Williams, 1980; Chomsky, 1981; Landau, 2015). Under the MTC (Hornstein, 1999; Boeckx et al., 2010), the same effect is achieved without an explicit c-command requirement, but because OC by the object or other non-c-commanding arguments would incur a Merge-over-Move violation (Chomsky, 1995), causing the derivation to crash.

3.2.1.2 *Implicit control*

In addition to control by the explicit subject of the matrix clause, RatCs allow control by the understood demoted subject of a passive. In order to maintain a strict OC account of control of RatCs, it is necessary to assume that the demoted subject is syntactically represented and is available as a syntactic controller (Chomsky, 1986; Jaeggli, 1986; Roeper, 1987; Collins, 2005). Baker, Johnson, and Roberts (1989) instantiate such a theory by claiming that the passive morpheme *-en* receives the agent θ -role and is able to bind the PRO of a RatC. A similar theory would place something like a null *pro* in the spec-*vP*, as in (21).

- (21) The boat [_{vP} pro_1 [was sunk [_{RatC} PRO₁ to collect the insurance]]]

Assuming this structure, OC of PRO in a RatC by the implicit demoted subject of a passive clause would be quite similar to control by the subject of an active clause. In either case, the external argument of the *v*P, whether explicit or implicit, serves as the syntactic antecedent to PRO (Whelpton, 2002).

However, such grammatical accounts of the passive do not have much to say about why implicit control is not possible in more contexts. In (22), we see that implicit predicative control is impossible (Landau, 2015). But if implicit control of RatCs is by a silent demoted subject in passives, then silent arguments (at least in the passive in (22c)) should be able to control PRO in other constructions.

- (22) a. John ate *(the meat) raw.
 b. I am now hiring *(people) [for John to work with].
 c. The room was left (*angry at the guests).

Because of this and other issues, the presence of a null pronoun which receives the agent θ -role in passives is controversial. Lasnik (1988), E. Williams (1985), Landau (2000), and A. Williams (2015) give strong arguments that there is no such null argument in the syntax of passives. If this is the case, then there can be no syntactic OC dependency between it and PRO.

Furthermore, implicit control by the understood agent of a passive must be interpreted as [+human] only when it controls PRO (Manzini, 1986). Thus (23a) cannot be interpreted to mean that the rain washed the stairs and then entered the basement, even though that interpretation is possible with an active matrix clause

(Landau, 2017, p. 4). This restriction on interpretation is only expected if control by the implicit agent is really NOC.

- (23) a. The stairs were washed [before PRO entering the basement].
 b. The rain₁ washed the stairs [before PRO₁ entering the basement].

3.2.1.3 *Superimplicit control*

RatCs can also have a controller that is completely absent from the sentence, as was seen in (20e), repeated in (24). Because there is no antecedent for PRO in this sentence, it must be NOC.

- (24) The ribbon was cut by a young girl [in order PRO to acquire the support of female voters].

One potential explanation for the interpretation in (24) is that this really is OC by the agent of the passive, and that the young girl is acquiring support for or in behalf of the organizers of the event, or that the young girl is understood to be in a part-whole relationship with the organizers (Tom Roeper, p.c.). However, this kind of relation is not necessary for superimplicit control to occur. In (25a), PRO more clearly refers to the organizers of the event, as inanimate signs cannot acquire support, even on behalf of the organizers (25b). The same point is illustrated by (26). Superimplicit control in RatCs cannot be OC.

- (25) a. A *pink* sign greeted the guests [just PRO to acquire the support of female voters].
- b. #A *pink* sign acquired the support of female voters (for the organizers).
- (26) The subtitles were in several different languages [in order PRO to acquire the support of immigrant voters].

3.2.1.4 *Fact control*

We will now turn to control by the fact expressed by the matrix clause. In (27), repeated from (20g) above, it is not the grass that promotes photosynthesis. It is the fact that grass is green. Thus, the fact expressed by the matrix proposition controls the PRO of the RatC.

- (27) [Grass is green]₁ [in order PRO₁ to promote photosynthesis].

E. Williams (1985) and Lasnik (1988) label these as cases of “S-control,” stating that the sentence itself is controlling PRO. One could attempt to instantiate this idea syntactically by stating that the controller is the event variable. But not all cases of fact control involve eventualities. For example, in (28), there is no single event described by the proposition *ewes kill easily*, and yet it is this fact that is understood to ensure the survival of local predators.

- (28) Ewes kill easily, to ensure the survival of the local predators.

(A. Williams, 2015, p. 296)

Therefore, under an OC account of control of RatCs, it must be the case that PRO can be controlled either by the matrix subject, the event variable, or when what is explained is not an event but a fact about one or more events, by a syntactically-represented situation variable (see, e.g. Percus, 2000).

3.2.1.5 *Summary of local RatCs*

Strict OC theories can account for the structural restrictions on control of PRO in RatCs. The preference for subject control and the restriction against object control and control by other structurally inaccessible arguments is obtained through the c-command requirement common to syntactic theories of control. However, even if subject control in RatCs is OC, at least implicit control and superimplicit control must be instances of NOC. Thus, even local control cannot be fully explained by a strict OC account.

3.2.2 OC and remote control³

Although the restriction against object control and non-c-commanding arguments in local RatCs could be the result of an OC dependency, the same restrictions appear to occur in the interpretation of remote RatCs. PRO in a remote RatC can refer to the individual named by the subject but not the object of the target clause. But in remote control, PRO and its understood antecedent are in separate sentences. This is a major problem for OC accounts of RatCs, since, by definition, syntactic dependencies must be within a single sentence. Because of this, A. Williams (2015)

³ Portions of the arguments in §3.2.2 are also published in A. Williams and Green (2017).

gives remote control of RatCs as evidence against the need for a grammatical dependency between PRO in a RatC and its understood antecedent. If remote RatCs must be an instance of NOC, then whatever explains the restriction against object control in remote RatCs could also explain local RatCs.

To maintain an OC account of remote RatCs, and to explain the structural restrictions on controller choice, would require that the remoteness of remote control is an illusion, and PRO in a remote RatC is bound by some sort of silent constituent. The underlying structure of a remote RatC such as (29), for example, could be something like one of the options in (30). Although this would still not allow the antecedent to c-command PRO, as is generally required for syntactic control (Williams, 1980; Chomsky, 1981; Landau, 2004), it simplifies the problem by at least putting the two in the same sentence.

(29) Harry₁ broke into the ministry. The reason was [PRO₁ to save Sirius].

(30) a. [_{DP} Harry₁ [_{D'} The reason]] was PRO₁ to save Sirius.

b. The reason [~~Harry₁ broke into the ministry~~] was PRO₁ to save Sirius.

Unless there is some covert binder in the remote RatC, as in (30b), a possibility I will examine in some detail and reject below, PRO is not in the same syntactic domain as its controller and there can be no syntactic or semantic dependency between the two. Since, as I will argue, there is no hidden binder in a remote RatC, OC accounts of remote RatCs must be rejected. Instead, this must be a case of NOC. PRO must be something like a free pronoun whose domain of reference is restricted

by non-grammatical factors such that *Harry* is PRO's only possible antecedent in (29). This will serve as additional evidence that at least some RatCs are NOC.

3.2.2.1 *Specifier ellipsis*

One way to attempt an OC account of control of remote RatCs is to posit elided material in the specifier of the subject of the specificational sentence containing the remote RatC as in (31).

- (31) Jon sank the boat. [_{DP} ~~Jon~~_T [_{D'} The [_{NP} reason]]] was PRO₁ to collect the insurance.

This is similar to Roeper's (1987) theory of PRO in the subject of NP, which he used to account for control out of nominals such as in (32). In a DP framework, PRO would be the specifier of D. PRO being in this position is consistent with Roeper's judgment for (33); when the specifier of D is occupied by another element, control out of the nominal is impossible.⁴

- (32) the PRO₁ destruction of the city [PRO₁ to prove a point].

(Roeper, 1987, p. 280)

- (33) *_{[DP [DP the city]'s [_{NP} destruction [_{RatC} PRO to prove a point]]}

(adapted from Roeper, 1987, p. 280)

⁴I disagree with this judgment. It is especially improved when placed in a sentence such as (i).

(i) [The city's destruction (just) to prove a point] was cruel.

Whatever the status of (33) and (i), it does not directly effect whether there could be an *elided* specifier of D.

The specifier ellipsis account would need to take this one step further, assuming that instead of PRO, DPs can have other silent specifiers, such as the elided DP in (31). The specifier-ellipsis account would put PRO in the same sentence as its antecedent, which is crucial for any binding account of control (although I will show that they are still not in the same syntactic domain). It also would potentially provide a unified account of other instances of remote control. In the examples in (34), the pronoun *it* could have an elided specifier as well. According to Elbourne (2013), *it* is a determiner with a silent NP complement. Also including an elided specifier would give the *it* of (34a), for example, the structure in (35).

- (34) a. Jon₁ made a promise. It was PRO₁ to shave himself. (Dowty, 1989)
 b. Sandy₁ wanted something. It was PRO₁ to leave the party.
 c. Jon commanded Sara₁ to do something. It was PRO₁ to go home.

- (35) [_{DP} ~~Jon~~ [_{D'} It [_{NP} ~~promise~~]]]

However, there are at least three reasons to reject this specifier-ellipsis account. The biggest problem is that it is unable to independently rule out control by the object. As demonstrated above in (14a), repeated in (36), remote RatCs generally do not allow control by the object of the target clause.

- (36) Dobby₁ protected Harry₂. The goal was [PRO_{1/*2} to escape from the Malfoys].

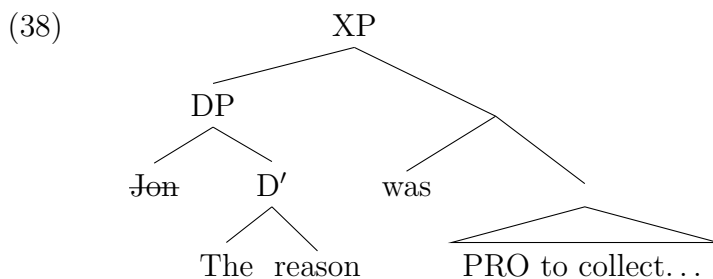
But if all that is required for ellipsis of the specifier is identity with a DP antecedent,

the account provides no reason why the example in (36) should not be able to have the structure in (37), with an elided specifier in identity with the object of the preceding clause.

- (37) *Dobby protected Harry₁. [_{DP} [_{DP} ~~Harry~~]₁ The reason] was PRO₁ to escape from the Malfoys.

In order to explain the restrictions on which DPs can serve as antecedents for ellipsis, this account would need to simply stipulate that the elided DP can only have as its antecedent the (deep) subject of the target clause or the party explanatorily responsible for the fact it expresses. Thus, while it would account for the referent of PRO syntactically, it is really only moving the problem to a higher null category (the elided specifier). Some other restrictions on which DPs could appear as antecedents would be necessary, and it is not clear that specifier ellipsis would add anything significant.

A second problem for the specifier ellipsis account is one of c-command. Even though PRO and its antecedent are in the same sentence, the elided material in a remote RatC such as (31) is embedded within the subject DP, as illustrated in (38), and hence does not c-command PRO.



It is not clear that any syntactic binding relation can hold between a specifier in the relevant position and anything in the complement of the copula. In (39), the specifier *Victor* is unable to bind the reflexive *himself*. Even a reflexive in a picture-NP, which generally can be good even without a c-commanding antecedent (Postal, 1971) cannot take the specifier of the subject as an antecedent (40) (although see Pollard and Sag (1992) for arguments that picture-NPs do not require a syntactic dependency in the first place).

(39) Victor's heart attack was a benefit to him/??himself.

(40) Lin's₁ downfall was that image of him₁/??himself₁ on the wall.

Finally, the third problem is that ellipsis of a specifier is not obviously licensed. The literature has discussed two requirements for ellipsis: an identity requirement (Chomsky, 1965; Sag, 1976, a.o.), and a licensing head (Lobeck, 1995; Saito & Murasugi, 1990). Identity with an antecedent is easily met (although as discussed there must be additional restrictions on what can serve as the antecedent). In (31), for example, the specifier is identical with the subject of the preceding clause. The requirement for a licensing head runs into problems, though. According to Lobeck (1995), the ellipsis site “must be properly head-governed, and governed by an X-

0 specified for strong agreement” (Lobeck, 1995, p. 41), where ‘strong agreement’ is defined as agreement that is morphologically realized in a productive number of cases. Lobeck relies on Chomsky’s 1986 definitions for *government* and *proper government* given in (41).

(41) a. **Government**

a governs **b** iff **a** m-commands **b** and there is no **y**, **y** a barrier for **b**, such that **y** excludes **a**.

b. **Proper Government**

b is properly governed by **a** iff **a** theta-governs or antecedent governs **b**

(i) **Theta-Government**

a theta-governs **b** if **a** is a zero-level category that theta-marks **b**, and **a**, **b** are sisters

(ii) **Antecedent-Government**

a antecedent-governs **b** iff **a** is coindexed with **b** and no barrier intervenes between **a** and **b**.

In order for the specifier to be elided under this approach, it would need to be properly head governed, i.e. it must be either theta-governed or antecedent-governed by a head specified for strong agreement. There is no syntactically accessible antecedent that could govern the specifier, and although D may be specified for strong agreement with N, it head-governs but does not theta-mark its specifier, and the

two are not sisters. Therefore, the specifier is not *properly* head-governed, and Lobeck’s requirements for ellipsis are not met. Even removing government as part of the licensing definition does not help. Lobeck (1995) and Saito and Murasugi (1990) agree that the agreeing functional head can only license the ellipsis of its *complement*; proper head government is only one way to accomplish this. Since the proposed elided constituent is the specifier of D, the ellipsis is not licensed.

For these reasons, a specifier ellipsis account of remote control must be rejected.

3.2.2.2 *Relative clause ellipsis*

We have just seen that specifier ellipsis cannot account for remote control. Our next attempt at a syntactic OC account will be relative clause ellipsis, illustrated in (42). However, this attempt will also prove insufficient.

- (42) Jon sank the boat. [_{DP} The reason [_{RelC} ~~Jon_I sank the boat~~]] was PRO₁ to collect the insurance.

In (42), ellipsis of the relative clause would be under identity with the target clause (although as will be discussed below, it is not clear that their surface identity is sufficient). Through ellipsis, the remoteness of remote control would be removed. This is true for both remote RatCs and other cases of remote control. Again assuming an Elbourne-style account of *it*, but without the elided specifier discussed above, the remote clause in (34a) would have the structure in (43).

- (43) [_{DP} It [_{NP} ~~promise-Jon_I-made~~]] was PRO₁ to shave himself.

On the surface, this account seems to suffer from the same c-command problem as specifier-ellipsis did. In (42), the elided antecedent is embedded in a relative clause that does not c-command PRO. This is a challenge for the relative clause ellipsis account, but it is one that is general to all specificational sentences (Higgins, 1973; Heycock & Kroch, 1999). Although in each of the examples in (44) the reflexive is not, on the surface, c-commanded by its antecedent, it still seems to be licensed, and a non-reflexive pronoun in the same position is ungrammatical. Therefore, whatever allows binding to occur in these examples may also explain the c-command problem in (42).

- (44) a. What Jon₁ is is proud of himself₁/*him₁.

(Heycock & Kroch, 1999, p. 369)

- b. The way Lee₁ disturbs people is with images of herself₁/*her₁.
 c. The thing Jon₁ likes is that picture of himself₁/*him₁

There are several reasons to doubt a relative clause ellipsis account. The first is that there are cases of remote RatCs where relative clause ellipsis will not help. For example, when *the reason* is replaced with *the goal*, the relevant relative clause cannot occur.

- (45) a. Jon₁ sank the boat. The goal was PRO₁ to collect the insurance.
 b. *The goal [(that) Jon sank the boat] was to collect the insurance.

It is possible that the underlying structure is something more like (46a), or perhaps

like (46b) (Maria Polinsky, p.c., based on ideas from Rizzi (1990)), but then the material to be elided is no longer identical to its antecedent, and it is not clear that its elision would be licensed, if identity with an antecedent is required. Even if we suppose that this relative clause is close enough to identical with the target clause to license ellipsis (see Ross (1969) for similar examples), binding out of this specifier position is impossible, as (47) and (48) illustrate.

- (46) a. Jon sank the boat. The goal [~~of Jon's sinking the boat~~] was PRO to collect the insurance.
 b. Jon sank the boat. The goal [~~that Jon pursued/had in sinking the boat~~] was PRO to collect the insurance.
- (47) a. What Paul's sinking the boat did was make him/*himself happy.
 b. Paul's sinking the boat made him/*himself happy.
- (48) The goal [~~that Paul pursued/had in sinking the boat~~] seemed reasonable to him/*himself.

In addition, a pronoun can take the place of the ellipsis site in examples such as (49).

- (49) Jon₁ sank the boat. The reason/goal behind it was PRO₁ to collect the insurance.

Again, even assuming that pronouns can have unpronounced subjects (and other

content), binding out of the complement of a preposition in this position is impossible (50). Therefore, there seems to be no place to put elided content to get the proper configuration for syntactically controlling PRO.

- (50) The best evidence for Lin's improvement is that image of him/*himself on the wall.

Furthermore, remote RatCs, just like local RatCs, do not require a syntactically expressed antecedent. In (14e), repeated in (51a), PRO may be understood as whoever organized the event. In this and other cases of superimplicit control, the relative clause ellipsis illustrated in (51b) will do nothing to allow the understood antecedent to syntactically bind PRO.

- (51) a. The ribbon was cut by a young girl. The goal was [PRO to acquire the support of female voters].
 b. The goal [~~of the ribbon's being cut by a young girl~~] was PRO to acquire the support of the female voters.

Finally, it is not clear that the relative clause ellipsis in (42) is licensed. Although the elided relative clause is, on the surface, identical with a preceding clause, they do differ structurally. Howard Lasnik (p.c.) notes that the structure of the relative clause is likely more complicated than what is shown in (42). Following a proposal by Larson (1987) dealing with temporal adjuncts, the relative clause would

be headed by a null operator that binds an empty category in the structure where a RatC would be, as in (52).

(52) The reason $[_{\text{RelC}} \text{Op}_1 [\text{Jon} [\text{sank the boat}] \epsilon_1]] \dots$

This is intended to capture the fact that (53) can either express the reason why Mary said something, as with the continuation in (53a), or the reason behind the fact she is reporting, as in (53b).

(53) The reason $[_{\text{CP}_1} \text{Mary}_1 \text{ said } [_{\text{CP}_2} \text{Jon}_2 \text{ sank the boat}]]$ was

- a. PRO_1 to get him arrested.
- b. PRO_2 to collect the insurance.

When the variable bound by the null operator is in the higher clause, the former reading results, and when it is in the lower, it is the latter. Due to the presence of the null operator and the variable in its structure, the elided relative clause is not identical to its antecedent clause, and ellipsis may not be licensed. However, as there is some debate over how strict the identity requirement for ellipsis is (see, for example, Ross, 1969; Wyngaerd & Zwart, 1999; Merchant, 2001), the differences here may be insignificant enough not to interfere with ellipsis.

Even so, the requirement for a licensing functional head is also not clearly met. Ellipsis of a relative clause could possibly be licensed by N, which strongly agrees in ϕ -features with (at least) the D head, and which may properly govern the relative clause if we assume that N θ -marks it. However, this would be a strange assumption

to make, and ellipsis is generally only licensed by agreeing *functional* heads, which N is not. Because of this, even though there are cases where relative clause ellipsis could potentially explain remote control, such ellipsis is not licensed, and therefore should be impossible.

The major objections outlined in this section against a relative clause ellipsis account have focused on the fact that there are instances of remote control of RatCs that it cannot explain, such as (45a) and (49). Therefore, an independent, non-grammatical account is already needed to explain at least these examples. Because this non-grammatical explanation is independently required, a simpler theory would be to rely on it for the interpretation of PRO in all remote RatCs. Furthermore, even in instances where material in a relative clause could in principle be syntactically connected to PRO, ellipsis of this relative clause does not appear to be licensed according to established requirements (Lobeck, 1995; Saito & Murasugi, 1990). Therefore, an OC account of remote RatCs is untenable.

3.2.3 Summary of OC accounts of RatCs

This section has demonstrated that a strict OC theory of control is unable to account for many RatCs. Although OC may explain structural restrictions on PRO's antecedent in local control, these same structural restrictions are apparent in remote RatCs. In order to maintain an OC account of control in remote RatCs, it would be necessary to posit some sort of elided material in order for the controller to be in the same syntactic domain as PRO. But this is impossible. Even if such ellipsis were licensed, the elided material would not be in a position to bind PRO. Remote

control of RatCs, then, cannot be OC. Instead, remote control must be NOC. Furthermore, even local RatCs exhibit NOC in cases of implicit and superimplicit control.

3.3 NOC accounts of RatCs

The previous section demonstrated that at least some RatCs, including remote RatCs, must be NOC. Because the same structural restrictions on interpretation seen in local RatCs appear to be active in remote RatCs, might it be the case that all RatCs are NOC? In this section I introduce A. Williams’s (2015) Responsibility Theory, which is in turn based on ideas from Farkas (1988). This theory attempts to provide a unified NOC account of both local and remote control of RatCs. I will begin with a summary of Farkas’s theory and its limitations. This will be followed by a summary of Responsibility Theory and how it attempts to explain the possible referents of PRO in RatCs, detailing the correct predictions it makes where Farkas’s theory did not, and highlighting how it handles cases where OC accounts fail.

3.3.1 Farkas 1988

Farkas (1988) is one of several papers arguing against theories of control that rely on syntactic binding. Instead, Farkas proposes that controller choice in OC constructions is based on a small number of what she calls “semantic relations”. The one that will be relevant here is the Responsibility relation (RESP). Farkas takes as a premise the claim that certain situations in the world have what she

terms *initiators*, where an *initiator* is defined as an entity who brings the situation about. More specifically, a situation may be the result of some act performed by an initiator with the intention of bringing that situation about. Farkas's basic claim is that certain OC predicates have as part of their meaning a RESP-relation that relates one of the arguments of the predicate to the situation described by the embedded clause. That argument is then understood as the initiator of the situation (the referent of the initiator must be left to the pragmatics). Farkas labels these predicates as RESP-inducing. For example, the verb *promise* has as part of its meaning the fact that the promiser is in the RESP-relation to the thing being promised. In reporting Jon's promise, (54a) states that Jon made himself responsible for a situation of leaving the room (i.e. he makes himself a potential initiator of such a situation).⁵ The verb *persuade*, on the other hand, carries as part of its meaning the fact that the persuadee is in the RESP-relation with the embedded situation. In reporting Jon's persuasion of Bill, (54b) states that Bill has accepted responsibility for a situation of leaving the room.

- (54) a. Jon₁ promised Bill₂ [PRO₁ to leave the room].
 b. Jon₁ persuaded Bill₂ [PRO₂ to leave the room].

PRO in OC constructions is linked to the initiator by a stipulated constraint on reference which Farkas calls the Principle of Controller Choice (PCC). This states that for RESP-inducing Vs, the controller of the infinitival complement is

⁵ See Searle (1965) on how to promise.

the argument linked to the initiator of the situation described by the complement. Because of the RESP-relation in (54a), Jon is understood as the initiator of the embedded situation, so PRO is understood to refer to him. In (54b), Bill is the initiator, and so PRO refers to him.

In some marked cases, the PCC does not apply.⁶ In well-known cases of control shift (Comrie, 1984) such as (55b), PRO does not refer to the initiator of the situation, which is understood to be Jon, as it does in (55a). Instead, PRO can be understood as Mary. Farkas claims that in (55b), a kind of coercion takes place; the controller can be an individual with whom the initiator is in the “A-relation,” where “A-relation” is defined by Farkas as existing between two entities x and y , when x brings about the actions of y . Thus, although in general PRO in the complement of a RESP-inducing predicate will be the initiator of the embedded situation, it may also be an individual over whose (relevant) actions the initiator has some control. Although Farkas does not explicitly state this, it seems to be the case that the A-relation can only hold between co-arguments of the RESP-inducing predicate. Were this not the case, (55b) could have a meaning where Jon promised Mary that some other person would be allowed to leave.

- (55) a. Jon₁ promised Mary [PRO₁ to leave early].
 b. Jon promised Mary₂ [PRO_{2/*3} to be allowed to leave early].

Finally, Farkas claims that if a situation has an intentional agent, that agent

⁶ Farkas does not elaborate on *why* these are marked.

will be understood either as the initiator of the situation, or as someone with whom the initiator is in the A-relation. If a situation has no intentional agent, then it will only be viewed as an intentional situation if it can be understood that an individual brought the situation about intentionally. Because of this, and because the RESP-relation requires an initiator in the embedded situation, complements of RESP-inducing predicates such as *promise* and *persuade* must describe situations that one could intentionally bring about. Because people generally do not have much control over what they look like, (56) will ordinarily sound like it cannot possibly be true.

$$(56) \quad \# \text{Jon} \left\{ \begin{array}{l} \text{promised} \\ \text{persuaded} \end{array} \right\} \text{Pete to resemble Bill.}$$

Controller choice under this account is based on a constraint on PRO's referent (the PCC) that states that PRO refers to the situation's initiator. The initiator is in turn determined by the semantics of the embedding predicate. Farkas intends this account to also apply to RatCs. However, it is not immediately clear how this is to be done. For complement control, the account states that the embedding predicate determines which of its arguments is in the RESP-relation with the embedded situation, i.e. which will be understood as the initiator. For RatCs such as in (57), *in order* would induce a RESP-relation that specifies that there is an initiator of the situation in the RatC, and the PCC would determine that PRO refers to it. However, because the arguments of the matrix clause are not arguments of *in order*, there would be no way for the initiator of the embedded situation to be determined

semantically the way it is in complement control. Farkas does not go into details about how this would be accomplished, but it is clear that there would need to be some sort of pragmatic restriction on the the potential referent of the initiator. Farkas defines an initiator of a situation as someone that completed some action with the intention of bringing about the situation. In (57), for example, that action is given in the matrix clause. Because Dobby is the one who brought about that action, he is understood as the initiator of the intended resulting situation, given in the RatC.

(57) Dobby₁ protected Harry₂ in order PRO_{1/*2} to escape from the Malfoys.

This account runs into problems when the understood initiator of the situation described in the RatC is not the one who performed the action in the target clause, as is the case with the superimplicit control illustrated in (9a), repeated in (58).

(58) The ribbon was cut by a young girl [just PRO to acquire the support of female voters].

Here, PRO would be tied to the initiator of the embedded situation. Using similar reasoning as described for (57) above, the initiator should be whoever performed the action described in the target clause, i.e. the young girl. However, as was discussed earlier, PRO in (58) can be understood as whoever organized the ribbon-cutting event. In other words, the initiator of the situation in the RatC is some unnamed entity, and it is not clear how Farkas's account would reach the correct interpretation.

3.3.2 Responsibility Theory

Responsibility Theory (A. Williams, 2015; see also A. Williams & Green, 2017), is a narrow adaptation of Farkas’s theory into a purely pragmatic account. Instead of attempting to account for complement control, Williams proposes a constraint on the referent of PRO similar to Farkas’s PCC, but that only applies to PRO in RatCs. According to Williams, PRO in a RatC will refer to the party responsible for the target fact that the RatC is meant to explain (or to the target fact itself). Williams does not require reference to the initiator of any situation; the domain of reference for PRO is limited to the responsible party. As we will see, this makes a correct prediction in (58), where Farkas’s theory struggled.

Let us now turn to how Responsibility Theory captures the control possibilities discussed above. I will focus my discussion on local RatCs, but the same analysis will apply to remote RatCs, since, as we will see, syntactic locality is irrelevant to Responsibility Theory. Recall again that PRO in a RatC can refer to (i) the surface subject of an active or passive target clause — but not the object or non-c-commanding arguments (59a–c), (ii) what is understood as the demoted subject of a passive (59d), (iii) other agents who can be understood as responsible for the fact expressed by the matrix clause (59e) but only some of the time (59f), or (iv) the target fact itself (59g).

- (59) a. Dobby₁ protected Harry₂ [in order PRO_{1/*2} to escape from the Malfoys].

- b. Sam₁ was arrested by the police [just PRO₁ to get himself off the streets].
- c. *David₁'s wife₂ brought some articles on reference along (in order) PRO₁ to discuss semantics with her₂.
- d. The ship was sunk [in order PRO to collect the insurance].
- e. The ribbon was cut by a young girl [in order PRO to acquire the support of female voters].
- f. A hired crook₁ burned down the house [in order PRO_{1/*2} to collect the insurance].
- g. [Grass is green]₁ [in order PRO₁ to promote photosynthesis].

In the following, I will elaborate on how Responsibility Theory is able to explain this data, even where OC accounts struggled. I then discuss two challenges Responsibility Theory faces that provide evidence against any such NOC-exclusive account of control of RatCs.

3.3.2.1 *Responsibility Theory and subject control*

In (59a), *Dobby* controls PRO. On the Responsibility Theory account, this is because he is viewed as responsible for the target fact, namely that he protected Harry. Other surface subjects can also be seen as responsible for the fact expressed by the matrix clause. The patient of the arrest in (59b) is available as a controller just in case Sam can be seen as being arrested intentionally. Putting it the other way around, understanding Sam as the controller requires one to infer that he was

responsible for his being arrested, and that he intended his arrest to result in his getting off the streets. If Sam did not aim to get off the streets by means of getting himself arrested, then this use of (59b) would be false. Of course one might instead view the police as primarily responsible for their arresting Sam. Accordingly, if the police intended by performing the arrest to get Sam off the streets, PRO can also refer to them, as in (60). For this reason Zubizarreta (1982) would refer to Sam as a *secondary* agent.

(60) Sam was arrested by the police₂ [just PRO₂ to get him off the streets].

The ability to become a secondary agent is limited. Roeper (1987) noted that secondary agents are limited to subject position. Even if (59b) is true, and Sam intended to get off the streets by means of getting arrested, (61), where *Sam* is named by the surface object rather than the subject, cannot be used to describe this situation. If Sam's ability to become a secondary agent is what allows PRO to refer to him in (59b), it must be the case that the grammatical position of a DP has an effect on how its referent is represented in relation to the situation described, beyond its thematic relation to the event. It must be the case that non-subjects are represented as not responsible (or at least not directly responsible). Because Sam is named by the surface object in (61), A. Williams and Green (2017) claim that he is represented as not responsible for what happened. When he is no longer referred to in object position, as in (59b), the sentence can have an interpretation where he is responsible. This is consistent with Zubizarreta's observations about the use

of subject-oriented adverbs like *intentionally*. Compare the passive (62a), in which *intentionally* can refer either to Mary's intentions or to Joe's, to the active (62b), in which it can refer to Joe's, but not Mary's, who is in object position.

- (61) * The police arrested Sam₁ [just PRO₁ to get himself off the streets].
- (62) a. Mary was seduced intentionally (by Joe).
b. Joe seduced Mary intentionally. (Zubizarreta, 1982, p. 43)

Because the referents of objects are viewed as not responsible under Responsibility Theory, object control is also ruled out in (59a). Harry cannot be seen as responsible for the target fact when referred to in surface object position. Therefore, in order for PRO to refer to Harry, he would have to be represented in a way that allows him to be responsible for the fact expressed. As we have just seen, one way to do this is to move *Harry* out of object position in a passive, as in (63). Although a reading of the passive (63) with *Harry* as the controller is difficult, it is possible to the extent that Harry can be viewed as responsible for his being protected by Dobby.

- (63) ?Harry₂ was protected (by Dobby) [in order PRO₂ to escape from the Malfoys].

According to A. Williams and Green (2017), Harry and Sam in (59a) and (61), respectively, cannot be seen as responsible secondary agents because they are represented in surface object position and thereby seen as not responsible. Because

of this, PRO cannot refer to them. The same reasoning can be used to rule-out control by other non-c-commanding arguments. In (59c), David’s wife is represented as more directly responsible for bringing the articles, and so PRO can only be understood to refer to her, not to David. However, A. Williams and Green (2017) point out that if it is explicitly stated that the referent of a non-subject argument such as the object is responsible, then control by the object may become possible, at least in remote control. This is illustrated in (64).

- (64) Dobby was protecting Harry₁, and this was an idea Harry had after he learned about elf-magic from Hermione. The goal was PRO₁ to escape from the Malfoys.

In sum, Responsibility Theory can easily account for subject control RatCs. PRO refers to the party responsible for the target clause, which in most cases will be named by the subject rather than the object in actives. In passives, subjects can be the controller because their referents can be viewed as secondary agents of the target fact. Control by the object is ruled out in local control by postulating that “the referent of a surface object is defeasibly depicted as nonresponsible” (A. Williams & Green, 2017, p. 242).

3.3.2.2 *Responsibility Theory and implicit control*

The assumptions required for explicit control also allow for control by the demoted subject of a passive (59d), repeated in (65). Here, PRO is understood as

whoever was responsible for the sinking of the ship. This account does not rely on the syntactic presence of the demoted subject, although it is compatible with such theories. Because the principles of Responsibility Theory will select as controller the party that is explanatorily responsible for the fact expressed in the matrix clause, it follows that the controller can be the agent of the matrix event, even if it is not present in the syntax of the matrix clause.

(65) The ship was sunk [in order PRO to collect the insurance].

There are cases where control by the demoted subject of a passive is impossible. For example, (66a) cannot mean that the ship was sunk so that the sinker would become a hero (compare to (66b), in which that interpretation is available). This example presents somewhat of a problem for Responsibility Theory; if the sinkers are understood to be responsible for the target fact, PRO should be able to refer to them. However, this is an even bigger problem for OC accounts, which would need to explain why a structural relation such as the binding of PRO by the implicit demoted subject is possible in (65) but not (66a). A. Williams (2015) notes that for Responsibility Theory, it is sufficient to state that the unacceptability in (66a) is due to conditions on what sorts of predicates make good RatCs (see Clark, 1990), or to matters of perspective (see Sundaresan, 2016, on perspective and long-distance anaphora), rather than just the situation described. Note that slightly changing the predicate in the RatC improves it (67).

(66) a. #The ship was sunk in order to become a hero. (Lasnik, 1988, p. 12)

- b. Jon₁ sank the ship in order PRO₁ to become a hero.

(67) The king's ship was sunk just to acquire notoriety.

(A. Williams, 2015, p. 299)

Furthermore, A. Williams (2015) contrasts (68a) with (68b), arguing that the latter is infelicitous because the killers are no longer responsible for the target fact. At the very least, properties of the sheep are also in part responsible for the fact that they are *easily* killed. Under grammatical theories, this contrast is surprising. There is no reason why an adjunct like *easily* should block a syntactic relation between PRO and the demoted subject.

- (68) a. Several ewes were killed. And the reason was to survive the winter.
- b. #Ewes are easily killed. And the reason is to survive the winter.

‘So that the killers might survive the winter’

(A. Williams, 2015, p. 299)

3.3.2.3 Responsibility Theory and superimplicit control

Because NOC accounts do not rely on the syntactic presence of the controller of PRO, superimplicit control requires no new assumptions. In (59e), repeated in (69), PRO can be understood as the organizer of the ribbon cutting because that person can be seen as responsible for the target fact. This is not limited to passives. In the active (70), a similar reading is more difficult, but still possible, especially with stress placed on *young girl*.

(69) The ribbon was cut by a young girl [in order PRO to acquire the support of female voters].

(70) A *young girl* cut the ribbon [in order PRO to acquire the support of female voters].

However, the availability of superimplicit readings needs to be constrained. In (59f), repeated in (71), PRO must be understood as the hired crook. It cannot refer to the people who hired the crook, even though they are, in a sense, responsible for the fact that the hired crook did what he did. The problem is further illustrated in (72), which cannot mean that whoever was responsible for the fire was to collect the insurance.

(71) A hired crook₁ burned down the house [in order PRO_{1/*2} to collect the insurance].

(72) #A fire burned down the house [in order PRO to collect the insurance].

Interestingly, when (71) is passivized, superimplicit control becomes available. The passive in (73) can have a reading that the intended insurance collector is someone who hired the crook to burn down the house.

(73) The house was burned down (by a hired crook) in order PRO to collect the insurance.

Recall that A. Williams and Green (2017) explain the unavailability of ob-

ject control by postulating that surface objects are viewed as not responsible, while subjects are likely to be seen as such. In (71), perhaps superimplicit control is unavailable because its active form highlights the crook's responsibility and downplays the responsibility of his employer. Because of this, the crook is the most likely controller for PRO in the RatC under Responsibility Theory. The passive in (73) deemphasizes his responsibility, and superimplicit control becomes available. In (69) and (70), the little girl is more likely than the crook in (71) to be viewed as an instrument instead of the responsible party, and superimplicit control is possible. As for (72), superimplicit control is unavailable because the most natural reading is simply one in which the fire is responsible for the house burning down, no person being implicated.

3.3.2.4 *Responsibility Theory and fact control*

Finally, we have seen that PRO in a RatC can be controlled by the fact expressed by the target clause. In (74a), repeated from (59g), one possible reading is that it is the fact that grass is green that promotes photosynthesis. This seems to be a problem for Responsibility Theory, since facts cannot be intentional, responsible parties. For this reason, A. Williams (2015) simply stipulates that in a RatC, PRO can be controlled *either* by the responsible party, *or* by the fact expressed by the target clause, with no explanation of the difference between the two. However stipulative it may be, this bifurcation seems necessary. According to (74a) for example, why is grass green? Because its greenness promotes photosynthesis. An alternative explanation could be that (74a) is just another example of superimplicit

control, where PRO refers to the entity responsible for grass being green, e.g. God, giving the paraphrase in (74b). This, though, would leave us wondering why God's promotion of photosynthesis explains the fact that grass is green. One answer, of course, is that the greenness of grass promotes photosynthesis. However, Alexander Williams (p.c.) notes that (74a) does not leave that conclusion to our imagination. With (74a) we say that photosynthesis is promoted by the greenness of grass.

- (74) a. Grass is green in order PRO to promote photosynthesis.
 b. \nrightarrow Grass is green so that God/the designer can promote photosynthesis.

Similarly, (75a) does not seem to have the meaning in (75b), even though the people who designed the car are responsible for the fact that its sides are sloped. Instead, it is the fact that the sides are sloped that reduces drag.

- (75) a. The sides of the car are sloped in order PRO to reduce drag.
 b. \nrightarrow The sides are sloped so that the designers might reduce drag.

Furthermore, suppose that the sinkers of the ship in (76) are responsible for the target fact. Howard Lasnik (p.c.) notes that control by the responsible party in this case would lead to a Condition C violation. Admittedly Condition C violations can be weak (see (77), although this still seems worse than (76)). Still (76) does not seem to mean that the ship was sunk so that the sinkers might enrich themselves. Instead, it conveys the meaning that the ship was sunk so that the sinking might enrich the sinkers.

(76) The ship was sunk in order PRO to enrich the sinkers.

(77) ?The sinkers₁ just want PRO₁ to enrich the sinkers₁.

Inasmuch as fact control is possible, it requires an explanation. Notice that it is still the case that the RatC expresses the teleological explanation of the target fact. When there is a responsible party, as in (75a) and (76), it must have been the intention of the responsible party that the target fact lead to the situation described by the RatC. In this way, fact control is similar to control through the Farkas's A-relation. Fact control is possible if the party responsible for that fact, if there is one, intended the result described in the RatC. However, this only holds when there is a responsible party. In uttering (74a), a speaker conveys a teleological explanation for the greenness of grass, but does not necessarily have to be committed to there being an intentional party responsible for that fact.⁷

Although Responsibility Theory as described here requires some stipulation to account for fact control, grammatical theories of control are also unable to account for it without difficulty, as demonstrated above.

3.3.2.5 *Responsibility Theory and remote control*

Responsibility Theory as outlined for local RatCs applies equally well to remote RatCs. Because no structural dependency is required between PRO and its understood antecedent, it makes no difference whether the two are in the same

⁷ It is possible that a speaker of (74a) does imply that there is a responsible party, possibly speaking in a metaphorical sense, without committing to the belief in one. If this is the case, then even fact control of RatCs would entail a responsible party.

sentence; the same interpretive restrictions can be posited for both Remote and local RatCs. Also, although Responsibility Theory does not make specific predictions about whether there will be other connectivity effects between elements of the target clause and the RatC in remote control, it is at least consistent with a lack thereof, since it does not require positing any syntactic link between the two clauses.

3.3.3 Challenges for Responsibility Theory

Responsibility Theory posits that PRO in RatCs is NOC, and that its interpretation is restricted by notions of responsibility, as summarized in (78).

- (78) PRO in a RatC will refer to
- i. the entity responsible for the target fact, or
 - ii. the target fact.

Subject control is predicted because subjects are likely to be seen as responsible for the fact described by their host clause. This seems especially true when the subject is an agent. The subject of a passive may also control PRO in a RatC just in case it assumes a secondary agent role, in that they are understood to be responsible for the fact expressed. In a similar manner, implicit, superimplicit, and remote control are possible just in case the entity to whom PRO refers is understood to be (directly) responsible for the target fact and the target fact does not highlight the responsibility of some other argument. Responsibility Theory thus is able to cover more of the data than an exclusively OC account.

However, Responsibility Theory, and all NOC accounts, face at least two challenges: how to rule out control by a surface object, and how to account for apparent cases of OC by an inanimate subject.

3.3.3.1 Ruling out object control

In A. Williams and Green (2017), object control is ruled out only under the assumption that surface objects are viewed as not (directly) responsible for the fact that contains them. This is a necessary stipulation, but, as A. Williams and Green (2017) acknowledge, it is unattractive because it posits a conventional effect of sentence structure beyond those of information structure, and independent of truth conditions. In (79), for example, Responsibility Theory requires that Sam must be understood as not responsible for his arrest. What I mean here is not that Sam did not cause his arrest. Instead, I mean that Sam must be understood as not responsible for the arresting itself, although this difference is subtle.

(79) The police arrested Sam (in order to get him/*himself off the streets).

Although raising the object to subject position in a passive allows Sam to be understood as responsible for the arresting (80), this is only possible when Sam is the subject of a passive. In the active form in (79), Sam is understood as not (primarily) responsible for the arrest. Even if it is explicitly stated that Sam initiated the arrest and was responsible for it, as in (81), Responsibility Theory must state that Sam cannot be understood as a responsible party in the relevant sense.

(80) Sam was arrested by the police (in order to get him/himself off the streets).

(81) *On Sam₁'s order, the police arrested Sam₁ [in order PRO₁ to get himself off the streets]. (Norbert Hornstein, p.c.)

There are at least two reasons why (81) should not allow control by the object under Responsibility Theory. First, perhaps lexical agency (in active clauses) is more important for RatCs looking for the responsible party. Because *the police* receives an agent θ -role in (81), the sentence is highlighting the police's responsibility, and PRO therefore refers to them. But this same reasoning does not seem to apply in (80), where it could be argued that *the police* is still receiving an agent θ -role. However, recall the contrast between (71) and (73), repeated in (82). In (82b), but not (82a), superimplicit control is available. This was argued to be the case because the passive deemphasizes the crook's responsibility, while the active highlights it. Similarly in (80), even though *the police* may receive an agent θ -role, the passive form of the sentence deemphasizes the police's responsibility, and control by the secondary agent *Sam* becomes available.

- (82) a. A hired crook₁ burned down the house [in order PRO_{1/*2} to collect the insurance].
- b. The house was burned down (by a hired crook) in order PRO to collect the insurance.

Second, even without a preference to choose the grammatical agent as the

responsible party, it is still not clear that Sam in (81) can be seen as *directly* responsible for the target fact, despite explicitly stating that he ordered the police to arrest him and is thereby indirectly responsible. A similar phenomenon has been observed for verbs of causation (see Pietroski, 2005; A. Williams, 2015, for discussion). For example, assume that Jon puts butter in the microwave and presses start, and does nothing else. Although Jon does not directly cause the butter to melt (it is the microwave that does), (83) is still considered true. However, if Jon forces some other person to put the butter in the microwave and push start, (83) becomes infelicitous. Because there is some other (human) agent who is more directly responsible for what caused the butter to melt, their role interferes with notions of Jon’s causation. Similarly in (81), it may be true that Sam caused the police to arrest him, but their responsibility for the arrest is more direct. Because of this, it is less surprising that PRO in the RatC would refer to the police rather than Sam under Responsibility Theory.

(83) Jon melted some butter.

As seen in (64), repeated in (84), control by the object may be more acceptable in remote control. A. Williams and Green (2017) explain that this is because objects are represented as *defeasibly* nonresponsible. When further elaboration is given, object control becomes available.

(84) Dobby was protecting Harry₁, and this was an idea Harry had after he

learned about elf-magic from Hermione. The goal was PRO₁ to escape from the Malfoys.

However this explanation does not fully predict the available contrasts between local and remote control. As seen in (85) and (86), even when the elaboration establishing the responsibility of the object is given prior to the target fact, control by the object is only available in remote control, not in local control.⁸

- (85) Because of an idea Harry had after learning about elf magic, Dobby protected Harry₁...
 - a. *...in order PRO₁ to escape the Malfoys.
 - b. The goal was PRO₁ to escape the Malfoys.
- (86) On his order, the police arrested Sam₁...
 - a. *...in order PRO₁ to get himself₁ off the streets.
 - b. The goal was PRO₁ to get himself off the streets.

Note that it is still necessary to maintain that agentive subjects are depicted as more responsible than patient objects, since even in remote control, subject control is preferred without supporting context establishing the object as responsible. How-

⁸ The remote control examples are less acceptable when the subject of the copular sentence is *the reason* instead of *the goal* (i). This is an interesting puzzle, but an exploration of the distinctions between the various kinds of sentences that can host a remote RatC is outside the scope of this dissertation.

- (i) a. *Because of an idea Harry had after learning about elf magic, Dobby protected Harry₁.
The reason was PRO₁ to escape from the Malfoys.
- b. *On his order, the police arrested Sam₁. The reason was PRO₁ to get himself off the streets.

ever, responsibility fails to explain why this preference is defeasible only in remote control.

3.3.3.2 *Cases of OC in RatCs*

The second challenge to Responsibility Theory and any other NOC theory of control in RatCs is that it is possible for an inanimate, non-responsible subject in the matrix clause to serve as controller (Landau, 2017). Because NOC requires PRO to have a [+human] interpretation, the examples in (87) must be instances of OC.

- (87) a. This book₁ was written [in order PRO₁ to be read]. (Williams, 1992)
- b. The house₁ was emptied [in order PRO₁ to be demolished].
(Español-Echevarría, 2000)
- c. The poem₁ was written by Hughes [in order PRO₁ to be admired by
silly girls]. (Hirschbühler, 1988)
- d. A test wire chamber module₁ was built [in order PRO₁ to be inserted
into the cryostat]. (Landau, 2017)
- e. The car₁ is streamlined [in order PRO₁ to accelerate faster].
(Whelpton, 2002)
- f. The battleship₁ is near the coast [in order PRO₁ to shell the harbor].
(Whelpton, 2002)

Although he rejects NOC accounts of RatCs, Whelpton (2002) proposes an explanation for examples such as (87) that may negate their problematic status for

Responsibility Theory. He suggests that the adjuncts in (87) are not actually RatCs, but subject-gap purpose clauses (SPCs), similar to the one in (88). Although Jones (1991) uses the presence of *in order* as a diagnostic for RatCs, Whelpton argues that *in order* is a general marker of subject-oriented control related to readings of intention and necessity.

(88) They sent the journalist₁ into the arena [*e*₁ to photograph the crowds].

(Whelpton, 2002, p. 193)

In an SPC, the empty subject of the adjunct is bound by the object of a transitive clause, as illustrated in (88) (Jones, 1991; Whelpton, 2002). However, Whelpton argues that it can also be bound by the subject of a copular clause. Part of the evidence he gives involves the ambiguity of (89). Under one reading, the journalist took the independent decision to be in the arena for the purpose stated. Under the other, the journalist was sent to the arena for that purpose. The former reading would be given a RatC analysis and the latter an SPC one.

(89) The journalist₁ was in the arena [(in order) *e*₁ to photograph the crowds].

(Whelpton, 2002, p. 194)

However, although this explanation is tempting, it faces problems. Whelpton (2002) argues that *in order* may only preface an SPC when the clause is adjoined to a copular sentence. If this is correct, then the adjuncts in (87) adjoined to passive matrix clauses cannot be SPCs. Even when the sentence structure is changed to

pattern more like canonical SPCs, as in (90), some of the examples still do not allow SPCs, giving further evidence that the corresponding examples in (87) do contain RatCs controlled by an inanimate subject, not SPCs.⁹

- (90) a. *Harry wrote this book₁ [*e*₁ to be read].
 b. *Workers emptied the house [*e*₁ to be demolished].
 c. *Hughes wrote the poem₁ [*e*₁ to be admired by silly girls].

Because there is good evidence that OC by an inanimate subject is possible in at least some RatCs, any NOC-exclusive theory, including Responsibility Theory, will fail to account for all the data.

3.4 Both OC and NOC are possible for RatCs

The previous two sections have demonstrated that neither strict OC nor strict NOC theories of control can adequately account for control in RatCs. The natural conclusion is that Landau (2017) is correct in stating that RatCs, just like temporal adjuncts, allow both OC and NOC. This solves many of the problems that strict OC and strict NOC accounts face. OC accounts were unable to account for remote, implicit, or superimplicit control, and NOC accounts were unable to explain control by inanimate subjects. If both OC and NOC are possible, then this is not a problem.

⁹ This does not preclude the possibility that some SPCs may be headed by *in order*. For example, putting (87d) into a more canonical SPC structure is acceptable (i). This suggests that at least (87d) may contain an SPC.

- (i) The engineer built a test wire chamber module₁ [*e*₁ to be inserted into the cryostat].

However, as was the case for temporal adjuncts, it is not the case that both types of control will always be available for a given sentence. The remainder of this section will first discuss the distribution of OC and NOC in general. This will be followed by a proposal on how to rule out object control in local RatCs while allowing it in remote control.

3.4.1 The distribution of OC and NOC in RatCs

Both OC and NOC are possible for RatCs, but just as with temporal adjuncts, it is not the case that both are equally available in all contexts. Here I discuss some factors that may influence or determine which variety of control will occur.

3.4.1.1 *Remote control is always NOC*

I argued in §3.2.2 that remote control cannot involve a syntactic OC dependency. If this is true, then all remote RatCs should exhibit NOC. This leads to the prediction that remote versions of the examples in (87) with control by an inanimate subject should be ungrammatical. This prediction is borne out. In each of the examples in (91), PRO cannot be understood to corefer with the inanimate subject of the target clause, despite the fact that control by such a subject is possible in local RatCs.¹⁰

- (91) a. *This book₁ was written. The reason/goal/purpose was PRO₁ to be read.

¹⁰ Examples (91c,e,f) may be acceptable under an implicit or superimplicit control reading, with PRO referring to Hughes, the driver of the car, or the people manning the ship, respectively. Crucially, though, they do not allow control by the inanimate subject of the target clause.

- b. *The house₁ was emptied. The reason/goal/purpose was PRO₁ to be demolished.
- c. *The poem₁ was written by Hughes. The reason/goal/purpose was PRO₁ to be admired by silly girls.
- d. *A test wire chamber module₁ was built. The reason/goal/purpose was PRO₁ to be inserted into the cryostat.
- e. *The car₁ is streamlined. The reason/goal/purpose is PRO₁ to accelerate faster.¹¹
- f. *The battleship₁ is near the coast. The reason/goal/purpose is PRO₁ to shell the harbor.

3.4.1.2 *Local subject control*

The case is not as clear with local RatCs, which can allow either OC or NOC. Control by the matrix subject in local RatCs could often be either OC, its interpretation being determined by syntactic binding, or NOC, the interpretation arising based on principles such as those in Responsibility Theory. For example, in (92), OC would result in *Harry* being the controller, since it is in the correct position to syntactically bind PRO. NOC would result in the same interpretation under Responsibility Theory, since Harry is the agent and will be understood as the one most directly responsible for the target fact.

¹¹ Interestingly, fact control appears to be an exception. Although facts are not animate, remote fact control is possible, as with (i) (Alexander Williams, p.c.). See also §3.5.

(i) The car is streamlined. The point is PRO to reduce drag.

- (92) Harry₁ stayed up late with Hermione in order [PRO₁ to master the summoning charm].

Two tests for OC suggest that local subject control is OC. First, only sloppy identity under ellipsis seems possible.

- (93) Harry₁ stayed up late in order PRO₁ to master the summoning charm, and Hermione₂ did too.

‘And Hermione stayed up late in order PRO_{2/*1} to master the summoning charm.’

However, this test does not provide sure evidence of OC, since Responsibility Theory may also predict sloppy identity for NOC of RatCs. Under Responsibility Theory, PRO will refer to the party responsible for the target fact. In the second conjunct, the clause to which the elided RatC adjoins is ‘Hermione worked hard every day,’ and this is the most likely candidate for the target fact. Therefore, PRO will still refer to Hermione, because as the agent of the second conjunct, she is the one who will be understood as most directly responsible for that fact.

The second test may be more reliable. PRO in a local RatC can only have a bound interpretation when controlled by *only*-DPs. Example (94) remains true in a situation where Hermione stayed up late in order to help Harry master the summoning charm, but it is false if Ron also stayed up in order to master it himself.

- (94) Only Harry₁ stayed up late in order PRO₁ to master the summoning charm.

‘[Nobody else]₂ stayed up late in order PRO_{2/*1} to master the summoning charm.’

In addition, an OC analysis of local subject control in RatCs would be consistent with the proposed preference for bound versus free variables from Reinhart (1983) discussed in §2.4.2.2.

3.4.1.3 *Semantic anomaly and local NOC*

It is clear that cases of implicit and superimplicit control must be NOC, but there are restrictions on when they can occur. For example, as was the case for temporal adjuncts, it appears that when both an OC and an NOC derivation are possible, OC is preferred. Landau (2017) states this even more strongly, arguing NOC in RatCs, will *only* be available when OC by the matrix subject is blocked, such as when it would lead to “semantic anomaly.” For example, we have seen that superimplicit control is available in (95). According to Landau, this is only possible because OC by the matrix subject would make the sentence denote an unlikely situation: ribbons cannot normally acquire support.

- (95) The ribbon was cut by a young girl [in order PRO to acquire the support of female voters].

In contrast, in (96), it is perfectly plausible that a hired crook could collect insurance. Therefore OC by the matrix subject is preferred, and superimplicit NOC is blocked.

- (96) A hired crook₁ burned down the house [in order PRO_{1/*2} to collect the insurance].

However, this explanation is probably not completely correct. After all, as was seen in Chapter 1, Kehler et al. (2008) demonstrated that people are much more likely to resolve the pronoun in (97) to the subject of a passive, even when it would lead to a very improbable story. Given this strong preference in addition to the overall preference for OC over NOC, it seems that comprehenders should strongly prefer subject control in (95), with the interpretation that the ribbon is the one winning votes, even though this interpretation results in a very strange story.

- (97) The demonstrators were denied a permit by the city council because...
- a. ...they *feared* violence.
 - b. ...they *advocated* violence.

Even ignoring this problem, there are cases of implicit control where OC by the matrix subject would not lead to semantic anomaly. For example, in (98), even though there is nothing semantically or pragmatically anomalous about young girls acquiring support, (98) still allows a superimplicit control reading where it is the organizers of the event acquiring support. But perhaps here, the young girl is either acquiring support for the organizers, or she can be seen as an instrument of the organizers unable to acquire support on her own.

- (98) A *young girl* cut the ribbon [in order PRO to acquire the support of female voters].

A stronger example is (99). Here, *the guests* would make a perfectly good controller. It is not at all implausible that the guests would acquire the support of female voters, and this reading is in fact available if the guests are seen as responsible for how they were greeted. It is less likely that the guests would be seen as acquiring support on behalf of the event organizers. If semantic anomaly of OC were required for NOC to be possible, then the preferred interpretation of (99) should be that the guests intended to acquire support. Instead, (99) has an interpretation parallel to (95), where the intended support-acquirers are the organizers of the event.

- (99) The guests were greeted by a young girl in order PRO to acquire the support of female voters. (Maria Polinsky (p.c.))

As was the case with temporal adjuncts, it appears that subject control leading to an unlikely situation may reduce the preference for OC, but this is not strictly required for NOC to occur.

3.4.2 Ruling out local object control

One of the biggest challenges for Responsibility Theory is ruling out object control in local RatCs. A. Williams and Green's (2017) attempt was to suggest that surface objects are depicted as defeasibly nonresponsible. Although it may be true that subjects (especially agents) are seen as more responsible than object patients

given the preference for subject control even in remote RatCs, this explanation fails to predict differences in the availability of object control in local and remote RatCs, as was seen in §3.3.3.1 with the examples repeated in (100) and (101). Whereas object control never seems to be available in local RatCs, it is possible in remote RatCs if it is explicitly stated that the object is responsible.

(100) Because of an idea Harry had after learning about elf magic, Dobby protected Harry₁...

- a. *...in order PRO₁ to escape the Malfoys.
- b. The goal was PRO₁ to escape the Malfoys.

(101) On his order, the police arrested Sam₁...

- a. *...in order PRO₁ to get himself₁ off the streets.
- b. The goal was PRO₁ to get himself off the streets.

Why is the constraint against object control so strong in local RatCs? Object control is ruled out in a strict OC account, because the object does not c-command the RatC and can therefore not syntactically bind its PRO. But given that NOC is also possible, what prevents NOC by the matrix object in local RatCs, given that it is possible in remote control? One possibility is that object control in local RatCs is ruled out simply due to the general preference for OC over NOC. In (100a), for example, *Dobby* is in a position to syntactically control PRO, and it is perfectly plausible that he would be the one escaping the Malfoys and that his helping Harry

could lead to that result. Because this OC reading is available and plausible, NOC by the object is blocked. In remote control, the OC preference is not at play, since OC is impossible. Therefore, object control is possible in (100b).

This explanation predicts that not only object control, but all NOC readings will be ruled out in (100a,101a). This seems to be correct. Even if the speaker highlights someone else’s responsibility in the matter, the only available reading seems to be OC by the subject in a local RatC (102a). But in a remote RatC, control by that third party is possible (102b).

(102) Because his owner₁ compelled him to, Dobby₂ protected Harry₃...

- a. ...in order PRO_{2/*1/*3} to escape the Malfoys.
- b. The goal was PRO_{1/2/*3} to escape from the Malfoys.

This explanation further predicts that if a speaker will accept superimplicit control in a local RatC adjoined to an active, transitive target clause, then NOC by the matrix object should also be possible. However, superimplicit control with transitive matrix clauses is difficult, given that the subject of the matrix clause is usually an agent and will therefore be understood as responsible. One example that may validate the prediction is (103). Inasmuch as a speaker allows the superimplicit control in (103a), they should also allow NOC by the object in (103b).

(103) a. At Trump₁’s request, a multilingual sign greeted the guests each morning in order PRO₁ to acquire the support of the immigrant population.

- b. At his request, a multilingual sign greeted Trump₁ each morning in order PRO₁ to practice connecting with the immigrant population.

Object control is therefore ruled out any time NOC is. When the RatC is obligatorily controlled, then only the subject of the matrix clause is in a position to bind it. Even when NOC is possible, as is always the case for remote control, object control may be dispreferred if the subject is an intentional agent that is understood to be more directly responsible for the target fact. But, if it is made clear that the object is responsible, then object control will be possible anywhere NOC is.

3.4.2.1 OC required with passive RatCs?

Landau (2017) presents what he terms the Jaeggli-Roeper Generalization, given in (104).

- (104) *The Jaeggli-Roeper Generalization* (Landau, 2017)

Active RatC allows OC or NOC; passive RatC imposes OC.

This generalization is based on the fact that inanimate subjects can control PRO in a passive RatC (see (87)), but in examples such as (105)–(107), implicit control, which has been demonstrated to be NOC, is impossible.

- (105) *The report was carefully prepared [PRO to be congratulated by the board of directors]. (Jaeggli, 1986)

- (106) a. A vote was taken [PRO to elect a president].

- b. *A vote was taken [PRO to be elected president].
 - c. John₁ took a vote [PRO₁ to be elected president]. (Roeper, 1987)
- (107)
- a. John₁ sank the ship [PRO₁ to be promoted].
 - b. *The ship was sunk [PRO to be promoted]. (Lasnik, 1988)

Landau argued that this same generalization applies to temporal adjunct control. Although I argued in Chapter 2 that the generalization does not always hold for temporal adjuncts, I believe that it holds for RatCs. Although Landau leaves the explanation of this generalization as an unsolved puzzle, Español-Echevarría (2000) attempts to provide an explanation. Español-Echevarría, who was the first to my knowledge to propose a hybrid OC/NOC account of RatCs, claims that a passive RatC disallows NOC due to principles governing controller choice in NOC. Following Farkas (1988), Español-Echevarría states that under NOC interpretations, the understood antecedent to PRO in a RatC is chosen based on a Principle of Controller Choice in RatCs (PCCRC), as given in (108).

- (108) *PCCRC*: (Español-Echevarría, 2000, p. 107)

For any s and s' , such that s corresponds to the matrix situation and s' to the purposive one in a purpose construction, the controller of the purposive infinitival clause is an individual i such that:

- i. both $\text{RESP}(i, s)$ and $\text{RESP}(i, s')$ hold, and
- ii. i must bear an agentive role from the rationale predicate.

For the examples in (105), (106b), and (107b), because the RatC is a passive, PRO neither receives an agentive θ -role, nor can it be viewed as responsible for the embedded situation. Because of this, NOC is blocked, and OC is the only option.¹² Additional evidence for this explanation is given in (109). Even though the RatC is not in passive voice, NOC by the implicit agent is still blocked, because the predicate *become rich* does not assign an agentive role to its subject.

- (109) a. John wrote this book [in order PRO to become rich].
 b. *This book was written [in order PRO to become rich].

(Español-Echevarría, 2000)

This explanation is similar to Landau’s (2018) [init] theory discussed in §2.3.2.2, since the [init] feature is closely tied, though not identical, to agency. Under Landau’s account, (109b) requires OC because the matrix subject (the potential OC controller) and PRO match in [-init] features.

But there are at least three reasons why such explanations cannot be correct. First, an agent θ -role for PRO is not required for NOC. Nor is it necessary for there to be a mismatch in [init] values. In (110), for example, PRO does not receive an agentive θ -role, and both it and the matrix subject are [-init], and yet NOC appears to be possible.

- (110) The king’s ship_[-init] was sunk just PRO_[-init] to acquire notoriety.

¹² Español-Echevarría gives a movement account of OC, following Hornstein (1999).

Second, it is not clear why PRO in a passive RatC could not be understood as responsible for the situation as a secondary agent, thereby becoming [+init], akin to Sam in the example repeated in (111). In (106b), for example, why could the person who took the vote not be understood as somehow responsible for their being elected president, thus becoming [+init]? If that were the case, then PRO in (112) would mismatch in [init] values with the potential OC controller, as illustrated in (112). Contrary to fact, NOC should be possible in such a situation.

(111) Sam_[+init] was arrested by the police [just PRO_[+init] to get himself off the streets].

(112) *A vote_[-init] was taken [PRO_[+init] to be elected president].

Finally, if the restriction against NOC in passive RatCs was due to the requirements of NOC interpretation alone, as Español-Echevarría (2000), though not Landau (2018), maintains, then we would expect remote control for passive RatCs to be impossible. However, NOC is much more acceptable in remote control.

- (113) a. The report was carefully prepared. The goal was [PRO to be congratulated by the board of directors].
- b. A vote was taken. The goal was [PRO to be elected president].
- c. The ship was sunk. The goal was [PRO to be promoted].

Perhaps the restriction against NOC in passive local RatCs is not due to a single factor, but because of a combination of separate interpretive preferences.

Among these could be a preference for NOC PRO in RatCs to have an agentive role as well as a general preference for OC over NOC. In addition, it was seen that a passive temporal adjunct also is less likely to allow NOC, and there may be some other interpretive constraint disfavoring NOC in passive adjuncts generally. These preferences are compounded in local RatCs to give a strong restriction against NOC when the RatC is passive. However, in remote control, OC is impossible, and the preference for it is void. In such cases, because NOC is the only option, the preference for PRO in NOC to be an agent can be ignored.

This type of explanation would also explain why NOC with passive temporal adjuncts is possible, even if passive temporal adjuncts more frequently exhibit OC. Because there is no responsibility requirement, the constraint against NOC is less than with RatCs, and therefore is more easily overridden.

3.5 Conclusion

This chapter has provided evidence that control in RatCs can be either OC or NOC, as was argued to be the case for temporal adjuncts in Chapter 2. In OC, which can only apply in local RatCs, the controller is the main clause subject in most cases, but may also possibly be an event or situation variable in cases of fact control if it is in fact OC. NOC occurs in all instances of remote control, where there can be no syntactic dependency between PRO and arguments of the target clause. In addition, NOC may occur in local RatCs. This is most frequently seen in cases of implicit control, when PRO is understood to refer to the implicit agent of a passive

target clause. NOC is also possible in cases of what I have called superimplicit control, where PRO is understood to refer to some person who is not an argument of the target clause, whether explicit or implicit.

As is the case for temporal adjuncts, grammatical constraints and syntactic structure alone cannot fully account for when NOC will be possible in local RatCs. Instead, the distribution of NOC must be due at least in part to processing or interpretive preferences or biases. These are likely to be similar to the preferences responsible for the distribution of NOC in temporal adjuncts.

The referent of PRO in NOC with RatCs is determined based on who is understood to be explanatorily responsible for the fact expressed by the target clause. This differs from NOC PRO in temporal adjuncts, where PRO had to refer to a logophoric perspective holder, but did not induce notions of responsibility. This difference likely arises from the meaning of the Rat head (sometimes pronounced *in order* in local RatCs), which may impose additional restrictions on the domain of PRO's reference (A. Williams & Green, 2017). This seems likely, given that even RatCs exhibiting OC seem to implicate some sort of responsible party or “initiator” (Landau, 2017, 2018).

One question that remains is how to deal with fact control. As discussed above, in local RatCs, one might initially think that fact control is OC by either an event or a situation variable in the syntax. However, fact control is also possible in remote RatCs, such as in (114).¹³ Given that remote control can only be NOC, syntactic control by an event or situation variable is impossible in such cases.

¹³ Also see Footnote 11.

(114) [Grass is green]₁. The reason is [PRO₁ to promote photosynthesis].

Responsibility Theory has little to say about how fact control arises, other to say that PRO in a RatC can refer either to the party responsible for the target fact, or to the target fact itself. Although this kind of disjunctive observation is somewhat unsatisfactory, I leave further explanation to later research.

Chapter 4: Control theories and other adjuncts

The previous two chapters have presented evidence that adjunct control can neither be classified as strictly OC nor as strictly NOC. Instead, I have agreed with Landau (2017) that at least temporal and rationale adjuncts are hybrid environments, where both OC and NOC may occur. In contrast to Landau, though, I have argued that NOC does not require that OC be ruled out semantically or otherwise; NOC is not simply a last-resort option arising when OC fails. Instead, the grammar freely allows both OC and NOC in these adjuncts. Still, OC is strongly preferred, and this is likely due to performance biases. Factors contributing to the choice of OC and NOC may include conceptual plausibility and structural features of the sentence. In addition, NOC interpretation requires that the understood referent of PRO be a logophoric perspective holder, and in the case of RatCs, that this referent be understood as explanatorily responsible for the fact the RatC is meant to explain.

This chapter investigates some of the broader implications of the previous two chapters. In §4.1 I review and expand on the way Landau (2017) implements this duality of control for temporal and rationale adjuncts in the Two-tiered Theory of Control (TTC) (Landau, 2015). As will be seen, his account leads to the prediction that all cases of adjunct control, not just temporal and rationale adjuncts, should

allow both OC and NOC given the right context. Section 4.2 therefore briefly discusses several other types of adjuncts, illustrating that this is true for some, but not others. I then discuss possible explanations for why certain adjuncts are exceptions, highlighting problem cases. In §4.3, I propose an alternative explanation within the framework of the Movement Theory of Control (MTC) (Hornstein, 1999; Boeckx et al., 2010) that can better account for many strict OC adjuncts that the TTC struggles with. Section 4.4 concludes the theory portion of the dissertation.

4.1 The two-tiered theory of control

In order to accommodate the data described in the previous chapters, any theory of control should be able to explain at least three things: (i) why OC is preferred to NOC in these adjuncts, but is not strictly required; (ii) why complement control does not allow the same duality, being instead strictly OC; and (iii) how the domain of reference for PRO is restricted in NOC contexts (i.e. why perspective or responsibility, etc., are necessary). After a brief summary of the mechanics of the TTC, I will discuss how this theory answers these questions.

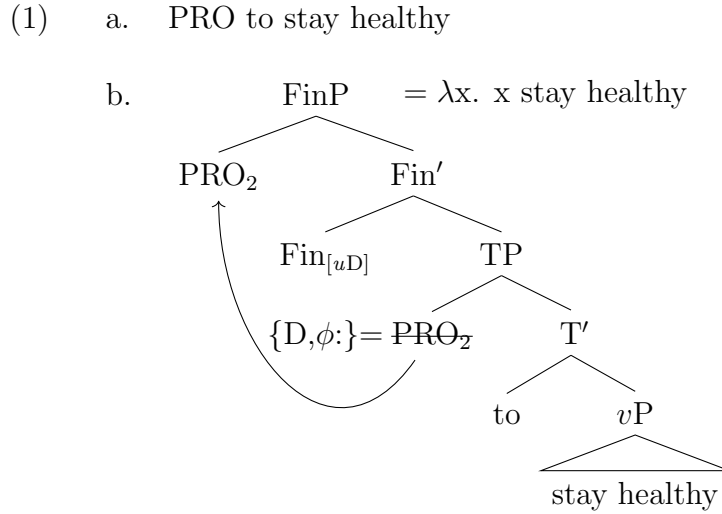
4.1.1 Background on the TTC

The TTC rejects traditional formulations of OC and NOC. Instead, it classifies control as either predicative or logophoric, similar to the way Williams (1992) does. In complements, logophoric control occurs with attitude predicates, and predicative with non-attitude predicates. The term “predicative control” is used to describe the

situation when a verb denotes a relation R between an individual x and a property p that entails $R^*(x, p(x))$, where R^* expresses essentially the same concept as R . For example, “ x managed p ” is true iff $\text{MANAGE}^*(x, p(x))$. This kind of predicative relation is said to apply in both complements and adjuncts, resulting in OC for both, although as will be discussed, Landau does not make it clear how exactly this works for adjuncts. Logophoric control, on the other hand, which appears only with attitude predicates, involves a relation between x and $p(i)$, where i is a variable restricted to the AUTHOR or ADDRESSEE of the context of evaluation. In complement control, this context is restricted to include only the matrix attitude holder of and their addressee, and the variable is associated with either of them, resulting in OC. In adjuncts, the variable i is not bound any argument of the matrix clause, and the context of evaluation is not restricted to any specific context, which results in NOC.

These ideas are implemented as follows. In both predicative and logophoric control, PRO is held to be a “minimal pronoun” with unvalued ϕ -features that, depending on the derivation, can surface as controlled PRO, a reflexive, a bound lexical pronoun, a resumptive pronoun, or other types of pronouns. Syntactically, this minimal pronoun will inherit whatever ϕ -features its binder is specified for. And semantically, it is vacuous. That is, even relative to an assignment function it would not by itself be assigned a value. In both predicative and logophoric control, a non-finite TP containing this minimal pronoun is the complement of a predication head (Fin), as illustrated in (1). This Fin has an uninterpretable [uD] feature, which attracts PRO to its specifier position. Because movement automatically causes λ -abstraction (Heim & Kratzer, 1998), as PRO raises to spec-FinP, it creates a

λ -predicate. But, due to its radical impoverishment and lack of semantic content, Landau states that upon movement, PRO does not saturate the *lambda*-predicate. The embedded FinP thus itself denotes a property; in (1), it is the predicate $\lambda x. x$ *stay healthy*.

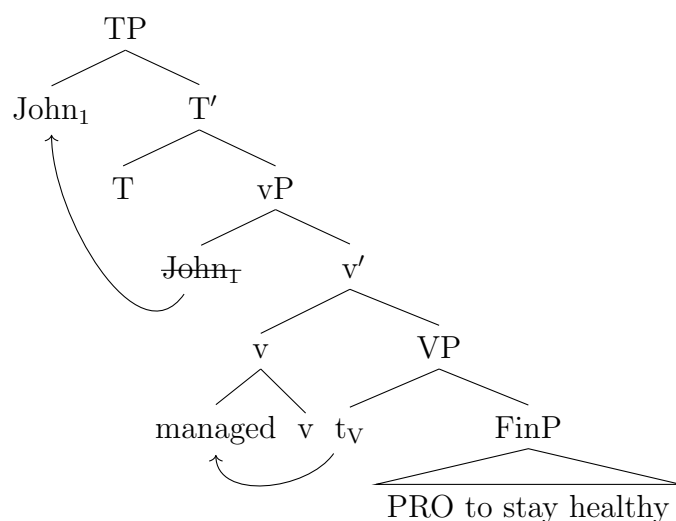


In predicative complement control, illustrated for (2) in (3), the FinP merges directly with the matrix verb. Landau states that the property denoted by the FinP is then “applied” directly to an argument of the matrix clause. But Landau cannot mean this literally, since the FinP is not sister to any argument in the matrix clause. So he may mean for the λ to be ‘passed up the tree’ and then ‘identified’ with the subject argument of the matrix VP, so that $\llbracket \text{VP} \rrbracket = \lambda x. V(x, \llbracket \text{FinP} \rrbracket(x))$. This could be achieved by repeated Function Composition, or by raising PRO to the level of the matrix VP, plus some rule that identifies the ‘raised’ argument with one from the matrix. But then Landau’s theory becomes nearly identical to the Movement Theory of Control. So perhaps Landau is instead using “applied” in a

less mechanical sense. Perhaps he means only that the relation expressed by the matrix verb, between the referents of its object and its subject, property p and individual s , entails a further relation between s and the proposition that $p(s)$. For example, perhaps *Ron managed to be polite* expresses a *manage*-relation between Ron and being polite, but then this relation holds only if Ron also has a certain relation to the proposition that he is polite. In that case, Landau’s “f applies to x” would just mean that the sentence entails $Q(fx)$ for a certain Q . And this is itself is a variant of what is sometimes called the *semantic theory* of complement control, articulated in Sag and Pollard (1991) and its precedents, and briefly discussed in §2.5.2. Predicative object control is similar, with the FinP being “applied” as a small clause predicate to the matrix object.

(2) John managed to stay healthy.

(3) *Derivation of predicative subject control* (see Landau, 2015, p. 26)

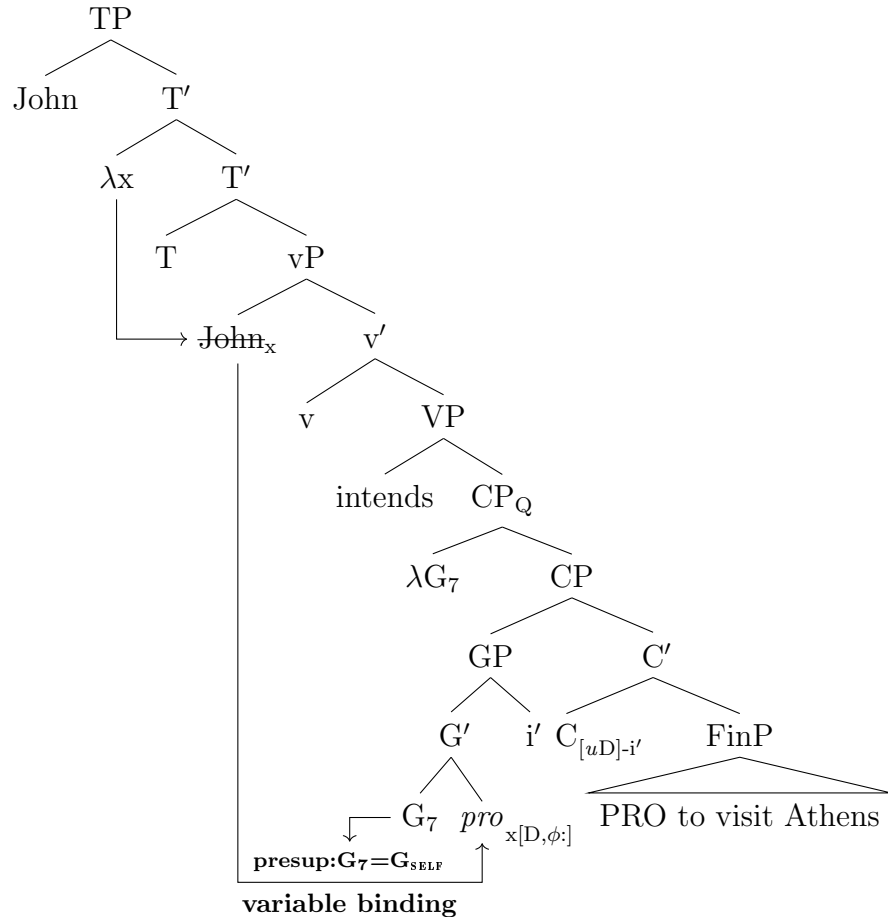


In logophoric control, which occurs with attitude verbs, the predicate denoted

by the FinP applies—this time in the literal sense, with the predicate combining with its sister as a function applying to an argument—to an intermediate null pronoun that is bound by the matrix controller. There is also additional structure in the CP of the embedded clause that is intended to capture the *de se* properties of OC PRO in logophoric control. This is illustrated for the sentence (4) in (5).

(4) John intends to visit Athens.

(5) *Derivation of logophoric control* (modified from Landau, 2015, p. 44)



Following Schlenker (2003) and others, Landau (2015) claims that attitude verbs act as quantifiers over sets of contexts, where a context is a tuple of coordinates

$i = \langle x, y, \text{TIME}(i), \text{WORLD}(i) \rangle$, where x and y are variables corresponding to the AUTHOR and ADDRESSEE of the context. Landau refers to these coordinates of the context as “arguments” of C , in an extension of the term’s usual sense. Furthermore, C is said to have an uninterpretable [uD] feature, which is satisfied by the presence of the null pronoun in its specifier. G_7 in (5) is a “concept generator” (Percus & Sauerland, 2003) that takes *pro* as an argument and entails that the attitude holder is in some acquaintance relation with the “*res*” (individual) that will be the referent of *pro*. The meaning of the embedding verb determines that the relevant attitude holder is the one in the matrix clause, but does not specify what the acquaintance relation is. This meaning comes as a presupposition triggered by the embedded C that the acquaintance relation G_7 is either the SELF relation for verbs like *intend*, which have an obligatory *de se* interpretation, or the THOU relation for verbs like *ask* which exhibit obligatory *de te*. This presupposition guarantees that *pro* will correspond either to the AUTHOR or ADDRESSEE of the matrix attitude predicate, leading to either subject or object control. In this indirect way, the sentence in (5) comes to entail that John as known to himself has the property of visiting Athens in all worlds compatible with John’s intentions in the actual world.

In sum, complement control consists of a FinP denoting a property being associated either with the matrix controller in predicative control, or with an intermediate pronoun which is bound by a matrix argument in logophoric control. Which structure the embedded clause takes is determined based on the specific embedding verb.

Landau (2015, 2017) states that adjunct control also falls into these two cat-

egories. But because adjuncts are not selected, they are free to adjoin with either a predicative structure or with a logophoric one. Predicative structures give rise to what I have been calling OC readings. But if Landau is assuming a theory of predication similar to semantic theories of control, where the embedding verb mediates the predication, then it is unclear how this would apply to adjuncts. Assuming that the predication relation does somehow obtain, then the antecedent of PRO will be limited to the closest c-commanding DP. If the adjunct attaches with a logophoric structure, on the other hand, then there is no restriction on the G_7 relation or the embedded context, and PRO will refer to the AUTHOR or ADDRESSEE of any relevant context, resulting in logophoric NOC.

4.1.2 Why OC is preferred over NOC

As illustrated succinctly in (6), predicative (OC) adjuncts have a simpler structure than logophoric (NOC) ones.

- (6) a. OC adjunct: $[_{PP} \text{ before/in order } [_{FinP} \text{ Fin } [_{TP} \dots]]]$
 b. NOC adjunct: $[_{PP} \text{ before/in order } [_{CP} C_{+log} [_{FinP} \text{ Fin } [_{TP} \dots]]]]]$

(Landau, 2017, p. 100)

Following Grimshaw (1994), Bošković (1996), and Speas (2006), Landau (2017) proposes a principle of economy of projection, which favors the derivation with a less complex structure, all else being equal, resulting in the more complex NOC structure in (6b) only being licensed if the OC structure in (6a) produces “semantic

deviance.” As was seen above, semantic anomaly of the OC derivation is not always necessary for NOC to be available. Therefore, although the preference for simpler structure may be correct, it must be the case that factors other than semantic anomaly can override that preference.

4.1.3 Why complement control only allows OC

Under the TTC, adjunct control can either be predicative or logophoric. In complement control, which type of control structure is used is determined based on selection by the embedding predicate. OC is ensured in non-attitude complements because the embedded clause is simply a predicate whose argument is instantiated by the closest c-commanding argument of the matrix clause. NOC is ruled out because the predication relation must be satisfied locally. Logophoric NOC is also ruled out in non-attitude contexts because of the selectional restrictions of the embedding verb.¹

Attitude predicates, on the other hand, select a logophoric complement and set the context of evaluation of the clausal complement as the attitude context of the matrix event. This ensures that the controller will be either the AUTHOR or the ADDRESSEE of the matrix event. It is important for Landau that the C is required to project either of these variables to its specifier to check its [*uD*] feature, but

¹ NOC is actually possible in complements with a *wh*-phrase in their spec-CP (see (i)). Note that (i) involves an attitude predicate, and therefore would involve logophoric control. Although Landau (2015) does not address this question, perhaps this has to do with the fact that *wh*-infinitives always have a modal interpretation, which in turn leads to generic interpretation of PRO (Bhatt, 1999). How this is instantiated in the TTC, though, is not clear.

(i) Jon asked [^{*}(how) PRO₁ to shave oneself₁].

which variable is projected is not lexically specified. This ensures that the property denoted by the FinP can apply to either the author or the addressee of the matrix verb, allowing for well-known cases of control shift such as in (7). In (7a), *pro* is bound by the ADDRESSEE of the matrix attitude, and in (7b), by the AUTHOR. However, this is still an instance of OC, since PRO in either case must be controlled by an argument of the matrix clause.²

- (7) a. Jim asked Mary_y [_{CP} *pro*_y [_{FinP} PRO to leave]].
 b. Jim_x asked Mary [_{CP} *pro*_x [_{FinP} PRO to be allowed to leave]].

Adjuncts differ from complements only in that they are not selected. Because of this, they are free to have either a predicative or a logophoric structure. With predicative adjuncts, PRO's λ is “applied” to the closest c-commanding argument, which for temporal and rationale clauses is the matrix subject. However, there is still a remaining question of how this is done. Here there is no mediating verb, and a semantic approach where the predication is mediated by the relation between the two clauses is unlikely, as there is nothing at all in the meaning of *while*, for example, that suggests that the two concurrent events should share a participant, much less one named by the subjects of the clauses.³ So it must be the case that the λ is passed up the tree, either through movement or through a complex series

² Although control shift is possible, there generally is a default controller based on the control verb. For example, *persuade* generally exhibits object control, and *promise* subject control, and it takes extra context to get control shift. Landau's (2015) theory provides no explanation of the default.

³ Rothstein (2004) stipulates of depictive secondary predicates, which have a semantics like *while*-adjuncts, that they combine with their hosts by a semantic rule that enforces exactly this sort of sharing. Nonetheless, this stipulation is not one that follows from the concept of temporal concurrence.

of function composition. Putting aside this question, and assuming that the λ does somehow “apply” to the matrix subject, it will result in OC due to the nature of predication. Logophoric adjuncts will be NOC because there is no restriction on the context of evaluation of the embedded clause. The null pronoun in the specifier of C that binds PRO is therefore free to refer to the AUTHOR or ADDRESSEE of any relevant context.

4.1.4 The interpretation of NOC

NOC in adjuncts is always logophoric under the TTC; predicative control necessarily results in OC. This provides a direct explanation of why PRO’s understood referent must be some sort of perspective holder in the discourse. PRO will be bound by either the AUTHOR or the ADDRESSEE of the embedded context. But again, since this context is not selected by anything in the matrix clause, what context of evaluation these AUTHOR and ADDRESSEE pertain to may vary given the right discourse context.

4.2 Other adjuncts

The previous chapters discussed temporal and rationale adjuncts, using them as evidence that both OC and NOC are possible in adjunct control. However, there are several different types of adjuncts that exhibit control, each with their own distinct properties (see Huettner, 1989; Landau, 2013). Therefore, although temporal and rationale adjuncts may allow both OC and NOC, this does not immediately

mean that all adjuncts will likewise. However, the TTC would seem to predict that this duality of control should extend to all adjuncts, although Landau (2015, 2017) does not explicitly make this claim. If temporal and rationale adjuncts allow both OC and NOC because their structure is unselected by a matrix verb, then the same should be true of all unselected adjuncts.

This section briefly discusses several types of adjuncts. Some of these will be shown to follow the pattern of rationale and temporal adjuncts, allowing both OC and NOC. Others seem to be restricted to one or the other. For some of these, I will propose a possible explanation for why they differ from other adjuncts within the framework of the TTC, but others present a genuine problem. The following section, §4.3, proposes an alternative account within the framework of the MTC.

4.2.1 Adjuncts allowing both OC and NOC

The TTC predicts that all adjuncts should exhibit the same duality of control as temporal and rationale adjuncts, allowing both predicative OC and logophoric NOC. Here I discuss three adjuncts that confirm this prediction: the response clause, the telic clause, and the absolute clause. Although I discuss the first in some detail, I will only give preliminary evidence for the others.

4.2.1.1 Response clauses

One adjunct that has been largely ignored in the literature is illustrated in (8). These adjuncts have been called reason clauses (Betancort, Carreiras, & Acuña-Fariña, 2006), rationale clauses (Hornstein, 1999), justification clauses (Stromdahl,

2018), or simply gerundival complements to *for* (A. Williams & Green, 2017). For clarity, and to distinguish them from RatCs, which have also been called reason clauses (A. Williams, 2015), I will call the adjuncts in (8) “response clauses.” The reason is that these adjuncts entail that the act of the main clause was meant as a response to what is described by the adjunct (A. Williams & Green, 2017; see also Fillmore, 1971; Fabricius-Hansen & Sæbø, 2011).

- (8) a. Harry₁ got a trophy [for PRO₁ winning the tournament].
- b. Mickey baked Minnie₁ a cake [for PRO₁ doing so well on the test].
- c. Mickey hugged Minnie₁ [for PRO₁ doing so well on the test].

Some responses clauses may be understood as conceptual “arguments” of what I will call *blame*-class verbs, such as *blame*, *praise*, and *thank*, as in (9). The meaning of the verb *blame*, for example, requires that there is an either explicit or implicit offense associated with the blame (Fillmore, 1971). This is not the case with the response clauses in (8). Although their conceptual relationship to the main clause predicate may differ, I will assume for now that the response clauses in either case have the same syntactic status.

- (9) a. Harry blamed Snape₁ [for PRO₁ breaking in].
- b. Hermione praised Harry₁ [for PRO₁ being such a great wizard].
- c. Harry thanked Ron₁ [for PRO₁ teaching him to play chess].

PRO in response clauses can be coreferential with the matrix subject, as in

(8a), or with the indirect or direct object, as in (8b–c) and each of the examples in (9). Response clauses also allow control shift, similar to what was seen for complements in (7). This is illustrated in (10) and (11). Example (10a) prefers object control, while (10b) exhibits subject control. And in (11), either subject or object control is possible, as long as Harry views Malfoy as ultimately responsible.

- (10) a. The principal thanked Sara₁ [for PRO₁ chaperoning the dance].
 b. Sara₁ thanked the principal [for PRO₁ being allowed to chaperone the dance].
- (11) Harry₁ blamed Malfoy₂ [for PRO_{1/2} losing the match].

Control shift is also possible for response clauses not associated with a *blame*-class verb (A. Williams & Green, 2017). In (12), PRO may be coreferential with either the main clause subject or object, depending on whether the flowers are viewed as an apology, in which case the subject controls PRO, or as a reward, in which case the controller is the object.

- (12) Jack₁ brought Sharon₂ flowers [PRO_{1/2} for working so late].

The fact that PRO is able to be controlled by either argument of the matrix clause gives our first piece of evidence that NOC is possible. Under the TTC, control shift is only possible in logophoric control, which allows *pro* to correspond either to the AUTHOR or to the ADDRESSEE of the relevant context. In predicative control for both complements and adjuncts, PRO’s controller will always be the next highest

c-commanding DP. Variable or shifting control should be impossible in predicative control, unless, of course, the adjunct has variable attachment sites.

There is, in fact, some evidence that response clauses have multiple possible attachment sites, and that attachment height can interact with controller choice. First, in (13), if the adjunct provides an explanation for the baking of the cake, then *Minnie* is the controller. But if it is an explanation for why Mickey had/got to do some activity, then *Mickey* is the controller. Therefore, it could be the case that response clauses exhibit OC by the object when the adjunct attaches low, and OC by the subject when it attaches higher.

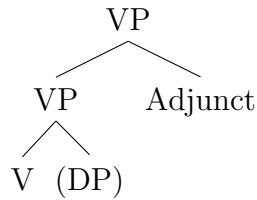
- (13) Mickey₁ had/got to bake Minnie₂ a cake for PRO_{1/2} doing so well on the test.

It is standardly assumed that the phrase *do so* replaces a VP, and that elements that cannot be stranded after *do so* are selected arguments of the verb (see, e.g. Whelpton, 1995; DeArmond & Hedberg, 1998). For example, in (14), ‘in the living/bedroom’ is an argument of the verb *put*, and therefore cannot be stranded; it must be included in the interpretation of *did so* (underlining marks the intended content of *do so*).

- (14) a. *Mildred put three books in the living room, and Dwight did so in the bedroom.
b. Mildred put three books in the living room, and Dwight did so, too.

VP adjuncts, on the other hand, can optionally be stranded. Since they Chomsky-adjoin to the VP, as in (15), *do so* can either replace the lower VP, leaving the adjunct stranded, or the higher VP, in which case the adjunct will be included in the elided content. In (16), ‘in the living room/bedroom’ is a VP adjunct and can therefore optionally strand.

(15) *Chomsky-adjunction*



- (16) a. Mildred read three books in the living room, and Dwight did so in the bedroom.
- b. Mildred read three books in the living room, and Dwight did so, too.

Based on the *do so* test, response clauses sometimes appear to behave as verbal arguments. In (17), *do so* seems to obligatorily include the response clause.

- (17) a. ??Jill sent Justin to his room for spilling water everywhere, and later Peter did so for refusing to clean up.
- b. Jill sent Justin to his room for spilling water everywhere, and later Peter did so, too.

Response clauses in other instances appear to act as VP adjuncts. In contrast to (17), which indicated that the response clause was within the minimal VP (i.e. that

it was behaving like a verbal argument), in (18) the *do so* test passes whether the response clause is included in the elided content or not.

- (18) a. Jack₁ brought Sharon flowers [for PRO₁ working so late], and David₂
did so [for PRO₂ leaving work early].
- b. Jack₁ brought Sharon flowers [for PRO₁ working so late], and David₂
did so, too.

It is tempting to conclude from (13), (17), and (18) that object-controlled response clauses are always situated lower in the tree than subject-controlled response clauses, and that therefore place of attachment can determine controller choice. Such a hypothesis would be consistent with response clauses being predicative OC. However, such a conclusion would be premature. As (19) and (20) make plain, even object-controlled response clauses sometimes behave as VP adjuncts with respect to the *do so*-test.

- (19) Jack brought Sharon₁ flowers [for PRO₁ working so late],
- a. and David did so [for PRO₁ finishing the project early].
- b. and David did so, too.
- (20) The car was always getting dirty and it was Billy's job to wash it. Last month his mom washed it for him₁ [for PRO₁ working so hard in school]
- a. and yesterday his dad did so, too.
- b. and yesterday his dad did so [for PRO₁ passing his biology exam].

Even response clauses associated with *blame*-class verbs sometimes behave as VP adjuncts, not as arguments, whether PRO is controlled by the main clause object, as in (21), or whether control shifts to the subject, as in (22).

- (21) Peter thanked/praised Justin₁ [for PRO₁ eating all of his dinner],
- a. and Jill did so [for PRO₁ cleaning up after himself].
- b. and Jill did so, too.
- (22) Sara₁ thanked the principal [for PRO₁ being allowed to go to the dance],
- a. and Tyler₂ did so [for PRO₂ being allowed to read in the library instead].
- b. and Tyler₂ did so, too.

Interestingly, both (18) and (22) require sloppy identity under ellipsis, which is suggestive of OC. Landau (2017) claims that OC in adjuncts is always predicative. Therefore, at least these response clauses must be exhibiting predicative OC. But once again, if response clauses were strictly predicative OC, then we would expect attachment site to strictly determine controller, which is not the case.

Further evidence that response clauses cannot be strictly predicative OC is the fact that controller choice is not limited to c-commanding arguments. First, response clauses allow implicit control, which we have seen is NOC. In (23a), PRO may refer to the implicit recipient of the medal. Example (23b) shows the same

thing, but uses a pronoun to remove the possibility that the response clause adjoins within the object DP.⁴

- (23) a. They awarded a medal [for PRO winning the contest].
 b. They awarded it [for winning the contest].

Second, in at least some contexts, response clauses allow non-commanding controllers, as (24) demonstrates. If control of response clauses were strictly predicative, then there would be no way for the embedded possessor to control PRO.

- (24) a. I left them in [her₁ locker] [for PRO₁ being so kind to me].
(Stromdahl, 2018)
 b. I put roses on the front porch of her₁ house [for PRO₁ being so kind to me].

The fact that sloppy identity was required under ellipsis (see (18) and (22)) is evidence for OC in at least some response clauses, but we have seen that this cannot be strict predicative OC. It is also in principle possible under the TTC

⁴ Note that implicit control is not always possible for response clauses. In (i), PRO requires an explicit antecedent (Alexander Williams, p.c.).

- (i) The dog barked *(at someone₁) [for PRO₁ approaching the house too quickly].

I will not attempt an explanation of when implicit control will be available, but note that implicit control was also not always available for RatCs (compare (ii) to (iii)) or for temporal adjuncts ((iv) vs. (v)).

- (ii) The ship was sunk [PRO to collect the insurance].
 (iii) *The ship was sunk [PRO to become a hero].
 (iv) Those lemons tasted especially sour [after PRO eating sugar].
 (v) *My iPad was stolen while [PRO distracting me].

for logophoric control to be OC, but even if control in response clauses were strict logophoric OC, the account would face several problems. First, this would require the adjuncts to be selected by some element of the matrix clause. Under the TTC, this is the only way for the AUTHOR and ADDRESSEE of the embedded context to be fixed as the matrix attitude holder and their audience. Although one could argue that this is the case for *blame*-class predicates, it cannot be the case that all response clauses are selected. Furthermore, (21) and (22) provide evidence that even for the *blame*-class, response clauses may behave syntactically as adjuncts.

A second major problem for positing strict logophoric OC in response clauses is illustrated in (25). PRO in response clauses allows inanimate controllers. Under the TTC, this can only be predicative control; logophoric control requires animate controllers, since only animate entities can be logophoric centers of the context.

- (25) a. The book₁ was praised [for PRO₁ showing how, and under what circumstances, a religion grows].⁵
- b. I included this book₁ in the book fair [for PRO₁ being so well written].

Because there is evidence that control in response clauses must sometimes be predicative and sometimes logophoric (assuming a TTC framework), we are left with the conclusion that response clauses allow either, consistent with the generalization that adjuncts allow both OC and NOC.

I conclude my discussion of response clauses with a brief note about the effects

⁵ https://en.wikipedia.org/wiki/Jane_Shaw

of attachment site. We saw above that the height of the response clause can affect controller choice. This may be in part because it determines which predicative controllers are possible, but it also may have an effect on the interpretation of logophoric control. It may be the case that attachment site is not determining a syntactic controller, but what the coherence relation between the two clauses will be. If the adjunct in (13), repeated in (26) is attached high, then it will be understood to be giving an explanation for why Mickey got to do something. If it attaches low, then it will be an explanation for why the cake was baked for Minnie. These coherence relations would then determine who the understood referent of PRO is, similar to the way coherence can determine interpretation of overt pronouns (Hobbs, 1979; Kehler et al., 2008).

- (26) Mickey₁ had/got to bake Minnie₂ a cake for PRO_{1/2} doing so well on the test.

This explanation is even more likely given the fact that overt pronouns have the same interpretive restrictions as PRO in response clauses (A. Williams & Green, 2017), as seen in (27).

- (27) a. #Abe₁ married Sue for PRO₁/his₁ writing nice poems.
(A. Williams & Green, 2017, p. 242)
b. Sue married Abe₁ for PRO₁/his₁ writing nice poems.
(A. Williams & Green, 2017, p. 242)
c. Jack₁ brought Sharon₂ flowers for PRO_{1/2}/his₁/her₂ working so late.

4.2.1.2 *Object-gap purpose clauses*

Another adjunct that allows both OC and NOC is the object-gap purpose clause (OPC). Purpose clauses (PCs) contain one obligatory gap that is coreferential with the theme argument of the matrix clause (Jones, 1991; Kawasaki, 1993; Whelpton, 1995). In OPCs, the obligatory gap is in the object position of the embedded clause. The subject may contain an additional empty category (PRO), which is generally coreferential with the indirect object of the main clause, if one is present (28a), or otherwise with the main clause subject (28b). Lexical subjects are also possible (28c).⁶

- (28) a. Chandler bought Monica₁ a new frying pan₂ [PRO₁ to cook with *t*₂].
 b. Monica₁ bought a new frying pan₂ [PRO₁ to cook with *t*₂].
 c. Chandler bought a new frying pan₂ [for Monica to cook with *t*₂].

Several authors have claimed that the dependency between the PRO subject of an OPC and its antecedent is OC (e.g. Nishigauchi, 1984; Kawasaki, 1993; Landau, 2013; Hallman, 2015). Evidence in support of OC being possible is that only sloppy identity is available under ellipsis in (29a), which can only be used to say that Chandler got his new frying pan with the intent of cooking with it himself. Also, PRO can only have a bound interpretation when controlled by an *only*-DP. Example

⁶ Many authors agree that the object gap in an OPC is the result of empty operator movement to the CP, illustrated in (i) (Chomsky, 1980; Williams, 1980, 1992; Whelpton, 2002).

(i) [_{CP} *Op*₁ [_{TP} PRO to... *t*₁...]]

For simplicity, I do not include this operator in the examples in the main text.

(29b) entails that no one else bought a frying pan to cook with themselves; it is still true in a situation where both Monica and Chandler bought frying pans intended for Monica's cooking.

- (29) a. Monica₁ bought a new frying pan [PRO₁ to cook with *t*], and Chandler₃ did, too.
- b. Only Monica₁ bought a new frying pan [PRO₁ to cook with *t*].

But there is also strong evidence that NOC is sometimes possible. For example, the PRO subject of an OPC can have a non-c-commanding or syntactically absent controller ((30a) and (30b), respectively).

- (30) a. I left it₁ in [her₂ mailbox] [PRO₂ to look over *t*₁ once she returned from the Bahamas]. (modified from Stromdahl, 2018)
- b. They₁'re kept in the overhead compartment [PRO to use *t*₁ in case of an emergency]. (modified from Stromdahl, 2018)

OPCs therefore allow both OC and NOC, similar to other adjuncts seen.

4.2.1.3 *Absolutives*

A final adjunct that appears to allow both OC and NOC is the absolute clause. These adjuncts adjoin as bare participial phrases, as in (31). Pires (2007) argues that absolute adjuncts are OC, based on many of the tests used to classify

temporal adjuncts as such (see §2.2). For example, in (31a), PRO’s controller must c-command it.

- (31) a. [Peter₂’s daughter]₁ went on to college, [PRO_{1/*2} being the best student in the class]. (Pires, 2007, p. 197)
- b. [PRO₁ Having come this far], I₁ can’t go back.

However, non-c-commanding controllers are possible given the right context. In (32), PRO can refer to the speaker. This is especially true when the adjunct is left-adjoined, but it is also possible, if slightly more marginal, when it is right-adjoined. Absolute clauses therefore also appear to conform to the generalization that adjunct control allows both OC and NOC.

- (32) a. [PRO Sitting in class the day after the party], my eyes refused to stay open.
- b. ?My eyes refused to stay open, [PRO sitting in class the day after the party].

4.2.2 Adjuncts with only NOC: Speaker-oriented adverbials

The previous adjuncts pattern with temporal and rationale adjuncts, but there may be some that differ, in seeming contrast to the predictions of the TTC. Here I discuss speaker-oriented adverbials, which seem to be restricted to NOC. Speaker-oriented adverbials represent the speaker’s evaluation of the proposition denoted by the matrix clause or the speaker’s degree of certainty about that proposition’s truth

(Ernst, 2009). These adverbials can surface as an adverb, as in (33a), an infinitive verb phrase, as in (33b), or a participial phrase, as in (33c).

- (33) a. Honestly, Jon would be better off without Mary.
 b. [PRO To be honest], Jon would be better off without Mary.
 c. [PRO Judging from experience], Jon will be better off without Mary.

PRO in (33b,c) refers to the speaker of the utterance. It cannot be coreferential with the main clause subject, unless that subject also refers to the speaker. These adjuncts must therefore be NOC. The same interpretation obtains if the adjuncts are adjoined to the right.

- (34) a. Jon would be better off without Mary, honestly.
 b. Jon would be better off without Mary, PRO to be honest.
 c. Jon will be better off without Mary, PRO judging from experience..

According to Cinque (1999), evaluative and evidential adverbs attach high in the structure, to functional projections well above the TP. If speaker-oriented adverbials containing control structures also attach high, then no argument of the sentence would be in a c-commanding position to bind PRO, and OC by an argument of the main clause would be impossible. Under the TTC, the adjunct could in principle adjoin with either a predicative or a logophoric structure, but only logophoric NOC would lead to a convergent derivation. With a predicative structure, the predicate would have no argument to be applied to and would remain unsatu-

rated. These adjuncts therefore do not pose a serious challenge to the predictions of the TTC.

4.2.3 Adjuncts with only OC

There also appear to be some adjuncts that are strictly OC. This again seems to contrast with the predictions of the TTC. Under the TTC, strict OC is only predicted if the structure and/or context of evaluation of the adjunct is selected by some element of the matrix clause. Otherwise, it should be able to freely adjoin with either a predicative or a logophoric structure with a free context of evaluation. If, however, what appears to be an adjunct is actually a(n optionally) selected argument of the matrix verb, then strict OC would be possible. This indeed seems to be the case for some OC “adjuncts.” Others, however, present a genuine challenge to the TTC, as they appear to display strict OC, and yet it is highly unlikely that they are selected by any element of the matrix clause.

4.2.3.1 *Goal clauses*

One adjunct that may be strictly OC is the goal clause, illustrated in (35) (Landau, 2013). To the best of my knowledge, these adjuncts do not allow NOC.

- (35) a. Max₁ works hard [PRO₁ to stay out of jail]. (Landau, 2013, p. 221)
b. Max₁ works hard [PRO₁ to avoid doing any work].

There is some evidence that goal clauses adjoin within the VP. In (36), the goal clause must be included in a *do so* anaphor. The intended interpretation of

(36) is that Max puts great effort into avoiding confrontation, and Billy puts great effort into avoiding exerting himself. Note that this is distinct from the similar (37), which contains a RatC and has the meaning that Max literally works hard, and so does Billy. Unlike the goal clause in (36), the RatC in (37) adjoins outside the VP, and can therefore be excluded from a *do so* anaphor's interpretation.

(36) *Max works hard [to avoid confrontation] and Billy does so [to avoid exerting himself].

(37) Max works hard (in order) to earn a living, and Billy does so (in order) to use up excess energy.

It is not implausible that the goal clause adjoins within the VP because it is selected as an (optional) argument of the matrix verb. Goal clauses are compatible with only a small number of matrix predicates (such as *work hard* and *labor diligently*), and the interpretation is similar to cases generally analyzed as complement control, such as (38).

(38) Max₁ tried hard [PRO₁ to stay out of jail].

If goal clauses are arguments of the matrix verb, merged within the VP, then the TTC could allow strict OC. The main clause predicate would select the goal clause with a predicative structure, being a non-attitude predicate. This is in contrast to unselected adjuncts adjoining higher in the structure, like temporal and rationale adjuncts, which can adjoin with either a predicative or logophoric structure..

4.2.3.2 *Result clauses and stimulus clauses*

Two other adjuncts that may be strictly OC are result clauses (39) and stimulus clauses (40) (Huettner, 1989; Landau, 2013).

- (39) a. The damp₁ seeped in [PRO₁ to chill our bones].
(Huettner, 1989, p. 26)
b. Harry₁ grew up [PRO₁ to be a famous wizard].
c. Ron₁ awoke [PRO₁ to find the fire had gone out].
- (40) a. Ginny₁ smiled/shuddered [PRO₁ to think what a fool she had been].
b. Hermione₁ blushed [PRO₁ to recall her flirtations with Ron].
c. Fudge₁ gnashed his teeth [PRO₁ to think of Sirius's escape].

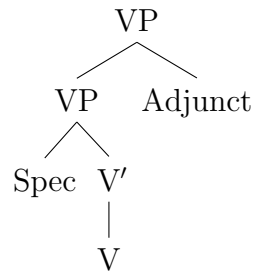
If these really are strictly OC, the TTC would have to say that they, too, are not really adjuncts, but (optional) selected arguments of the main verb. Intuitively, this seems less likely for these clauses than for goal clauses. But like goal clauses, result and stimulus clauses must be included in the interpretation of a *do so* anaphor, which generally is taken as an indication of argumenthood.

- (41) a. *Harry grew up [to be a famous wizard], and Dudley did so [to be a nice guy].
b. *Ginny smiled [to think what a fool she had been], and Hermione did so [to think how smart she had been].

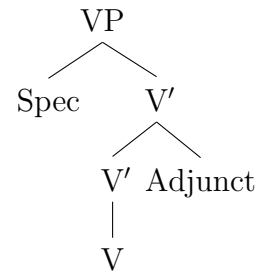
- c. *Ginny shuddered [to think what a fool she had been], and Hermione did so [to think how silly she must have looked].

However, Whelpton (1995) suggests that *do so* does not target the verb and its arguments directly, but simply the VP node, and furthermore, that some adjuncts may Chomsky-adjoin to the VP, as in (42a), but, crucially, that other adjuncts may adjoin to a V' level, as in (42b). Adjuncts Chomsky-adjoined to the VP may be optionally included in the interpretation of *do so*, as the elided constituent could be either the lower or higher VP. V'-adjoined adjuncts, on the other hand, would obligatorily be included in *do so*, despite their being adjuncts.⁷

(42) a. *Chomsky adjunction*



b. *V' adjunction*



If result or stimulus clauses are true adjuncts adjoined with the structure in (42b), then the TTC would have no explanation for why they exhibit strict OC. Despite their being located within the VP, they would be unselected by the verb, and there should be no restriction on their adjoining with either a predicative or a logophoric structure.

⁷ A similar distinction could also be made even in Bare Phrase Structure (Chomsky, 1995; see also Hornstein, 2008), since in (42a), the adjunct adjoins higher than the specifier, and in (42b), it is lower.

4.2.3.3 *Subject-gap purpose clauses*

Subject-gap purpose clauses (SPCs), such as the one in (43), are similar to OPCs, but the obligatory gap coreferring with the theme of the matrix clause is in subject position, and there are no other gaps.⁸

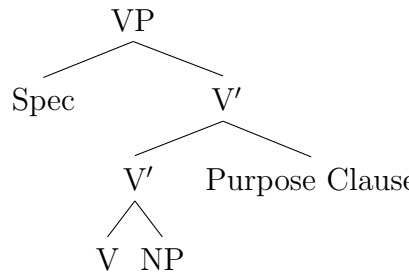
- (43) Harry brought Hermione₁ along [PRO₁ to deal with the security guards].

SPCs allow inanimate controllers, in contrast to OPCs, which is indicative of OC.

- (44) a. I bought the shelf₁ [PRO₁ to hold books]. (Williams, 1992, p. 317)
 b. I bought this blender₁ [PRO₁ to help me make split pea soup].

(Landau, 2015, p. 22)

Like the OC adjuncts discussed above, SPCs adjoin within the minimal VP (Jones, 1991; Whelpton, 1995), as illustrated in (45).

- (45)  (Whelpton, 1995, p. 107)

Once again, it seems unlikely that all SPCs are selected by some element of

⁸ Many discussions of SPCs (e.g. Jones, 1991; Whelpton, 2002) maintain that the empty category in an SPC is an operator that raises to Spec-CP, just like the object gap in an OPC (see Footnote 6). I continue to use PRO here for convenience, but neither the MTC nor the TTC posit that PRO is a distinct syntactic entity. Under the TTC, it is in fact something like an operator-variable pair, once it raises to Spec-FinP. Under the MTC, OC PRO will be a trace of movement, and according to Nunes (2001), the same is true of variables bound by a null operators.

the matrix clause, and control in SPCs under the TTC is predicted to be either OC if the adjunct is adjoined with a predicative structure or NOC if a logophoric structure is used instead. It is clear that OC is possible, but I have no evidence that NOC is as well. If they are indeed strictly OC, then the TTC has no satisfactory explanation of why that would be so.

4.2.3.4 *Telic clauses*

A final adjunct that is restricted to OC is the telic clause. Telic clauses, illustrated in (46), express the outcome of the event denoted by the modified verb.⁹

- (46) a. Harry₁ nervously opened the letter, [only PRO₁ to discover it wasn't actually for him].
- b. It₁ was sunny outside all morning, [only PRO₁ to start raining right when we decided to go to the park].
- c. Due to our diligent firefighters, the historic mansion₁ remained untouched by the wildfire, [only PRO₁ to be destroyed by an earthquake three months later].

These adjuncts, also known as “outcome” clauses, have received little attention in the literature. Where they have been discussed, they have been classified as OC by the matrix subject (Huettnner, 1989; Whelpton, 1995; Landau, 2013). That OC is possible is made evident by (46b,c), which have inanimate controllers. In addition,

⁹ See Whelpton (2001) for a detailed discussion of telic clauses and their semantic properties.

(47) demonstrates that implicit control is not possible, which provides further, albeit not conclusive, evidence for strict OC.¹⁰

- (47) a. *The meal was devoured, only PRO to discover it was poisoned.
b. The side-door on the plane was opened [only *(for me) to realize that my parachute wasn't fastened properly].

But, to reiterate, strict OC is unexpected under the TTC, unless the structure of the adjunct is selected by some element in the matrix clause, which seems unlikely. If the adjunct is not selected, the TTC predicts that NOC be should possible given the right context.

The challenge that telic clauses present for the TTC is even greater than it was for result, stimulus, and subject-gap purpose clauses. These adjuncts were shown to adjoin within the VP, behaving syntactically as pseudo-arguments and making the claim more feasible that their structure is selected by the matrix verb, as would be required by the TTC for strict OC. However, telic clauses can adjoin to a huge variety of predicates, and are unlikely to be included as an optional argument of each. Furthermore, they adjoin too high in the structure to be considered verbal arguments. Example (48) demonstrates that temporal PPs such as *on Monday* are Chomsky-adjoined to the VP; they can either be stranded outside of a *do so* anaphor, or included in its interpretation. Whelpton, 1995 uses VP fronting as

¹⁰ This kind of evidence cannot be taken as conclusive because the implicit control in these examples could potentially be ruled out for other reasons. As noted above, even adjuncts that allow implicit control in some instances do not always. It may be the case that other examples diagnostic of NOC are eluding me.

an additional diagnostic for elements being associated with the VP. In (49), the temporal modifier can be fronted along with the VP and its arguments.

- (48) a. Rachel [_{VP} [_{VP} prepared some pasta] on Monday], and Monica did so
on Tuesday.
- b. Rachel [_{VP} [_{VP} prepared some pasta] on Monday], and Monica did so,
too.

- (49) Rachel asked Monica to prepare her some salmon on Monday, so prepare
her some salmon on Monday, Monica did.

Telic clauses, however, cannot front with the VP, as (50c) makes plain. Based on this kind of evidence, Whelpton argues that telic clauses adjoin outside the VP, at the IP level, well beyond the selectional domain of the verb.

- (50) a. Chandler asked Monica to prepare him some spaghetti, so she made
him spaghetti, only to realize that he actually wanted linguine.
- b. ...so make him some spaghetti, she did, only to realize that he actually
wanted linguine.
- c. *...so make him some spaghetti, only to realize that he actually wanted
linguine, she did.

Because telic clauses cannot be feasibly selected by the matrix verb, they remain a striking problem case. Although the TTC predicts that they should allow both OC and NOC, only OC appears to be possible.

4.3 The movement theory of control

Landau’s (2017) analysis of control of temporal and rationale adjuncts, situated within the TTC, predicts that all adjuncts should allow both OC and NOC. This account can therefore, of course, be easily extended to adjuncts where this is true. The TTC struggled, however, with certain adjuncts that appear to exhibit only OC, but are unlikely to be selected as arguments of the matrix verb. This section demonstrates that the duality of adjuncts with respect to OC and NOC distribution is not contingent on Landau’s (2015, 2017) implementation of control. With minimal assumptions, the Movement Theory of Control (MTC) does just as well as the TTC. In fact, when phase theory is taken into account, the MTC does better than the TTC at explaining some cases of strict OC.¹¹

4.3.1 Background on the MTC

The MTC (Hornstein, 1999; Boeckx et al., 2010, a.o.) is prototypical of many syntactic theories of control in that it establishes a specific syntactic dependency (in this case movement) between PRO and its antecedent in OC structures. In short, OC differs from NOC in that in the former, what is traditionally labeled PRO is the trace of movement of the controller from the embedded to the matrix clause, while in the latter, PRO is the null pronominal *pro*. This is implemented as follows.

The MTC allows a DP chain to receive more than one θ -role, in contrast to previous theories assuming a traditional θ -criterion (Chomsky, 1981) limiting

¹¹ See Boeckx et al. (2010, ch. 7) for a broader discussion on problems with selectional theories of control.

DP chains to a single role. OC is the result of movement from one θ -position to another. A DP-trace is called ‘PRO’ when it occurs in the lower θ -position, but the term ‘PRO’ has no other theoretical significance. Example (51) illustrates how this works. Here, *Jon* moves from the subject position of the embedded *buy* to the subject position of the matrix *want*, receiving the θ -feature of both verbs. In this way, *Jon* is understood as both the wanter and the buyer in the sentence.

(51) Jon₁ wants [~~Jon~~_T to buy a car].¹²

OC in adjuncts is handled with the same mechanism, i.e. the controlled element and the controller are two links in an A-chain. The only difference is that adjunct control requires what has been called *sideward movement* (Nunes, 1995), in which an element can move from one syntactic object to the root of another within a single derivation, as illustrated in (52).¹³

(52) *Derivation of adjunct control* (simplified from Boeckx et al., 2010, p. 88)

a. *Applications of select, merge, and copy:*

Num = John₀, T ^{ϕ^+} ₁, saw₀, Mary₀, after₀, T ^{ϕ^-} ₀, eating₀, lunch₀

PP = [after John T ^{ϕ^+} eating lunch]

VP = [saw Mary]

b. *Copying of John:*

¹² This derivation has been greatly simplified. *Jon* would be merged as the specifier of a little *v* in the embedded clause, receiving the external θ -role of *buy*. It would then move to the embedded spec-TP for EPP reasons, then to the matrix *v*, receiving the external θ -role of *want*, and finally to spec-TP of the matrix clause, for Case and EPP.

¹³ These derivations use machinery of the Minimalist Program. ‘Num’ refers to the Numeration (Chomsky, 1995).

PP = [after John $T^{\phi+}$ eating lunch]

VP = [saw Mary]

N = John

c. *Merger of John and VP:*

PP = [after John $T^{\phi+}$ eating lunch]

VP = [John saw Mary]

d. *Applications of select, merge, and copy, and deletion in phonological component:*

Num = John₀, $T^{\phi+}$ ₀, saw₀, Mary₀, after₀, $T^{\phi-}$ ₀, eating₀, lunch₀

TP = [John [$T^{\phi+}$ [_{VP} [_{VP} ~~John~~ saw Mary][_{PP} after ~~John~~ $T^{\phi-}$ eating lunch]]]]

NOC interpretations arise under the MTC when the null subject of the controlled clause is not a trace of movement, but is instead the null pronoun *pro* more commonly seen in *pro*-drop languages.

4.3.1.1 *Why OC is preferred over NOC, but not required*

Under the MTC, movement resulting in OC and pronominalization resulting in NOC are constrained by principles of economy. According to Hornstein (1999, 2001, 2003), pronominalization is more “costly” than movement, and is only possible as a last-resort option when movement is blocked. However, the last-resort status of pronominalization as originally formulated is too strong, as it would rule out any case of NOC in adjuncts in favor of OC by the matrix subject, which could arise

through sideward movement. Boeckx and Hornstein (2007) acknowledge a similar problem. If pronominalization were strictly last-resort, then (53a) should be ruled out due to the availability of (53b), which Hornstein and Kiguchi (2003) argue arises through movement.

- (53) a. John₁ said that [*pro*₁ washing himself₁ delighted Mary].
 b. John said that [PRO₁ washing herself₁ delighted Mary₁].

In order to allow both (53a,b), Boeckx and Hornstein (2007) propose that pronominalization is only ruled out when movement could not establish the same interpretation (see also Boeckx et al., 2010). Thus, NOC is not always ruled out by the grammar when OC is available, as long as NOC results in an interpretation that OC could not have.¹⁴ However, OC interpretations may also be preferred more generally. Boeckx and Hornstein assume that parsers are transparent with respect to grammars, meaning that if a grammar has a preference, then the parser will respect that preference. When a comprehender reaches a gap in the incremental processing of a sentence with a control structure, they will prefer to posit a trace of movement if possible rather than a null pronoun, all things being equal. The pronominalization and interpretation in (54b) is not ruled out by the grammar, but because parsers would prefer to posit a trace as the null subject of the adjunct, resulting in (54a).

- (54) a. John₁ kissed Mary₂ without PRO_{1/*2} getting embarrassed.

¹⁴ This idea is similar to what Reinhart (1983) proposed for bound versus free variables, as discussed in §2.4.2.2.

- b. John₁ kissed Mary₂ without *pro*_{*1/2} getting embarrassed.

The strong preference for OC interpretations in adjunct control is therefore due to in part to a grammatical constraint requiring OC if it is possible for a given interpretation,¹⁵ and in part due to a parsing preference (resulting from the grammatical constraint) for positing traces over null pronouns in incremental processing. This combination results in a general preference for OC over NOC.

Boeckx and Hornstein (2007) and Boeckx et al. (2010) argue that parsers are *completely* transparent to grammatical constraints, and that if positing a trace in a given position is possible, parsers must do so. This would explain why examples such as (55) only seem to allow OC by the matrix subject, even when it results in a strange interpretation. Upon encountering the empty category in the adjunct, it is possible to posit a trace linked to the matrix subject, and so parsers must do so.

(55) #The bank₁ was robbed [while PRO_{1/*2} being smart not to raise the alarm].

(Landau, 2017, p. 7)

However, this does not explain why the same is not true in either of the examples in (56). Evidently, parsers are able to override the preference for a trace in at least some circumstances, even when a trace in the relevant position would be possible.

¹⁵ This explanation has the consequence that all cases of subject control in adjuncts must be OC, inasmuch as sideward movement from the adjunct to the subject position of the matrix clause is licit, but that any non-subject control interpretation must be NOC.

- (56) a. The president₁ was elected [without PRO_{1/2} considering his competence]. (Roeper, 1987, p. 297)
- b. The potatoes₁ were tastier [after PRO_{#1} eating carrots].

The idea that the preference for OC in general is due to a parsing preference, and not a grammatical constraint, fits well with the data given above demonstrating that structural properties of the sentence cannot fully determine when NOC will be possible. Structural, discourse, and processing factors may all compete in determining whether NOC is possible. An example of the interaction of such constraints is given in Boeckx and Hornstein (2007). It was argued that NOC is available in (53a) despite the availability of OC in (53b) because at the point where the empty category is encountered, if parsers posited a trace, they would not yet be able to assign it a referent; the only positions that something could have moved to from that position come later in the sentence. The preference to quickly assign reference to dependent elements (see, e.g. Nicol & Swinney, 1989; Badecker & Straub, 2002) is in competition with the preference for a trace. This competition results in the possibility of either a trace or a pronominal being posited, depending on which preference is favored. Similar competition may be involved in NOC cases of adjunct control.

4.3.1.2 *Why complement control differs*

The MTC assumes that OC is preferred over NOC in complements for the same reason that it is in adjuncts. A grammatical constraint rules out NOC for

any interpretation that could have arisen through movement, and since parsers are transparent to the grammar, a parsing preference will rule out any NOC interpretation when an OC one is available. However, for adjuncts, but not for complements, this preference can be overridden in the proper context. It is not clear why complements and adjuncts should differ in this respect under the MTC, but one possibility is that sideward movement, which is involved in the derivation of adjuncts, may for some reason be more “costly” than upward movement, which takes place in complement control. If that is true, then the additional cost of sideward movement may be enough to reduce the parser’s preference for traces over *pros* in adjuncts. This would lead to the preference scale for the derivation of control represented in (57).

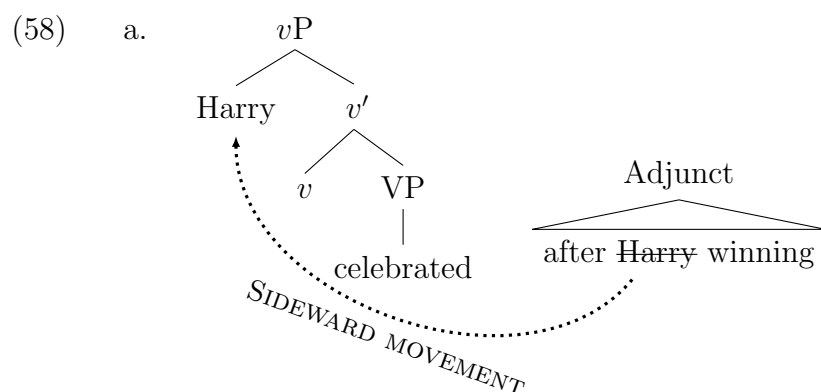
(57) *Preference scale for derivations of control:*

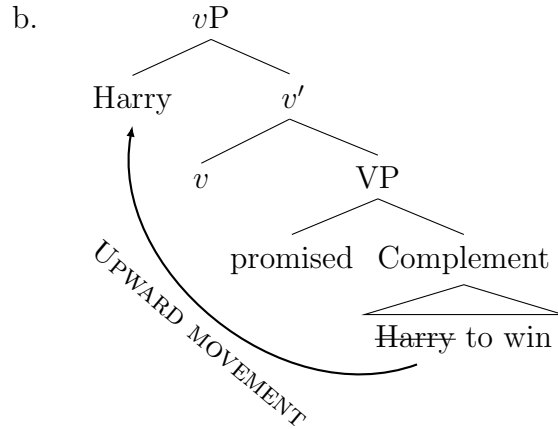
upward OC \gg sideward OC \gg NOC via pronominalization

But what is the source of the preferences in (57)? Why would sideward movement be more costly than upward movement? As discussed above, the preference for OC over NOC is in large part due to processing preferences. This accounts for why NOC is lowest on the scale. Might the preference for upward versus sideward movement also be the result of processing biases? Perhaps sentences involving sideward movement are simply more difficult to process than sentences with upward movement. One reason why this might be the case begins with the fact that adjuncts are optional. Because they are optional, perhaps they are less predictable. And if they are less predictable, a comprehender will have less of an expectation, at the matrix

verb, of needing to form a control dependency, than when the verb selects a control complement. But then again, even if this is true, why should online predictability have anything to do with what interpretations are licit or available offline? There is no logical connection here, so the effect would simply have to be stipulated. Unlike the preference for OC over NOC, this effect cannot be reduced to other known parsing preferences, such as the preference for local antecedents over distant ones or the preference for syntactic versus discourse dependencies. Therefore, stating that (57) is due exclusively to processing preferences is tenuous.

It is also not immediately clear what grammatical constraints would result in (57). In terms of the Minimalist Program, both upward and sideward movement involve copy and re-merger of an element of the growing syntactic structure. Neither involves more steps or even different underlying operations that could lead to a greater cost. There is only one real difference between the two, so therein must be found the cost difference: sideward movement involves copying an element from one tree and moving it to the root of another, as in (58a), while upward movement involves copying from and re-merging to the same tree, as in (58b).





Perhaps sideward movement incurs a derivational penalty akin to the one that has been posited for moving out of islands (Chomsky, 1972; Lasnik, 2001). Although I do not speculate here on the exact nature or source of this penalty, let us simply suppose by hypothesis that there is a penalty for moving an element from within one tree to the root of another, unconnected tree. Suppose, furthermore, that this penalty is weak,¹⁶ and does not cause the derivation to crash, but instead results in a lower “degree of grammaticality” (Epstein, 1990; see also Chomsky, 1965, 1986; Lasnik & Saito, 1984). Because both upward and sideward movement can lead to convergent derivations, both may result in grammatical strings; those involving sideward movement would simply be lower on the scale between fully grammatical and fully ungrammatical.

If this hypothesis is on the right track, the preference for upward OC versus sideward OC is due to a weak grammatical constraint against movement to a non-commanding position. If there is some performance penalty associated with this grammatical violation, then the lower grammatical status of sideward OC would

¹⁶ See Chomsky (1965), Epstein (1990) for a discussion on different types of violations resulting in penalties of differing strength.

make its appeal relative to NOC weaker than upward movement's. This in turn would lead to a greater probability of both OC and NOC being accepted in adjuncts involving sideward movement than in complements, in which movement is upward.

Admittedly, positing that sideward movement is grammatically more costly than upward movement is somewhat stipulative. But something like it as part of the scale in (57) would be required in order to capture the differing availability of NOC in complement and adjunct control under the MTC. Interestingly, sideward movement is also involved in the examples from Boeckx and Hornstein (2007) in (53), repeated in (59), that allow both OC and NOC derivations. This is consistent with the idea that OC derived from sideward movement is less strongly preferred to NOC than OC derived from upward movement is.

- (59) a. John₁ said that [*pro*₁ washing himself₁ delighted Mary].
 b. John said that [PRO₁ washing herself₁ delighted Mary₁].

4.3.1.3 *The interpretation of NOC*

Under the MTC, the interpretation of NOC *pro* is not constrained by the syntax in the way the deleted copy of OC is. Instead, it is free to refer in the same way an overt pronoun would. Although this does not explain why NOC requires the understood antecedent to be a perspective holder in adjuncts, it is also not incompatible with that fact. Boeckx and Hornstein (2004) tentatively suggest that *pro* in NOC may just be a null logophoric pronoun, and as such, it requires its

referent to be a logophoric center in the discourse. Why a logophoric *pro* must appear in NOC, rather than a regular *pro*, however, is left without explanation.

4.3.2 The MTC and other adjuncts

Hornstein (2001) assumes an Uriagereka (1999)-style adjunction in which adjuncts are linearized and therefore become islands before being merged with the main clause (see also Nunes, 2001). If this is the case for all adjuncts, then the MTC makes the same prediction that the TTC made: namely, that all adjuncts should allow both OC and NOC. For the MTC, this will be because all cases of OC of adjuncts will necessarily involve sideward movement. Because this is more costly than upward movement, NOC should be available for all adjuncts given the right context. The MTC will therefore do just as well as the TTC on adjuncts that allow both OC and NOC. And just like the TTC, the MTC as outlined so far struggles with adjuncts that allow only OC. In this section, I outline a proposal for how the MTC can deal with strictly OC adjuncts that adjoin low. Section 4.3.3 will discuss problem cases for the MTC.

Let us first turn to low OC adjuncts. Above it was seen that goal clauses (60a), result clauses (60b), stimulus clauses (60c), and SPCs (60d) all exhibit strict OC.

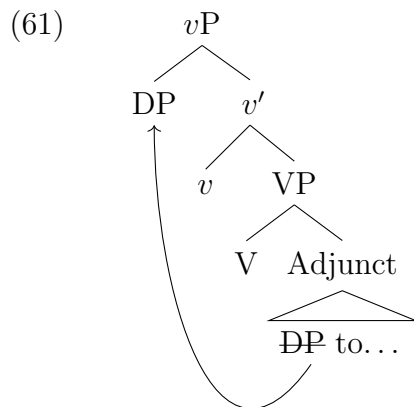
- (60) a. Max₁ works hard [PRO₁ to stay out of jail].
 b. Harry₁ grew up [PRO₁ to be a famous wizard].
 c. Ginny₁ shuddered/smiled [PRO₁ to think what a fool she had been].

- d. I bought this blender₁ [PRO₁ to help me make split pea soup].

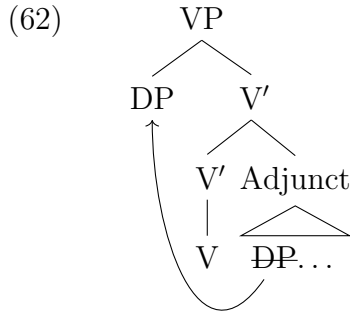
Under the TTC, strict OC would have to be explained by positing that these clauses are not actually adjuncts, but optionally selected arguments of the matrix verb. If they are actually complements, then the MTC need not say anything more. But this seems unlikely, especially for SPCs.

Under the version of the MTC outlined above, strict OC is only expected if upward movement from the ‘PRO’ position to the controller position is possible. There are two requirements that must be satisfied for this to be possible. First, the adjunct must adjoin lower than the base position of the controller, and second, the adjunct must not (yet) be an island to movement. We will look at each of these in turn.

Each of the adjuncts in (60) was demonstrated above to adjoin to the VP. For the adjuncts in (60a,c), this places the adjunct clearly under the merge position of the subject in spec-*v*P, as illustrated in (61).



But what if the controller is not base-generated in the vP , but as an object of V , as is the case with (60b), which has an unaccusative subject controller, and (60d), which has control by the object? Kratzer (1996), following Larson (1988), proposes that direct objects of verbs are base-generated as the specifier of V . If that is the case, and if adjuncts may adjoin to the V' level as Whelpton (1995) argues, then these adjuncts too may adjoin in a position lower than the base position of the controller, as in (62).



If these adjuncts adjoin with the structures in (61) and (62), they are in a position where upward movement from the controllee to the controller positions should be possible. However, we are still left with the problem that these are adjuncts, and, according to Hornstein (2001), Nunes (2001), and Uriagereka (1999), they should become islands prior to or upon adjunction. But in phase theory (Chomsky, 2001), this is not necessarily the case. Let us make the standard assumption that C and v are phase heads. If an adjunct is smaller than a CP , then it should remain active, even after being adjoined, until the next highest phase. Its subject should then be

able to upward move out of the adjunct into the matrix clause before the adjunct becomes an island.

I assume that this is the case for the adjuncts in (60). Goal clauses, for example, are smaller than a CP, as evidenced by the fact that a lexical subject is impossible, in contrast to temporal and rationale adjuncts (see (63)).

- (63) a. *Harry grew up [for him to be a great wizard].
b. Harry went to school [before he became a great wizard].
c. Harry had to go to school [in order for him to become a great wizard].

Therefore, the subject of a goal clause can upward move after adjunction. And because the goal clause adjoins lower than the base position of the matrix subject (see (61)), OC by the matrix subject is possible.¹⁷

This proposal may also work in a convergence-based approach to phasehood (Felser, 2004; Grano & Lasnik, *in press*), in which a constituent is not spelled-out until it has no more unvalued/uninterpretable features. Under the MTC, the subject DP in the adjuncts in (60) have unvalued case features, which motivates their movement to the matrix clause. Therefore, the adjunct will not become an island directly upon adjunction, since it has not yet converged, and upward movement will still be possible.

¹⁷ Note that Hornstein (1999) follows Nunes (1995) in assuming that the Extension Condition (Chomsky, 1995) applies to adjuncts. If this is true, then an alternative derivation, whereby the subject sideward moves out of the adjunct into the matrix clause followed by low, late adjunction, is impossible.

Additional evidence that these adjuncts do not immediately become islands is the fact that CED island effects (Huang, 1982) in them are weak or nonexistent.

- (64)
- a. What₁ did Max work hard [to do t_1]?
 - b. What₁ did Harry grow up [to be t_1]?
 - c. Who₁ did Ginny smile/shudder [to think the poison would kill t_1]?
 - d. What₁ did you buy this blender [to help you make t_1]?

If, as I propose, upward movement is allowed in these adjuncts, leading to strict OC, they must be distinguished from adjuncts in which both OC and NOC are possible. There are two ways this could be done. First, if the adjunct adjoins higher than the base position of the subject, sideward movement will be required, regardless of when the adjunct is spelled-out, since the adjunct will never be in a position in the tree low enough to allow upward movement. Second, low adjuncts with structures at least as big as a CP will also not allow upward movement to the matrix subject position, since the CP adjunct will be spelled-out upon merger of the matrix v .¹⁸ It must therefore be the case that all of the adjuncts discussed above that allow both OC and NOC have one of these two properties. This is at least true for OPCs, which have a CP structure (Chomsky, 1980; Williams, 1980, 1992; Whelpton, 2002), as illustrated in the examples repeated in (65). I leave it to future research to verify that this is the case for other adjuncts.

¹⁸ Although under a convergence-based theory of phasehood, even CPs may allow upward movement if they still contain elements with unvalued features.

- (65) a. Chandler bought Monica₁ a new frying pan₂ [_{CP} Op₂ [PRO₁ to work with *t*₂]].
- b. I left it₂ in [her₁ mailbox] [_{CP} Op₂ [PRO₁ to look over *t*₂ once she returned from the Bahamas]].

4.3.3 Problems for the MTC

The MTC is able to account for adjuncts allowing both OC and NOC, as well as for low adjuncts allowing strict OC—something that that TTC struggled with. However, there are at least two problem cases for the version of the MTC proposed here: telic clauses, which display strict OC, but may adjoin higher than would be required for upward movement, and speaker-oriented adverbials, which display strict NOC.

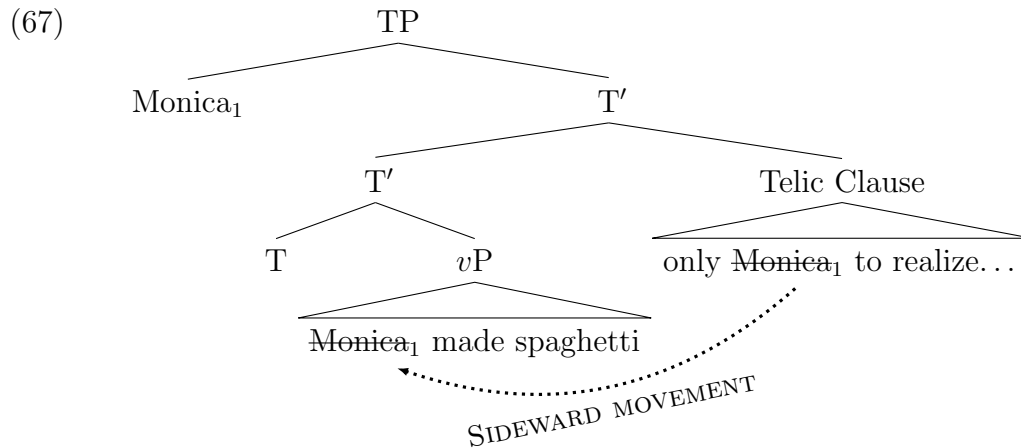
4.3.3.1 *Telic clauses*

Strict OC is unexpected under the MTC, unless the adjunct attaches lower than the base position of the controller and is small enough to be included in the same phase, thus allowing control via upward movement. But as discussed in §4.2.3.4, Whelpton (1995) provides evidence from VP fronting that telic clauses adjoin to the IP level, well outside the merge position of the subject within the *v*P. The relevant examples are repeated in (66).

- (66) a. Chandler asked Monica to prepare him some spaghetti, so she made him spaghetti, only to realize that he actually wanted linguine.

- b. ...so make him some spaghetti, she did, only to realize that he actually wanted linguine.
- c. *...so make him some spaghetti, only to realize that he actually wanted linguine, she did.

Whelpton argues that because telic clauses cannot be fronted with the VP, they must be higher than the (extended) verbal projection, i.e. at the IP level, as illustrated in (67). Because of this, the only way for OC to occur would be through sideward movement.



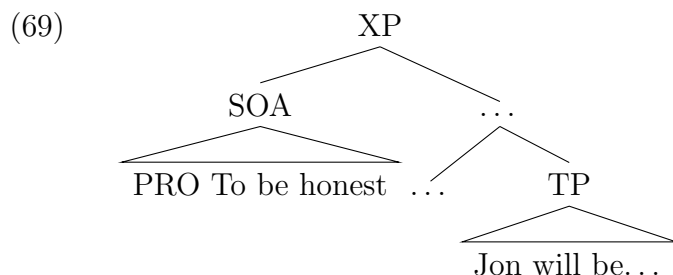
Because sideward movement is required, the account presented here predicts that NOC should be possible in telic clauses given the right context. In order to account for telic clauses, the MTC would either have to say that they attach lower than Whelpton (1995) thought, or provide evidence that NOC is possible. Again, I leave further investigation of telic clauses to future research.

4.3.3.2 *Speaker-oriented adverbials*

Finally, speaker-oriented adverbials like those in (68) present something of a challenge for the MTC. It was noted above that PRO in these adjuncts appears only to be able to refer to the speaker, which is evidence for their being strictly logophoric NOC.

- (68) a. [PRO To be honest], Jon would be better off without Mary.
 b. [PRO Judging from experience], Jon will be better off without Mary.

The TTC can explain this if speaker-oriented adverbials adjoin high in the clause, above the position of the matrix subject, as in (69). In this position, the adjunct is too high for a sentential argument to predicatively control PRO, and therefore, logophoric control is the only option.



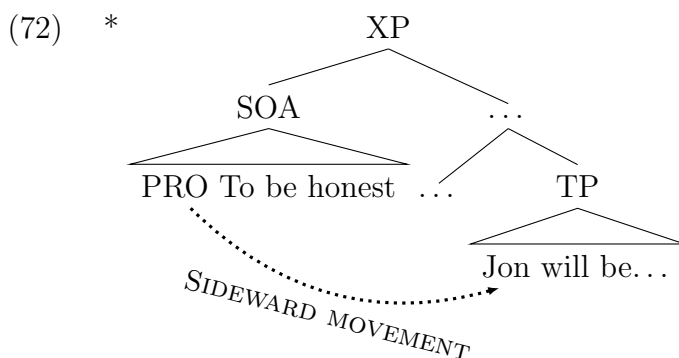
Intuitively, it seems that a similar explanation should be able to apply to the MTC. With the structure in (69), PRO is not c-commanded by any other element of the sentence. Movement out of that position to any position in the main clause would then result in an ill-formed chain, the head of the chain not c-commanding the tail (Chomsky, 1995). Although the same is true initially for all

cases of sideward movement, here the problem is more serious, since even at the end of the derivation, the final position of the moving element does not c-command the trace in the adjunct. However, Hornstein and Kiguchi (2003) argue that c-command is not required for sideward movement. They demonstrate that in examples like (70), which involve sideward movement, PRO's controller does not c-command it, even on the surface, and yet the example demonstrates all the characteristics of OC. And this is not limited to psych-verbs, as might be assumed based on theories such as that of Belletti and Rizzi (1988), since PRO in (71) is also not c-commanded by its OC antecedent (Norbert Hornstein, p.c.).

(70) John said [that [PRO₁ washing herself] delighted Mary₁].

(71) [PRO₁ Brushing her teeth] made Mary₁ late for the movie.

It is therefore not clear why in speaker-oriented adverbials the matrix subject should not be able to sideward move from the adjunct into the main clause.



4.4 Conclusion

In the previous chapters, I argued, agreeing with Landau (2017), that temporal and rationale adjuncts allow both OC and NOC. Many early and some more modern theories of control assumed that OC and NOC were in complementary distribution, and significant theorizing was done to explain that complementarity. For some authors, this distribution was based on the structure of the sentence containing PRO. For Manzini (1983), for example, the distinction was quite general: OC obtained when PRO was in an object clause, and NOC when it was in a subject clause. Similarly, Landau (2000) claimed that NOC was structurally conditioned, only obtaining for VP-external infinitives. For other authors (e.g. McFadden & Sundaresan, 2016; Hornstein, 1999; Landau, 2017, 2018), even if strict complementarity was not part of the theory, it was argued that NOC is only possible where OC is not.

I have shown that the distribution of the two types of control is not so simple. If one defines OC as a syntactic (or predicative) dependency between PRO and its antecedent, and NOC as a non-syntactic one, as Hornstein (1999) and Landau (2017) do, the two types of control are not in complementary distribution; temporal, rationale, and some other adjuncts allow both. However, it is still the case that complements and some adjuncts are strictly OC. Labeling the syntactic version of control as OC is therefore something of a misnomer, as a construction may exhibit syntactic control without syntactic control being obligatory.¹⁹

¹⁹ Landau (2015) makes a related observation. In the TTC, OC need not always involve the same syntactic dependency. In complements, both predicative and logophoric control are OC.

If temporal and rationale adjuncts allow both OC and NOC, a simple hypothesis would be that the same is true for all adjuncts. This is in fact what the discussion in Landau (2017) implies, though the claim is not made directly. This chapter has shown that this hypothesis is too general. Some adjuncts seem to only allow one type of control. Certain adjuncts appear to be strictly OC, while very high ones may be strictly NOC. For the TTC, the strict OC adjuncts can only be accounted for by claiming that they are in fact not adjuncts, but complements. If such is the case, then the matrix verb may select a predicative structure for the adjunct, resulting in strict predicative OC. This claim has some merit for adjuncts like goal clauses, but it is far less plausible for SPCs and telic clauses.

The MTC, on the other hand, combined with phase theory, is able to handle most of the strict OC adjuncts without having to claim that they are complements. If the adjunct adjoins low enough and is not a phase, then it will allow upward movement from the controlled to the controller position. If upward movement makes OC more strongly preferred than sideward movement does, possibly due to sideward movement incurring a weak grammatical penalty that does not ensue with upward movement, then these adjuncts would be expected to require OC just as strongly as complement control does. Despite these successes, the MTC struggles with telic clauses, just as the TTC did. Since telic clauses adjoin higher than the merge position of the matrix subject, upward movement out of the adjunct to the relevant position is impossible. The MTC also has difficulty explaining the interpretation of speaker-oriented adverbials, which are strictly NOC.

Finally, when an adjunct allows both OC and NOC, it is clear that the bound

variable reading of OC is often strongly preferred, although that preference may have different sources based in part on which specific theory of control is espoused. Regardless of what theory of control is chosen, I have provided initial evidence that the preference for OC may be overridden in favor of NOC by (a combination of) various factors, including attachment site and conceptual plausibility.

Unlike the distinction between upward and sideward movement, which I argue has a grammatical basis, the preference for OC is more likely due to performance biases. As a first step in investigating the processing constraints involved, the remainder of this dissertation investigates the real-time processing of adjunct control structures. Although specific interpretive biases are not yet directly examined, the experiments presented do provide foundational knowledge about the timing of the interpretation of PRO. This knowledge will be crucial for future investigations of how different factors and sources of information affect the processing of control. These experiments will also give initial insights into the role of prediction in the the interpretation of control.

Part II

Processing

Chapter 5: Processing adjunct control

The bulk of this dissertation has explored questions about the grammatical constraints governing adjunct control and its syntactic representation. In the next chapters, I investigate questions about how adjunct control is recognized and interpreted in real time. After reviewing some of the questions about adjunct control that have been asked in previous literature in this chapter, Chapter 6 asks about the timing of and the role of prediction in the resolution of PRO in subject-controlled temporal adjuncts. A better understanding of the processing of adjunct control may ultimately yield new diagnostics for questions about the grammar. For example, it may provide new measures for distinguishing syntactic and discourse representations. Or it may provide evidence on the nature of interpretive constraints, including those leading to a preference for OC over NOC. This evidence may show that some constraints that were assumed to be the result of processing biases are not tenable as such, or that other constraints that appeared to be grammatical are actually underlyingly due to processing.

5.1 Previous research on the processing of adjunct control

Much of the prior work on the processing of adjunct control structures has focused on one of the following questions: (i) what can processing measures tell us about the syntactic representation of sentences containing adjunct control? (ii) how fast are control structures processed? and (iii) how accurately is the correct antecedent to PRO retrieved in online processing? This section briefly reviews the literature for each of these questions. Section 5.2 then discusses some of the remaining questions.

5.1.1 Syntactic representation

One goal of previous processing research on adjunct control has been to adjudicate between competing theories of the syntactic representation of passives and implicit control. In a series of papers, Mauner et al. (1995) and Mauner and Koenig (1999, 2000) explored the processing of RatCs adjoined to target clauses with active, long passive, short passive, or intransitive structures, as in (1).

- (1) a. The contestant spun the game show's wheel [to win a prize].
b. The game show's wheel was spun by the contestant [to win a prize].
c. The game show's wheel was spun [to win a prize].
d. The game show's wheel spun [to win a prize].

Using a stop-making-sense task combined with self-paced reading (Mauner et al., 1995; Mauner & Koenig, 2000) or eyetracking-while-reading (Mauner & Koenig,

1999), these studies consistently found that RatCs took significantly longer to process and, where it was measured, that they were judged to make sense significantly less frequently, when adjoined to an intransitive matrix clause than in any other condition. There was no significant difference in the processing or judgments about sentences containing short passives, long passives, or active sentences.

Mauner and colleagues took these processing facts as evidence in support of the presence of a syntactically active implicit agent in short passives. Since there is no difference in the processing of a RatC following either an active or passive, the reasoning goes, it is likely to be the case that both involve the same interpretive constraints, namely grammatical binding of PRO by the agent of the matrix clause. However, in Chapter 3, it was argued that implicit control in RatCs is actually NOC (see §3.2.1.2, specifically). If that is the case, then whether the so-called “implicit agent” is syntactically represented is irrelevant, as it does not enter a syntactic control relation with PRO. These studies also do not provide direct evidence for the interpretation of PRO. It could therefore be the case that the slowdowns in reading and the greater rejection rate of RatCs after intransitives were due not to difficulty in finding an antecedent to PRO, but to other reasons. For example, (1d) may be unacceptable simply because the RatC does not provide a reasonable explanation for the fact expressed by the intransitive clause (see A. Williams & Green, 2017).

McCourt et al. (2015) provide additional experimental evidence that casts doubts on Mauner and colleagues’ conclusions. Using self-paced reading, McCourt et al. compare explicit and implicit control not only in local RatCs, but in remote ones as well, as in (2).

- (2)
- a. The committee interviewed the candidates [just in order to find the best person for the job].
 - b. The candidates were interviewed [just in order to find the best person for the job].
 - c. The committee interviewed the candidates. The reason was [to find the best person for the job].
 - d. The candidates were interviewed. The reason was [to find the best person for the job].

Remote control cannot involve a grammatical OC dependency between PRO and its understood antecedent (see Chapter 3). Because of this, its interpretation must be mediated pragmatically. Therefore, if processing measures such as self-paced reading are able to distinguish between the resolution of syntactic and non-syntactic dependencies, as Mauner and colleagues suggest, then one might expect there to be a difference between the interpretation of remote and (explicit) local control. If, on the other hand, there is no processing difference between local and remote control, then, McCourt et al. argue, the lack of a processing difference between explicit and implicit control in Mauner and colleagues' studies cannot be used to argue for grammatical binding of PRO in the latter.

This is indeed what McCourt et al. find (see Figure 1, their Figure 4). In their Experiment 4, they found similar reading times at the RatC in sentences with explicit and implicit control. Reading times in RatCs in a local configuration trended

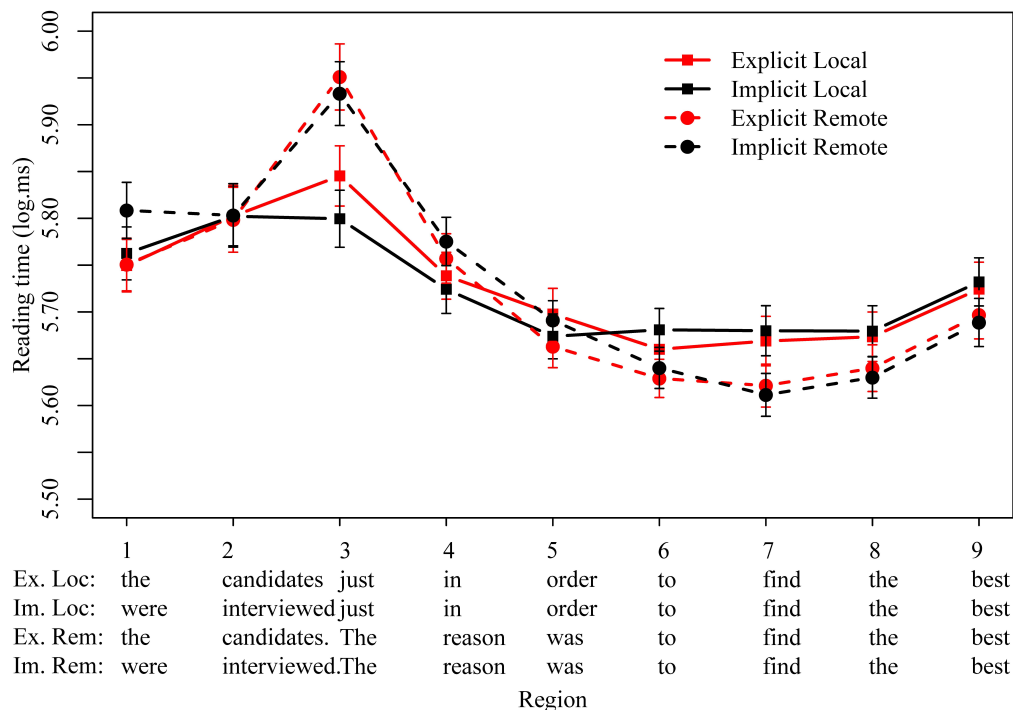


Figure 1: Mean logged reading times (ms) for Experiment 4 in McCourt, Green, Lau, and Williams (2015).

slower than those in a remote configuration at the non-finite verb, but the difference was not significant ($p = 0.07$).¹

McCourt et al. argue that if similar processing profiles reflect anaphoric dependencies of the same type, then control in RatCs must be non-syntactic across the board. Since remote control cannot involve OC, local control must not either. However, the authors acknowledge that this argument relies on self-paced reading times being sensitive to the difference between OC and NOC. It is possible that OC and NOC are not distinguished by processing cost (see Cunnings, Patterson, &

¹ Because there is good independent evidence that implicit control must be NOC, even if the marginal difference between reading times in the local and remote control conditions in McCourt et al. (2015) were meaningful, it still would not reflect a processing difference for OC and NOC. If such an difference were shown, then we would expect local implicit control to pattern with the remote control conditions.

Felser, 2014). Therefore, McCourt et al. conclude that their results either provide evidence that RatCs are always NOC, which I argue in Chapter 3 is not the case, or that they at least undermine Mauner et al.’s arguments for OC in implicit control. A third possibility, once again, is that PRO was not actually being interpreted in these experiments. It could have been that comprehenders were at least initially only shallowly interpreting the RatCs, being content to leave final resolution of PRO until later, and only if it should prove to be necessary.

One other effect that McCourt et al. (2015) briefly note is the role of prediction in the processing of RatCs. In their Experiment 3, they found that when the local RatCs were prefaced not by *just in order*, but by a neutral temporal modifier, as in (3), reading times in the local conditions were significantly slower than in the remote conditions. This was taken to reflect a speed-up in the remote conditions due to the subject of the remote clause being predictive of a RatC. Although this experiment did not specifically manipulate predictiveness, it does suggest that prediction of an upcoming structure led to facilitation in processing, supporting a large body of literature on the role of prediction in sentence processing (see, e.g. Kamide, Altmann, & Haywood, 2003; Yoshida, Dickey, & Sturt, 2013; Kehler & Rohde, 2013).

- (3) a. The committee interviewed the candidates [three days ago to find the best person for the job].
- b. The candidates were interviewed [three days ago to find the best person for the job].

5.1.2 Speed of processing control structures

Another body of work has focused on the speed of processing control structures. In contrast to pronouns, there has been relatively little work on the timing of the resolution of PRO. And the majority of what we do know comes from studies of complement control as in (4), rather than adjunct control (5).

- (4) a. Mickey₁ managed [PRO₁ to eat].
b. Mickey₁ promised Minnie [PRO₁ to eat].
c. Mickey persuaded Minnie₁ [PRO₁ to eat].
- (5) Mickey₁ talked to Minnie [before PRO₁ eating].

Studies on complement control (e.g. Boland, Tanenhaus, & Garnsey, 1990; Demestre, Meltzer, Garcia-Albea, & Vigil, 1999) have generally found that the anaphora can be processed quickly. However, complement control (4) differs from adjunct control (5) in important ways. First, although interpreting complement control structures may still require the use of structural information (Hornstein, 1999; Landau, 2000, 2015), the matrix verb gives early cues that a control structure is coming as well as what the referent of PRO will be. It is therefore plausible that the rapid processing seen in complement control structures is due at least in part to information conveyed by the main-clause verb.

With adjunct control, the participial clause is not selected by any element of the matrix clause, and the choice of antecedent is often based strictly on the

attachment site of the adjunct (Clark, 1990).² Because comprehenders do not have advanced help from the embedding verb to determine who the speaker intends to refer to, resolution of the implicit subject may be more difficult.

Betancort et al. (2006) found that at least some cases of adjunct control did show greater processing difficulty than complement control. These authors investigated the processing of RatCs in Spanish headed by *para* (6a) in comparison with response clauses headed by *por* (6b) using eyetracking while reading. As Betancort et al. explain, adjuncts headed with *para* are strongly biased to be interpreted with subject control, and those with *por* with object control. These were compared with complement control structures with similar biases towards either subject or object control.

- (6) a. Yolanda₁ se-casó con Jorge₂ [para PRO₁ tener dinero]
 Yolanda₁ married with George [to PRO₁ have money]
 ‘Yolanda married George in order to have money.’
- b. Yolanda se-casó con Jorge₁ [por PRO₁ tener dinero]
 ‘Yolanda married with George₁ [for PRO₁ have money]
 ‘Yolanda married George because he had money.’

The results of this experiment showed that for adjuncts, in contrast to complements, there were late effects of recency of the antecedent. Although there were no reliable effects in first-pass reading times, both regression path and second-pass reading times were significantly faster in object control adjuncts headed by *por* than in subject control adjuncts headed by *para*. Betancort et al. state that this effect

² This is only true when OC is involved. See Chapter 2.

supports earlier theories (Frazier, Clifton, & Randall, 1983; Nicol & Swinney, 1989) that posited a Garden Path effect in the processing of control structures, such that comprehenders initially take the most recent potential antecedent (here, the object of the matrix clause) as the antecedent to PRO, and that this initial assumption must later be revised for subject control sentences. This is argued to be the case despite the fact that the preposition introducing the adjunct (*para*) strongly biases toward subject control readings; the comprehender's initial reaction goes contrary to statistical probabilities of interpretation. In complement control, the authors found no evidence for a Garden Path effect, in contrast to the earlier studies.

Although this conclusion provides an explanation for the slower processing of the subject-controlled RatC, it is also largely stipulative. The experiments used provide no direct evidence on the timecourse of interpretation or on what antecedents are being considered. The slowdowns in processing RatCs compared to response clauses could therefore have been due to other differences between the two adjuncts, not necessarily due to readers initially assigning an incorrect object control interpretation for PRO in the RatC.

5.1.3 The quality of retrieval

Although previous experiments provided evidence about the speed of processing of control structures, none used measures that provided direct evidence on when or whether PRO was actually interpreted. Parker et al. (2015) more directly detected the activation, but their questions were less about the timing of PRO's resolution as about the accuracy of retrieval of PRO's antecedent in memory. In

two experiments using a facilitatory interference paradigm (Pearlmutter, Garnsey, & Bock, 1999), Parker et al. measured self-paced reading times in sentences containing temporal adjuncts such as (7). The first experiment manipulated the animacy of the controller ((7a–b) vs. (7c–d)) and of an intervening distractor (the subject of a relative clause modifying the matrix subject) ((7a,c) vs. (7b,d)).

- (7) a. The doctor that the researcher evaluated extensively was commended after disproving the controversial theory himself at the research institute in Europe.
- b. The doctor that the report evaluated extensively was commended after disproving the controversial theory himself at the research institute in Europe.
- c. The experiment that the researcher evaluated extensively was commended after disproving the controversial theory himself at the research institute in Europe.
- d. The experiment that the report evaluated extensively was commended after disproving the controversial theory himself at the research institute in Europe.

The first measure of the interpretation of PRO was at the gerundival verb. Because PRO in temporal adjuncts prefers an animate controller, as Parker et al. confirm, animacy may serve as a cue used in the search for an antecedent.³ It

³ This study assumes a Lewis and Vasishth (2005)-based model of memory and sentence processing.

was found that reading times at the gerundival verb were faster for sentences with inanimate main-clause subjects when the distractor was animate, suggesting that a search for an antecedent to PRO had already begun at the verb.⁴

The second self-paced reading experiment provided further support that a search for PRO's antecedent was initiated by the adjunct's verb. In items such as (8), where both the target and the intervening distractor were animate, reading times at the gerundival verb were slower when both characters were of the same stereotypical gender, as in (8a). Parker et al. suggest that this could be due to a "fan" effect, which can arise in grammatical contexts when multiple items match the retrieval cue, and may reflect interference at the encoding stage. If this is true, then it provides further evidence that participants were at least initiating a retrieval for PRO's antecedent at the embedded verb.

- (8) a. The harpist that the diva liked very much was congratulated after playing the beautiful song herself at the brand new recording studio.
- b. The harpist that the guitarist liked very much was congratulated after playing the beautiful song herself at the brand new recording studio.
- c. The drummer that the diva liked very much was congratulated after playing the beautiful song herself at the brand new recording studio.

⁴ Facilitation was also seen in the region following the reflexive, suggesting that at least some of the time, the distractor was activated as PRO's antecedent, or at least as a candidate, licensing the reflexive. However, it is also possible that the effect from the reflexive was due to searching the main clause arguments in memory, not PRO. See Parker and Phillips (2017) for discussion on interference effects in the processing of reflexives.

- d. The drummer that the guitarist liked very much was congratulated after playing the beautiful song herself at the brand new recording studio.

Although self-paced reading times are a fairly indirect measure for anaphora resolution, these experiments provide initial evidence for the rapid interpretation of PRO in temporal adjuncts.

5.2 Remaining questions

The previous research on adjunct control leaves several remaining questions. The simplest of these involves the timing of the interpretation of PRO in online processing. Although Parker et al. (2015) provides some evidence that a search for PRO's antecedent is initiated early in the adjunct, it still does not provide direct evidence for when that search is completed. None of the other studies on adjunct control can distinguish the interpretation of PRO from the processing of the adjunct more generally. Therefore, it is still not clear when PRO in these adjuncts is fully interpreted, or whether listeners allow shallow, underspecified representations until later in discourse, if full resolution is completed at all.

Second, these studies do not fully resolve the question of the path PRO's interpretation takes. Is the most recent potential filler considered first, even when the syntax biases you towards more distant antecedents, as Betancort et al. (2006) suggest? This could help explain some of the facilitatory interference effects in Parker et al. (2015). But these results are also consistent with a simultaneous search

of all potential antecedents, as in the ACT-R model of sentence comprehension (Lewis & Vasishth, 2005).

The experiments in Chapter 6 begin to address these questions for temporal adjuncts using visual-world eyetracking, which can provide a more direct measure of online interpretation of referential expressions. Previous studies have shown that upon hearing a pronoun, for example, listeners tend to look at the character on the screen to whom they assume the pronoun refers (Arnold, 1998; Arnold, Eisenband, Brown-Schmidt, & Trueswell, 2000; Arnold & Lao, 2015). These results form a foundation needed for successfully addressing other questions, such as the role of prediction in the resolution of adjunct control, what interpretive and processing biases are at play in the competition between OC and NOC, and how the process of interpretation may vary for different types of adjunct control.

Chapter 6: Processing temporal adjuncts

This chapter¹ explores the online interpretation of PRO in right-adjoined temporal adjuncts, as in (1a), which are strongly biased towards subject control interpretations, especially when the main clause subject is animate. This is compared to the processing of overt pronouns, as in (1b).

- (1) Mickey₁ ran into Daisy₂ in front of the school. . .
- a. . . [before PRO₁ picking up a blue ball].
 - b. . . [before he₁/she₂ picking up a blue ball].

Using visual-world eyetracking, it is shown that when listeners may believe a control structure to be a likely continuation, they are just as quick to resolve reference when they hear the non-finite verb “eating” as they are when they hear the pronoun “he.” This is the case even though there is no overt expression in (1a) whose semantic function is just to evoke a specific individual in the comprehenders memory, here in the role of eater. When the experimental context is manipulated to reduce the likelihood of control structures, participants are slower to resolve PRO, but only insofar as the cue to anaphora (the non-finite verb) is longer. This provides evidence that,

¹ This chapter reports joint work with Michael McCourt, Ellen Lau, and Alexander Williams.

in at least some contexts, PRO is identified quite rapidly, despite being inaudible, and is furthermore resolved online as part of the incremental interpretation, and that listeners are able to make rapid use of structural information in the computations involved in the resolution of anaphora once the relevant bottom-up input is received.

6.1 Background: anaphora resolution generally

Within the research on the interpretation and processing of referential expressions, pronouns have received significant attention. For example, a speaker of (2) can use both “Mickey Mouse” and “he” to refer to Mickey Mouse.

(2) Mickey Mouse talked to Minnie Mouse before he ate.

To understand this use of the name “Mickey Mouse,” it might be enough for a listener to access its representation in his or her mental lexicon, as this might be linked to the singular concept MICKEY MOUSE. But understanding the use of “he” requires more than lexical access, since the pronoun is surely not itself linked to MICKEY MOUSE. Instead, it requires consultation of other representations in memory, such as a representation of the discourse in which the pronoun occurs, of the syntax of the local sentence, of the speaker’s interests, and so on.

Much work in psycholinguistics has been directed at the online processing of pronouns and other anaphoric expressions. Their study promises to illuminate the mechanisms by which disparate information sources are integrated in language com-

prehension (Ehrlich & Rayner, 1983; Blanchard, 1987; Arnold et al., 2000; Stewart, Pickering, & Sanford, 2000; Kehler & Rohde, 2013). Given the potential complexity of this task, one set of questions revolves around timing. How long does it take to resolve reference? And in general, is resolution initiated immediately upon perception of the anaphoric expression? Or do we, often enough, resolve reference only when our practical goals demand it? There is active pursuit of these questions in the literature (see, e.g. Stewart, Holler, & Kidd, 2007; Karimi & Ferreira, 2016; see also Ferreira, Bailey, & Ferraro, 2002, for a discussion on other instances of shallow processing).

Seminal work by Arnold et al. (2000) using the visual world paradigm has shown that pronouns can be very rapidly interpreted to infer the referent intended by the speaker, especially when the pronoun’s “ ϕ -features” (person, gender, and number) agree with a single entity in the discourse. In their experiments, participants viewed a picture with two characters and heard descriptions in which a pronoun referred to one of them. Results showed that when the two characters mismatched in gender, participants looked to the correct character in the picture within approximately 200 ms after the offset of the pronoun, suggesting that they were able to use the gender features of the pronoun to successfully resolve reference by that time.

However, pronominal dependencies in English have a particular profile of properties that do not generalize across all referential dependencies. First, they are cued by an overt anaphoric expression (the pronoun). This might seem unremarkable, but there exist many common cases of referential dependencies that do not share

this property, such as with the null *pro* found in Spanish and many other languages, and, of course, PRO. Second, their interpretation is strongly influenced by discourse factors and less so by structural information. When a pronoun's ϕ -features are compatible with multiple entities, comprehenders are guided in their identification of a referent by factors such as information structure (Crawley, Stevenson, & Kleinman, 1990; Grosz et al., 1995; Kehler & Rohde, 2013) and discourse coherence (Hobbs, 1979; Kehler et al., 2008; Kehler & Rohde, 2013). They are also influenced at least initially by psychological factors such as attention (Arnold & Lao, 2015). However, at least for overt pronouns like English 'him' or 'her,'² structural information about the antecedent is not directly relevant, beyond the constraints of Principle B, which prohibits antecedents that are syntactically too local (Chomsky, 1981). Structural information is relevant only indirectly, in any effects it may have on information structure and coherence. Things are arguably different for PRO, however. Here the dominant information relevant to reference resolution is the syntactic position of the antecedent. So we have no reason to expect that its processing will proceed in the same way as an overt pronoun's.

This chapter asks a specific question in this area: whether it matters to the timing of anaphora resolution if the surface cue to anaphora is an audible pronoun,

² There are other sorts of pronouns that do seem to be targeted at grammatical relations, namely subject-oriented anaphors (Katada, 1991; De Vos, 2012). For example, in Japanese, the subject-oriented anaphor *zibun* must be coreferent with a subject. In contrast with the reflexive *zibun-zisin*, though, this subject need not be local. This is illustrated in (i).

- (i) John_i-ga [Bill_j-ga Mike_k-ni {zibun_{i/j/*k}
John-SUBJ Bill-SUBJ Mike-IO {zibun-zisin?_{i/j/*k}} -no koto-o hanasita to] itta.
-GEN matter-DO told that said
'John said that Bill told Mike about self.' (Katada, 1991, p. 289)

like “he” in (2), or instead a non-finite participial verb in a control structure, like “eating” in (3).

(3) Mickey Mouse talked to Minnie Mouse before eating.

A speaker can use (3) just like (2), to say that Mickey talked to Minnie before he, Mickey, ate. But now the process of understanding the speaker will be different in two important ways. First, the understanding that it was Mickey who ate depends on different sorts of information in the two cases. For (3) but not (2) the sentence itself determines the interpretation, due to its structure and meaning. Only (2) can be used to say something else—for example, that Mickey talked to Minnie before Donald ate—since “he” may be used to refer to any male salient in the discourse. Second, only (2) contains an *overt* and *unambiguous* sign of reference to a particular eater, namely “he.” For (3), in contrast, the signal of such reference is both implicit and temporarily ambiguous. It is implicit, because it consists not in the lexical semantic properties of any one word, but in the fact that “eating” is here the predicate of a non-finite clause; and such clauses, when lacking an audible subject, generally have their entailed subject role filled anaphorically. And it is temporarily ambiguous, because the signal of anaphora is in principle uncertain until after the word “eating,” as (4) makes plain. Here “eating” is not the predicate of any clause, but rather the gerundival subject of one, and on this use it does not signal anaphoric reference to any particular eater.

(4) Mickey Mouse talked to Minnie Mouse before eating was forbidden.

Determining whether these differences in understanding synonymous uses of (2) versus (3), or similar pairs with temporal or other adjuncts with control dependencies, impact the timing of reference resolution is an important step towards better a understanding of what aspects of processing generalize across all referential dependencies, and conversely, a better understanding of what drives the aspects of processing that appear to depend on properties of the referential expression and the relevant information sources. It may also provide evidence about when PRO is identified and whether it is actually interpreted in online comprehension.

6.2 Experiment 1

Our first experiment examines the timecourse of interpretation of the implicit anaphora in adjunct control structures to that of overt pronouns in similar sentences. With a design similar to that of Arnold et al. (2000), we used visual-world eyetracking to measure the timecourse of interpretation of temporal adjuncts such as those in (1). In several experiments (e.g. Arnold, 1998; Arnold et al., 2000; Arnold & Lao, 2015), it has been shown that upon encountering a pronoun, comprehenders consistently look to the image of the character in a visual-world scene that they believe the speaker is using the pronoun to refer to. This is taken as evidence for the timing of resolution of the pronoun, especially when the task encourages participants to look to what the sentence is talking about by having them verify the sentence they hear against the picture it describes. We similarly expect that upon encountering the non-finite verb in a sentence like (1a), comprehenders will look to the referent

evoked by the implicit subject if it is being interpreted immediately. Looks to the correct referent will therefore be taken as evidence that reference resolution has been successfully completed. We measure the timecourse of looks to that referent, comparing it to the timecourse of the interpretation of overt pronouns as a baseline.

Despite the evidence that many language comprehension processes are rapid and incremental, there are several reasons one might expect the processing and interpretation of the implicit subject in adjunct control structures to proceed slowly. Two such reasons were mentioned in the previous section. In contrast to when there is an overt pronoun, control structures have no overt morpheme dedicated to reference in their subject position. Instead, the first indication that a referent is needed is given indirectly by the non-finite morphology (*-ing*) on the embedded verb.³ Therefore, if processing is taking place incrementally, then at the embedded verb, comprehenders must identify the verb and the event it corresponds to, notice that the verb is missing a subject, and determine which character the speaker intended to refer to with that missing subject. Furthermore, as illustrated in (5), whether a control relation is even necessary may not become clear until several words after the verb. If (5a) is spoken on its own, then an anaphoric dependency for the implicit subject is necessary; it must be understood that Mickey talked to Minnie before he, Mickey, ate pizza at the park. But if (5a) is continued with (5b), then the nonfinite clause becomes the gerundival subject of the adjunct, and no anaphoric dependency is necessary. Because the structure of the adjunct will not be clear to

³ Note that this also differs from complement control, in which the cue for control is given one word earlier, at *to*.

the incremental processor at the point of the verb, it is possible that comprehenders will wait to interpret the implicit subject until the structure is disambiguated.

- (5) a. Mickey talked to Minnie before eating pizza at the park on Sunday...
b. ... was forbidden.

To examine the timecourse of interpretation of the implicit subject in adjunct control, the current experiment will compare it to the interpretation of a pronoun intended to refer to the same character, as in (6).

- (6) Mickey was talking to Minnie in front of a huge tree before eating/he ate pizza.

Both of these expressions involve coreference with the main clause subject. In general, there is often a strong bias towards pronominal coreference with a prior subject rather than with an object (e.g. Arnold et al., 2000), and this may be in part due to the discourse focus of subjects (Grosz et al., 1995). In order to reduce *a priori* biases towards coreference with either argument of the main clause, the experiment included a manipulation of which character was in focus by adding an additional sentence prior to the one containing the adjunct, as in (7).

- (7) a. Hey there's Minnie! Mickey was talking to her in front of a huge tree before eating/he ate pizza.

- b. Hey there’s Mickey! He was talking to Minnie in front of a huge tree before eating/he ate pizza.

Finally, as a measure of whether a subject bias was still in effect, we included a control condition with a pronoun coreferring with the main clause object. If, for example, participants are faster at resolving both subject-oriented pronouns and PRO than object-oriented pronouns, this may be due simply to a bias to look at the character corresponding to the subject. If, on the other hand, participants are just as quick to resolve both types of pronouns, then any difference in the resolution of PRO is less likely to be purely due to such biases.

6.2.1 Materials and methods

6.2.1.1 Participants

Thirty-three participants (22 female) were recruited at the University of Maryland campus, and prior written consent was obtained. Participants were all native speakers of American English, and were at least 18 years of age (mean age = 22.5). Each received \$10 for their time. Two were excluded for low accuracy on comprehension questions (less than 80%), and one for equipment failure, for a total of 30 participants in the analysis.

6.2.1.2 Materials

Stimuli consisted of auditory descriptions of scenes involving two main participants selected out of a set of four well-known characters: Mickey and Minnie Mouse,

and Donald and Daisy Duck. The auditory stimuli each were composed of two sentences: an initial sentence focusing on one of the two characters in the scene (e.g. *Hey, there's Mickey!*), and a second sentence describing the content of the picture. The second sentence began with a main clause predicate, with the two characters as arguments (the subject and the object/indirect object). This was followed by a prepositional phrase describing the third element of the image in order to draw attention away from the two characters immediately before the critical region. The description concluded with a temporal adjunct headed by *before*, *after*, or *while*.

In a 2×3 design, stimuli varied with respect to which character was focused on initially (the subject or the object of the main clause), and with respect to the referential expression used as the subject of the temporal adjunct. In what we call the “PRO” conditions (PRO being a common label for the implicit subject in control structures (Chomsky, 1981)), the temporal adjunct was non-finite, including an implicit “PRO” subject coreferential with the subject of the main clause. In the other conditions the temporal adjunct was finite and had an overt pronominal subject used to refer either the referent of the main clause subject (“pron_{subj}” conditions) or the main clause object (“pron_{obj}” conditions). In the critical stimuli and in all but one of the fillers, the two characters were of opposite gender. The pronominal subject (*he/she*) was therefore unambiguous. For the PRO conditions, because the subject was implicit, the first indication that a referential dependency was required was the non-finite verb. Within the experiment this cue was also unambiguous, identifying the main clause subject as the antecedent of the implicit subject of the temporal adjunct, although a non-finite verb in general is ambiguous in that it can

Table 1: Experiment 1 sample stimuli

Condition	Preamble
FocObj	Look there’s Mickey! Minnie was talking to him in front of a huge tree
FocSubj	Look there’s Minnie! She was talking to Mickey in front of a huge tree
PRO	Temporal adjunct after <u>putting</u> on a nice new bow, and they seem to be having a good time.
pron _{subj}	after <u>she</u> put on a nice new bow, and they seem to be having a good time.
pron _{obj}	after <u>he</u> put on a nice new hat, and they seem to be having a good time.

be followed by continuations that do not require an OC dependency. Initial focus was manipulated as an attempt to reduce any preferential looking to a single character based on their salience in the preceding discourse. A sample set of stimuli are given in Table 1. Each set was paired with a single image.

Auditory stimuli were recorded in a sound-attenuated room by a single male speaker of American English. Each stimulus set was recorded in parts, with each part in a carrier phrase. After normalizing for intensity, the two recordings were spliced together at the point indicated in (8) by the vertical bar. This was done in order to minimize potentially confounding differences in the acoustics of the stimuli before the critical word. The splice point immediately preceded the non-finite verb in the PRO conditions, and the pronoun otherwise, so that there would be no coarticulatory clues about the content of the upcoming critical word. After splicing, the stimuli were filtered to remove noise. All recording and processing of

the auditory stimuli was done in Praat (Boersma, 2001; Boersma & Weenink, 2017). The average duration of the critical word in the PRO conditions (the non-finite verb) was 314 ms. In the pron_{subj} condition, the average critical word duration was 153 ms, and in the pron_{obj}, it was 152 ms.

- (8) Look there's Mickey! Minnie was talking to him in front of a huge tree after
| Tom left.

Thirty sets of auditory stimuli were distributed across six lists using a Latin square design, such that each participant saw five trials from each condition. Twenty fillers were also included in each list, for a total of 50 items. The fillers were similar in form to the critical items, and contained an equal number of PRO, pron_{subj}, and pron_{obj} sentences. The only difference was that the filler stimuli contained discrepancies between the picture and the auditory description of it; the location of the discrepancy was balanced throughout all parts of the description across filler items. This was done to encourage participants to attend the visual stimulus at the corresponding point in the description. Two practice items were also created: one where the description matched the image, and one where it did not.

Visual stimuli consisted of scenes containing two characters located on the bottom right and bottom left corners of the picture, equally distant from the center and of roughly the same size. The stimuli were balanced with respect to which two characters were seen together, as well as which character appeared on the left or right side of the screen. The picture also contained a third prominent, inanimate

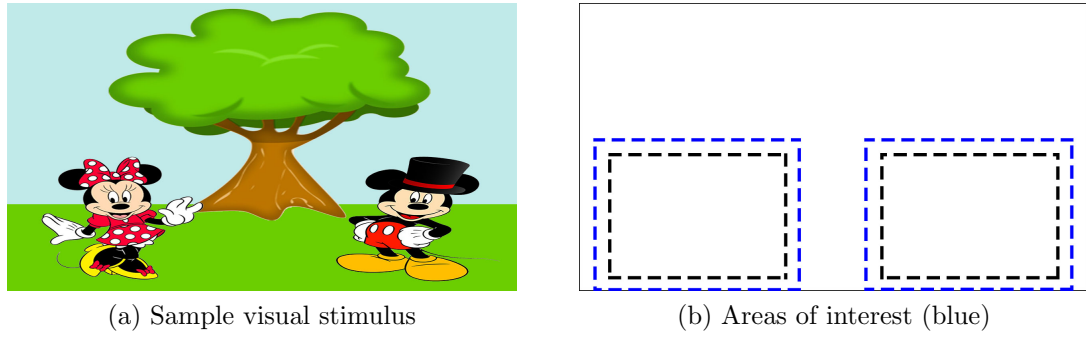


Figure 2: Experiment 1: Sample visual stimulus and regions of interest. Figure (a) is the image displayed for the sample auditory stimuli from Table 1. In Figure (b), the dotted black rectangles give the regions in which the two characters were contained, and the dotted blue rectangles show the regions of interest used in analyzing the eyetracking data. Any fixations not in those regions were considered looks to “other.”

element that was placed at the top center. A sample image is given in Figure 2(a). The two main regions of interest in the eyetracking analysis were fixed across trials, and included the entire image of the character and a small surrounding area to allow for gaze drift. This is illustrated in Figure 2(b). Any gazes not in these two areas of interest were classified as looks to “other.”

6.2.1.3 Procedure

Eye movements were recorded using an EyeLink 1000 tower mounted eyetracker (S.R. Research, Mississauga, Ontario, Canada), interfaced with a PC, with a sampling rate of 1000 Hz. Visual stimuli were displayed on a 23-in. LCD monitor, approximately 104 cm away from where participants were seated. Viewing was binocular, but only the right eye was recorded. Auditory stimuli were presented at a comfortable volume using stand-alone speakers situated next to the monitor.

The experiment was implemented using the Experiment Builder software (S.R. Research, <http://www.sr-research.com/eb.html>). At the beginning of the experiment, participants were introduced to the four characters to ensure familiarity. This was followed by a nine-point calibration procedure, and presentation of the two practice items. Stimuli were then presented in five blocks of 10 items each, with recalibration at the beginning of each block (and otherwise as needed) and a drift-correction fixation point at the center of the screen to begin each trial. Visual and auditory stimuli were presented simultaneously, with the image remaining on the screen for the duration of the auditory description. At the conclusion of the auditory description, the image disappeared, and participants were asked to indicate whether the description matched the image. The comprehension question was always the same: participants indicated whether the description and the image matched by pressing a button on a remote control.

Each participant was presented with the items from one of the six lists. The order of experimental and filler items within that list was randomized for each participant.

6.2.1.4 Data analysis

The minimum accuracy for participant inclusion on the comprehension questions was 80%. Two participants were excluded for low accuracy. One additional participant was excluded for equipment malfunction. For the remaining participants (n=30), eye movements were analyzed in the window from the onset of the critical word using the eyetrackingR package (Dink & Ferguson, 2015) in R (R Core Team,

2014). Twenty-two trials were excluded due to high trackloss (greater than 25%), resulting in a loss of 2.4% of the data. The mean trackloss per trial in the remaining data was 2.2%.

In order to estimate when the correct interpretation was achieved in each condition, we compared the divergence in looks to the characters corresponding to the subject and the object within a single condition using pairwise cluster-based permutation analyses with t-tests (Maris & Oostenveld, 2007) on data binned into 5 ms bins. The point at which looks to the two characters diverged was taken to be evidence that successful interpretation was achieved. However, this analysis did not allow for a direct comparison to measure significance of differences in timing across conditions.

In order to compare conditions, mixed-effects growth curve models (Barr, 2008; Mirman, Dixon, & Magnuson, 2008) were used. These analyses were used to determine whether our manipulations affected the pattern of looks to the target character or the competitor in order to better understand any differences in timing seen from the cluster-based analyses. The window of analysis in the growth-curve models extended from 100 to 1025 ms after the onset of the critical word (the non-finite verb in the PRO conditions and the pronoun otherwise). The beginning of this window was chosen empirically by plotting the grand mean of looks to the target and identifying the first consistent upward inflection point in the grand mean curve (Barr, 2008; Law II, Mahr, Schneeberg, & Edwards, 2016). The end of the window was similarly chosen empirically, by identifying the first consistent downward inflection point in the grand mean curve of looks to the target. Prior literature has found

that roughly 200–250 ms is required to plan an eye movement in response to stimulus onset (see Matin, Shao, & Boff, 1993, for discussion), which is well within our window of analysis.

Models were generated using the `lmerTest` package (Kuznetsova, Brockhoff, & Christensen, 2014), which uses Satterwaithe approximations to calculate degrees of freedom in determining significance. The `pronsubj` condition was used as the referent condition, and the `PRO` and `pronobj` conditions were compared pairwise against it. The empirical logit of the proportion of looks to each area of interest (AOI) was combined into 25 ms time bins. Initial models indicated no significant effect of the focus manipulation. Therefore, in the models reported here, data across the focus manipulation were combined. These models included fixed effects Cue (type of referential expression), Time, Time², and when it resulted in a better fitting model, Time³, as well as interactions between Cue and the time variables. The time variables were coded as orthogonal polynomials in order to eliminate correlations among the parameter estimates. Participants and items were included as random effects, including the time variables as intercepts. In the results of these analyses, an effect of Cue indicates a difference in the intercept of the model. Because the other variables are coded as orthogonal polynomials, an effect of cue reflects an overall difference in proportion of looks based on cue across the region of interest. An effect of the Time variable reflects a difference in the overall increase or decrease of looks over time. A Time² effect captures differences in how much the curve is bent upwards or downwards, and Time³ reflects additional curvature. See Winter and Wieling (2016).

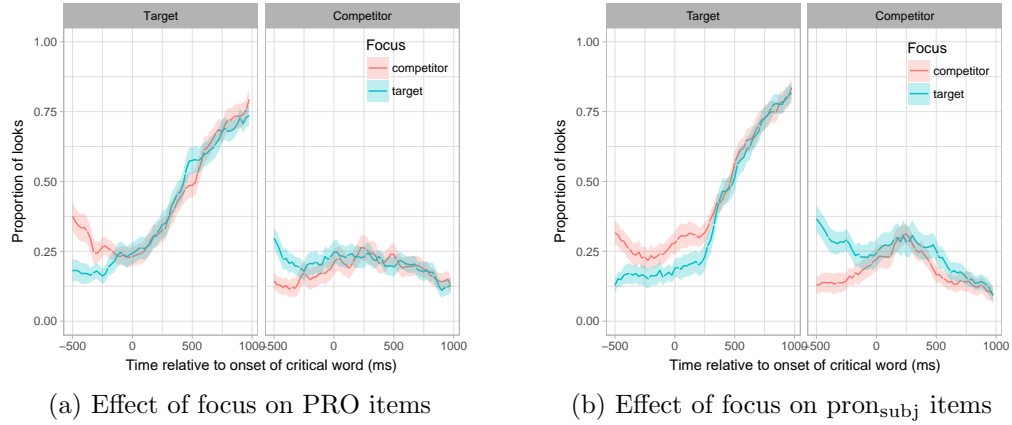


Figure 3: Experiment 1: Effect of focus manipulation on PRO (Figure (a)) and $\text{pron}_{\text{subj}}$ (Figure (b)) items. The non-focused character received more looks in the region prior to the critical word, but this effect disappears before the onset of the non-finite verb in the PRO condition. In the $\text{pron}_{\text{subj}}$, the effect lingers marginally, but disappears before other effects. The x-axis represents time in milliseconds from 500 ms before the onset of the critical word to 1000 ms after.

6.2.2 Results

6.2.2.1 Effect of focus

The effect of focus was measured on looks to the target and competitor for each of the three cues using growth curve analyses. Initial focus did cause significantly more looks to the character who was not initially focused immediately preceding the critical word, but this effect did not continue into the critical region of interest, where the focus manipulation had no significant effect, as illustrated for the PRO condition in Figure 3(a). The only possible exception was for looks to the target in the $\text{pron}_{\text{subj}}$ conditions, as illustrated in Figure 3(b). Here there were marginally more looks to the subject between 50 and 225 ms after the onset of the pronoun

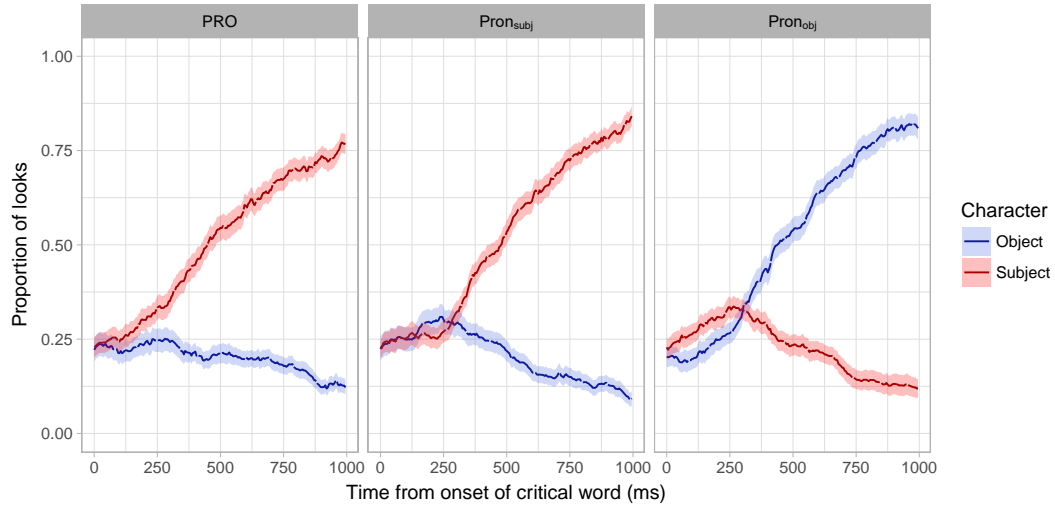


Figure 4: Experiment 1: Divergence point. Proportion of looks to the character corresponding to the main clause subject (red) or object (blue) for the PRO, pron_{subj}, and pron_{obj} conditions. The x-axis represents time in milliseconds from the onset of the critical word.

when the initial focus was on the character corresponding to the matrix object ($p = 0.08$ post-clustering in a cluster-based permutation analysis). This marginal effect was likely spillover from effects in the pre-critical region, and it disappears by 250 ms after the onset of the pronoun. Because this was earlier than any effect of the referential expression, as discussed below, and because there was no significant effect of initial focus in any other condition, the data across the focus manipulation were combined in further analyses.

6.2.2.2 *Estimating time of interpretation*

Looks to the subject or object at the critical word based on condition (PRO, pron_{subj}, or pron_{obj}) are plotted in Figure 4. Cluster-based analyses revealed that looks to the subject and object diverged significantly in the PRO condition at 295

ms after the onset of the non-finite verb, in the $\text{pron}_{\text{subj}}$ condition at 345 ms after the onset of the pronoun, and in the pron_{obj} condition at 370 ms ($p < 0.05$ pre-clustering, $p < 0.001$ clustering from this time to the end of the window, in each case). This is consistent with the results in Arnold et al. (2000) for the interpretation of overt pronouns whose gender features unambiguously identify a referent. Once again, however, this analysis does not allow for a direct comparison between the conditions. Although the cluster-based analysis gives us rough timing estimates, it does not tell us whether the differences in timing across conditions is significant.

6.2.2.3 *Effect of Cue*

Looks to the target or competitor across the three cue conditions are given in Figure 5. Looks to the target began to increase and looks to the competitor began to decrease by around 250 ms in each condition, continuing through 1025 ms post stimulus onset. A mixed-effects growth curve analysis indicated a significantly lower increase in looks to the target in the PRO condition overall compared to the $\text{pron}_{\text{subj}}$ condition, represented by an interaction of cue type and Time ($t = -2.616$, $p < 0.01$), reflecting the fact that the peak proportion of looks to the target in the PRO condition was lower. But although the total increase in looks was lower, looks to the target in the PRO condition appear numerically to begin to increase at an earlier point than in either pronoun condition. There was no significant difference in the total proportion of looks across conditions, nor were there any differences in the time terms between the pron_{obj} and $\text{pron}_{\text{subj}}$ conditions in looks to the target. A mixed effects growth curve model on looks to the competitor revealed a marginal difference

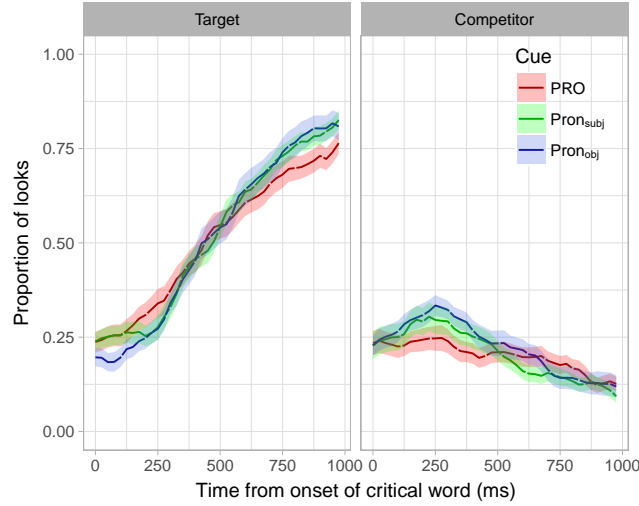


Figure 5: Experiment 1: Effect of Cue. Proportion of looks to the target or competitor characters. In the PRO (red) and pron_{subj} (green) conditions, the target corresponds to the main clause subject, and the competitor to the main clause object; in the pron_{obj} (blue) condition, this is reversed. The x-axis represents time in milliseconds from the onset of the critical word (the non-finite verb in PRO conditions, and the pronoun in the other conditions). Shaded area in this and other figures represents standard error.

in the Time variable between the PRO and pron_{subj} conditions ($t = 1.94$, $p = 0.054$), with a higher rate of looks to the competitor in the pron_{subj} condition, as well as a significant difference between the Time³ variables of the PRO and pron_{subj} conditions due to early differences between the two ($t = -2.119$, $p < 0.05$). There were no other significant effects.

6.2.3 Discussion

Experiment 1 investigated the process of reference resolution for the implicit (PRO) subject of non-finite temporal adjuncts in comparison to overt pronouns used to refer to the character corresponding to either the subject or the object

of the main clause. For the implicit subject in the temporal adjuncts used here, reference is determined based on structural features of the sentence. For overt pronouns, on the other hand, reference resolution is influenced by discourse factors, guided by the morphological features of the pronoun; structural features are only important insofar as they affect information structure. As the focus manipulation had no significant effect on looks in the critical window, reference resolution in this experiment appeared to be possible without regards to information structure.

Our results showed a numerical difference in the timing of reference resolution, as demonstrated by divergence points in looks to either character (Figure 4), with the divergence in the PRO condition occurring roughly 50 ms earlier than in the $\text{pron}_{\text{subj}}$ condition. Although the analysis of these divergence points in each of the three conditions provides an estimated point of interpretation, it does not directly compare timing differences between conditions. However, the growth-curve analysis indicated significantly more looks to the competitor in the $\text{pron}_{\text{subj}}$ condition than in the PRO condition, indicating a relative lack of competition between the two characters in the PRO condition. This difference is likely to have contributed to the difference in timing seen. Still, although the significant difference in looks to the competitor is suggestive that the timing differences are real, the strongest claim we can make about timing is that the interpretation of PRO appears to be at least as fast, if not faster, than the resolution of a pronoun referring to the same character.

This fast interpretation of the implicit subject is somewhat surprising considering the differences in which features are important for reference resolution between PRO and pronouns, and despite large differences in the cue in terms of semantics,

morphology, and duration (duration of the non-finite verb in the PRO condition was twice as long as the duration of the overt pronouns in the other conditions, with an average of 314 ms vs. 153 ms).

6.2.3.1 A general subject preference?

The results of Experiment 1 suggest that the interpretation of the implicit subject in adjunct control is just as fast, if not faster, than the interpretation of overt pronouns. Importantly, this cannot be due solely to a general subject bias in the materials. It is true that two-thirds of our items required participants to look at the subject at the critical word, since that was the case for both the PRO and the pron_{subj} conditions. There might also have been a general subject bias in the critical region if these sentences led to the subject's referent being predicted as the likeliest next mentioned character (Kehler & Rohde, 2013). But if a subject bias were strongly contributing the speed of interpretation of the implicit subject, then we would expect the PRO condition to be identical to the pron_{subj} condition, which was not the case; there were significantly more early looks to the competitor in the pron_{subj} condition.

There are at least two additional reasons not to think the results of this experiment stem solely from a subject bias. First, the focus manipulation was included in order to reduce the overall preference for looking at one character over the other. This manipulation succeeded in that the proportion of looks to the character that was initially focused was lower than looks to the unfocused character immediately preceding the critical word. Importantly, this effect disappears either before

or rapidly after the onset of the critical word, as illustrated in Figure 3, suggesting that participants were not relying solely on general looking preferences at that point. Instead, the gender cues on the pronouns and the structural information for the implicit subject's interpretation were sufficient for participants to quickly and unambiguously select a referent without regard to information structural biases for either character.

Second, there was no significant difference in looks to either character in the two pronoun conditions. In other words, participants were just as fast to look at the correct character after hearing a pronoun, whether that character was the subject or the object. In the pron_{obj} condition, this could not have been due to a subject preference, and yet it was no slower than looks to the subject in the $\text{pron}_{\text{subj}}$ conditions. Participants were also just as likely to look at the competitor upon hearing a pronoun, whether that competitor corresponded to the subject or object.

6.2.3.2 Rapid use of structural information

Significantly fewer looks to the competitor in the PRO condition seems to have contributed to fast resolution of the implicit subject. But why would the interpretation of PRO be so fast? One possible explanation might be that in searching for the intended antecedent of a pronoun, both the subject and the object are initially considered, but for PRO, only the subject is. This would be consistent with the idea that participants use only structural information in searching for a referent for PRO, as the main clause subject was the only structurally accessible antecedent. For pronouns, the search could at least initially include both characters. Accord-

ing to a family of two-staged models of pronoun interpretation, comprehenders first search the discourse for all possible referents, and then after check them against the features of the pronoun (but see Kehler, 2008, for criticisms of such models). In our experiment, this would mean that participants would hear the pronoun and activate both discourse characters, and only then filter out the character that did not match the gender of the pronoun. This does not mean that both characters in the discourse will have equal consideration. Pronouns are often more likely to be used to refer to a preceding subject (Crawley et al., 1990; Grosz et al., 1995), at least when the discourse seems to tell a story as a narration (Kehler & Rohde, 2013). Therefore, it could be that the referent corresponding to the subject would receive greater consideration during the filtering stage than the one corresponding to the object, although the $\text{pron}_{\text{subj}}$ condition did not differ significantly from the pron_{obj} condition.

However, if this two-stage model were to account for the slightly faster resolution of PRO, it would need to somehow be stated so that all the referents are not automatically retrieved in the first stage, but only the structurally licit referent described by the subject. Nothing in the two stage model independently motivates this. Additionally, having separate strategies for pronouns and PRO is different from what cue-based retrieval accounts (e.g. Lewis & Vasishth, 2005) would predict, in which the retrieval process would happen in a single step for both involving search of all antecedents based on available cues.

6.2.3.3 *Prediction in the processing of PRO?*

Another possible explanation for why interpretation was so fast in the PRO condition is that participants may have been actively predicting a control structure in the adjunct. There are two potential sources for such a prediction in this experiment. Perhaps the sentence contexts in the main clause of the items, possibly in combination with the scene depicted on the screen, had some intrinsic property or set of properties that made them likely to be continued with a control structure. This possibility is tested in Experiment 2. Or, it may have been the case that the experimental context had a large enough proportion of control structures that participants correspondingly began predicting PRO. Under either possibility, the speed of looks to the correct character in the PRO condition would not necessarily reflect the speed of bottom-up interpretation of PRO. Experiment 1 leaves open the possibility that the process of resolving the reference of PRO takes longer than resolution of a pronoun if prediction of a control structure led participants to begin that process earlier in the PRO condition.

There are at least two reasons why this seems to be a likely possibility. First, looks to the target in the PRO condition began to increase around 125 ms after the onset of the critical word. Given that saccade planning is generally assumed to take 200–250 ms (Matin et al., 1993), this increase appears to be too early. As noted above, this cannot only be due to a general preference to look at the subject, since a similar early increase was not seen in the *pron_{subj}* condition. Instead, it is possible that participants initially predicted a control structure and started

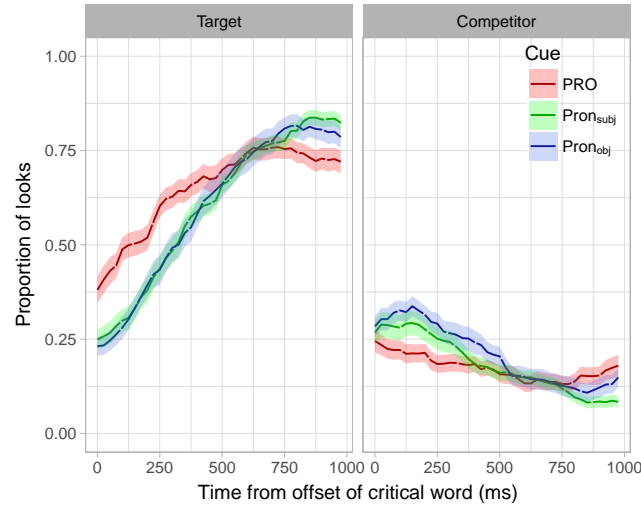


Figure 6: Experiment 1: Results from offset of critical word. Proportion of looks to the target or competitor characters. The x-axis represents time in milliseconds from the offset of the critical word.

planning a saccade towards the target character before the onset of the critical word. When they heard the beginning of the critical word, if it was anything other than a pronoun, they would have had no reason to doubt their prediction, and would have continued to look at the subject. However, if they heard the onset of a pronoun, then they would have reason to discard their prediction and cancel that saccade.⁴

Second, when the results are plotted from the offset of the critical word instead of the onset (Figure 6), it becomes especially clear that looks to the target in the PRO condition began surprisingly fast. For pronouns, looks to the target did not begin to rise until shortly after the pronoun offset, diverging significantly from looks to the competitor within 225 ms. Because the non-finite verbs were on average

⁴See Curtis, Cole, Rao, and D’Esposito (2004) on the speed of canceling a saccade.

around 160 ms longer than the pronouns, if reference resolution were occurring at the same rate, we would expect looks to the target in the PRO condition to diverge from looks to the competitor perhaps 160 ms faster when plotted from critical word offset. And this is assuming that the same amount of auditory input would be required in each case, which would be surprising given the differences in the complexity of the cues. However, looks to the target in the PRO condition were even faster than that, diverging from looks to the competitor within 10 ms of the offset of the critical word—215 ms faster than in the pronoun condition, and roughly 55 ms earlier than could possibly be expected, unless the control structure received expedited processing due to prediction. Experiments 2 and 3 were designed to assess and reduce the likelihood that participants would predict a control structure.

Importantly, if prediction did lead to faster looks in the PRO condition, then this prediction evidently did not result in an overall prediction of likely reference to the character associated with the main clause subject. As already noted, if participants were predicting subject reference, then we would expect looks in the PRO and pron_{subj} conditions to be matched. If prediction is involved, then facilitation in reference processing appears to be strictly tied to successful prediction about the surface form.

6.2.3.4 *Learned strategy?*

A final factor that may have increased the speed of looks in the PRO condition is that participants could have developed a strategy within the experiment to look to the subject any time they did not hear “he” or “she.” If this were the case,

participants would not need to resolve the anaphoric control dependency at all in the critical window. Although participants would still have to interpret the pronoun in other conditions, hearing anything besides the pronoun would be enough to tell them to look at the subject. This possibility is removed in Experiment 3. Such a strategy could have independently caused artificially fast looks in the PRO condition, or in tandem with prediction of a control structure, in which case participants would actively predict a control structure, and only abandon that prediction if the onset of a pronoun was heard.

6.3 Experiment 2

Looks to the character corresponding to the subject in the PRO conditions in Experiment 1 were initially faster than looks to the correct character in the pronoun conditions. Experiment 2 consisted of a cloze task designed to test whether the critical items of Experiment 1 were likely to induce prediction of a control structure after the preposition in the adjunct. Such a prediction may have facilitated looks to the correct character when anything other than a pronoun was encountered in Experiment 1, resulting in unexpectedly fast looking times in the PRO condition.

6.3.1 Materials and methods

6.3.1.1 *Participants*

Sixty participants (39 female) were recruited via Amazon MechanicalTurk, and electronic consent was obtained. Participants were all native speakers of American

Table 2: Experiment 2 sample cloze items

Condition	Text
FocObj	Look there’s Mickey! Minnie was talking to him in front of a huge tree after _____.
FocSubj	Look there’s Minnie! She was talking to Mickey in front of a huge tree after _____.

English, and had passed a native speaker proficiency test. Participants were at least 18 years of age (mean age = 37.5), and received \$4 in compensation.

6.3.1.2 Materials

The materials for this experiment were based on the 30 critical items from Experiment 1. For each item, participants were presented with the visual image and the text of the description up to the preposition in the adjunct clause (see Figure 2(a) and Table 2). Following the manipulation in Experiment 1, items varied within subjects based on which character was initially focused. Items were randomized in presentation.

6.3.1.3 Procedure

The experiment was presented using the Ibex platform (Alex Drummond: <http://spellout.net/ibexfarm>). For each item, participants were presented with the visual stimulus, with the text to be completed directly below. Participants were asked to complete the sentence as quickly as possible with whatever first came to mind. They were instructed that the sentence was intended to describe the image,

and that they could use the image as they decided how to complete the sentence. Participants were familiarized with the task with two practice items.

6.3.1.4 Data analysis

Responses were coded for type (whether the response began with a non-finite verb in a control structure ('PRO' responses), a pronoun, or other) and referent (whether the subject of the adjunct, implicit or explicit, appeared to corefer with the subject of the matrix clause only, the object only, both the subject and the object, or some other entity). Intended referent was determined based on the entire content of the response. If the response did not disambiguate the intended referent, it was coded as unclear reference. The effect of focus on response type and referent was tested with multinomial log-linear regression models using the *nnet* package in R (Venables & Ripley, 2002). P-values were obtained with ANOVAs on the regression models. Significance of differences in the proportions of type or referent of responses within a single focus condition or across focus conditions was measured using linear mixed-effects models (Bates, Mächler, Bolker, & Walker, 2015), with participants as random effects. P-values for the linear mixed-effects models were obtained using the *lmerTest* package (Kuznetsova et al., 2014).

In order to test whether predictability of control structures led to faster interpretation in the PRO condition of Experiment 1, we fit mixed-effects growth curve models to the empirical logit of the proportion of looks to the target and competitor within the PRO condition, with the cloze probability for control structures in each item obtained in Experiment 2 as a fixed effect.

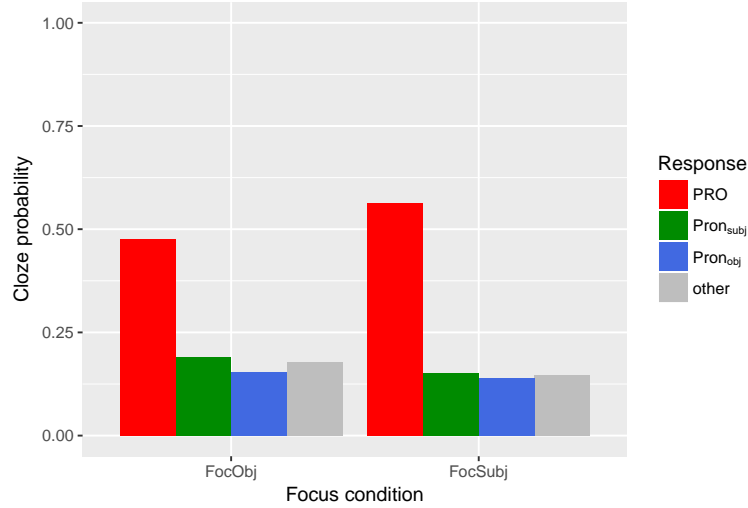


Figure 7: Experiment 2: Responses by type. Proportion of responses beginning with a control structure (PRO responses), a pronoun coreferential with either the subject or the object or the main clause, or other, based on whether the prompt had initial focus on the subject or the object.

6.3.2 Results

The proportion of responses of each type are given in Figure 7. Responses began with control structures in 52% of responses, with a pronoun coreferential with the main clause subject in 17% of responses, and with a pronoun coreferential with the main clause object in 15% of responses. A linear mixed-effects model revealed that control structures (PRO) were significantly more frequent than responses beginning with either type of pronoun (PRO vs. pron_{subj}: $t = 12.77$, $p < 0.001$; PRO vs. pron_{obj}: $t = -14.57$, $p < 0.001$). Multinomial log-linear regression also showed a significant effect of focus condition on response type ($\chi^2 = 14.04$, $p < 0.001$). Focus also had a significant effect on the proportion of responses beginning with a control

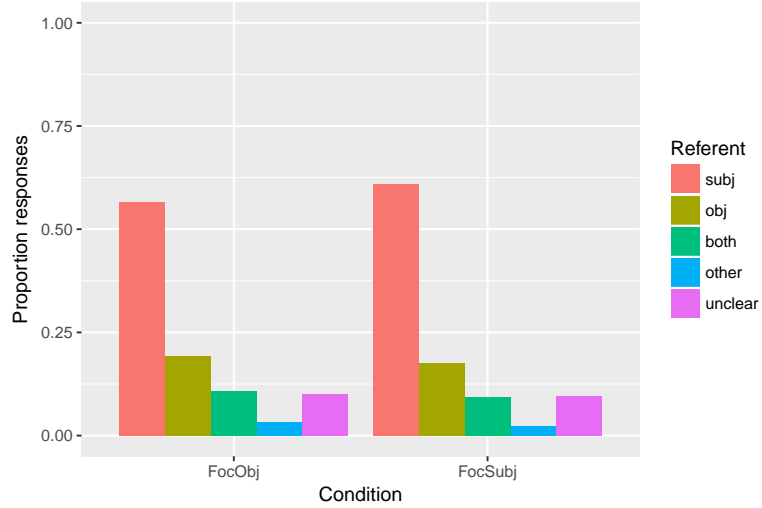


Figure 8: Experiment 2: Responses by referent. Proportion of responses with clear initial coreference with the main clause subject, object, both, or other, based on whether the prompt had initial focus on the subject or the object.

structure ($\chi^2 = 13.75$, $p < 0.001$), with fewer PRO responses given in the FocObj condition (45% vs. 56%).

Responses were also coded for which character was the intended subject of the response. For overt pronouns, the intended referent was inferred based on the gender and number of the pronoun. For responses containing a control structure, intended referent was inferred strictly based on disambiguating information in the rest of the sentence. For example, some responses were consistent with both characters performing the action together. When the rest of the context did not make it clear who the intended referent was, the response was coded as such, despite the high probability that coreference with the main clause subject was intended. This was done in order to not presuppose that participants were always intending OC interpretations. Figure 8 gives the proportion of responses whose subject cor-

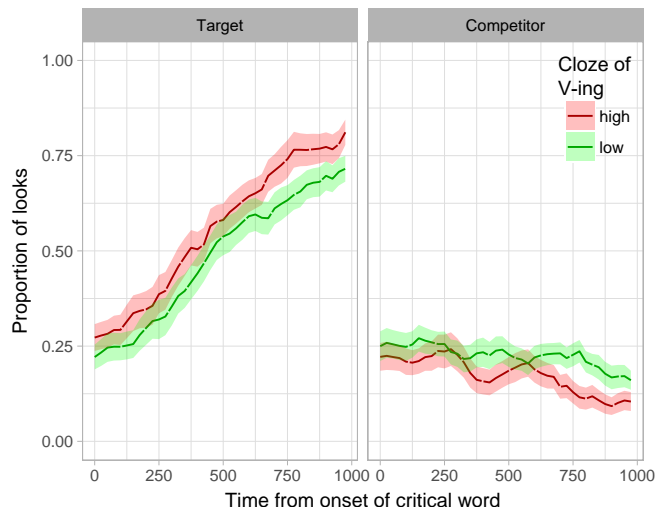


Figure 9: Effect of cloze on Experiment 1. Proportion of looks to the target and competitor in the PRO condition of Experiment 1 based on the cloze probability of a control structure in each item in Experiment 2. The high cloze group consists of all items for which control structures had a cloze probability of > 0.5 (mean = 0.619, sd = 0.078). The low cloze group consists of all items with ≤ 0.5 cloze (mean = 0.421, sd = 0.069).

responded to each referent. A multinomial regression indicated no effect of focus condition on intended referent ($\chi^2 = 5.18$, $p > 0.1$). Overall, responses indicating clear coreference with the main clause subject were significantly more frequent than responses with clear coreference with the main clause object (59% vs. 19%, $t = -17.44$, $p < 0.001$). This was largely due to responses with control structures. When these responses are removed from the analysis, coreference with the main clause subject was no more frequent than coreference with the main clause object (39% vs. 35%, $t = -0.93$, $p > 0.1$).

The proportion of control (PRO) responses varied across individual items from 28% to 76%. Figure 9 illustrates the effect of the cloze probability of a control

structure on looks in the PRO condition of Experiment 1 (although the data in the figure is split into two groups—high and low cloze—cloze was a continuous variable in the growth curve model). The cloze probability of a control structure had only a marginal main effect on total looks to the target ($t = 1.717$, $p = 0.091$), which were at least numerically higher for items corresponding to those with high cloze for control structures. There was a significant main effect of cloze on looks to the competitor ($t = -2.367$, $p < 0.05$); higher cloze for control structures in Experiment 2 led to fewer looks to the competitor in the PRO condition in Experiment 1.

6.3.3 Discussion

This experiment tested one possible explanation for why looks to the target referent were so fast in the PRO condition of Experiment 1. If the preambles of the critical items led to prediction of an upcoming control structure, then participants may have been able to use that prediction to aid their interpretation, leading to faster looking times than when a less-predicted pronominal subject was heard. The overall preference for control structure continuations compared to continuations beginning with a pronoun in Experiment 2 is consistent with this interpretation. Because control structures were more predicted than other continuations, looks to the subject may have been faster in Experiment 1 when that expectation was realized.

In contrast to Experiment 1, the focus manipulation in Experiment 2 had a significant effect on PRO responses. Because PRO continuations were significantly more frequent in the FocSubj condition, it would be reasonable to expect looks in Experiment 1 to have been even faster in PRO conditions when initial focus was on

the subject. This was not the case. However, although control continuations were fewer in the FocObj condition, they were still significantly more frequent than continuations beginning with a subject-oriented pronoun or an object-oriented pronoun. It may therefore be the case that control structures were still predicted enough to cause facilitation in reference resolution in the PRO condition of Experiment 1.

The effect of cloze on looks in Experiment 1 was directly tested using a growth-curve analysis. As illustrated in Figure 9, cloze had a significant main effect on the proportion of looks to the competitor: higher cloze meant fewer looks overall. This suggests that individual item contexts may have led to prediction of control structures, which then may have facilitated rapid resolution of reference in the PRO condition. Looks to the target were also numerically affected by cloze, but this effect was not significant. One possible reason for this is that even the relatively low cloze may have been high enough in comparison to other continuations to cause facilitated looks to the target. However, it is also possible that cloze did not significantly affect looks to the target because participants were already using the strategy mentioned above of looking to the target whenever anything other than a pronoun onset was heard in the critical region, and that prediction based on cloze did not add any additional speed.

Experiment 2 also tested whether participants were more likely to continue the adjunct with reference to the character corresponding to the main clause subject or object. Because of the large proportion of PRO continuations, there was a correspondingly large amount of coreference with the subject. However, when control structures are removed, we did not find any independent subject preference. When

they did not use a control structure, people were just as likely to refer to either character. This is consistent with the lack of a significant subject preference effect seen in the pronoun conditions of Experiment 1.

6.4 Experiment 3

Experiment 3 was designed to further investigate why resolution of PRO in Experiment 1 appeared to be faster than resolution of a pronoun. This experiment included all the items from Experiment 1, in addition to extra fillers designed to to remove the possibility of assuming that every non-pronoun onset in the temporal adjunct was the onset of a non-finite verb and to reduce the overall proportion of control structures. Additional fillers were also added to reduce within-experiment bias to refer to the subject character. Although these changes do not affect the predictability of control for any individual critical item, they do change the overall biases within the experiment, which in turn may affect participants' interpretive strategies.

6.4.1 Materials and methods

6.4.1.1 *Participants*

Thirty-one participants (20 female) were recruited at the University of Maryland campus, and prior written consent was obtained. Participants were all native speakers of English, and were at least 18 years of age (mean age = 21). Thirty of the participants were compensated with course credit, and one with \$5. One partic-

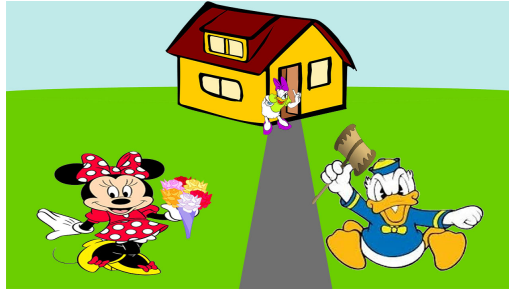
Table 3: Experiment 3: Sample fillers

Condition	Stimulus
Filler (true)	Look there’s Donald! Minnie found him outside of Daisy’s house after <u>Daisy</u> kicked him out for being rude.
Filler (false)	Look there’s Donald! He brought Daisy to the pool after <u>summer</u> had already ended and it had closed.

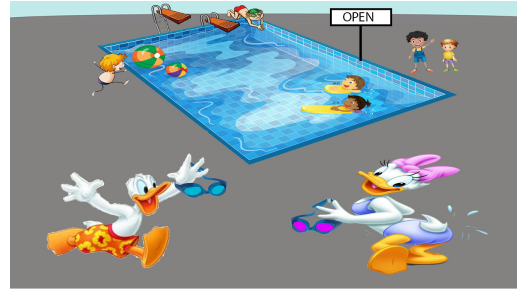
ipant was excluded for high trackloss (>25%), for a total of 30 participants in the analysis.

6.4.1.2 Materials

All stimuli from Experiment 1 were included. Forty new filler items were included In addition to the 20 from Experiment 1. These consisted of 10 items similar to the original fillers, but all with a pronoun coreferring with the main clause object as the subject of the temporal adjunct clause. This was included in order to reduce the overall proportion of items with subject reference in the adjunct. The remaining 30 new fillers had a subject in the adjunct referring to something or someone other than the two main characters; often this was the third prominent element in the image (see Table 3 and Figure 10). Half of these 30 fillers were true (i.e. the image matched the description), and half were false, as were the other 10 new fillers. This brought the total number of items each participant saw to 90, 45 of which should have been judged true. The recording of the auditory stimuli followed the same procedure as in Experiment 1.



(a) Sample true filler image



(b) Sample false filler image

Figure 10: Experiment 3: Sample filler visual stimuli.

6.4.1.3 Procedure

Stimuli were presented in nine blocks of 10 items each. The procedure followed that of Experiment 1 in all other respects.

6.4.1.4 Data analysis

The procedure for data analysis was also the same as in Experiment 1. Mean proportion of looks to the target across conditions began to increase at 100 ms after the onset of the critical word and to decrease at 1100 ms, so the window of analysis was 100–1100 ms. Three trials were excluded for high trackloss (greater than 25%), resulting in a loss of 0.33% of the data. The mean trackloss per trial in the remaining data was 0.048%.

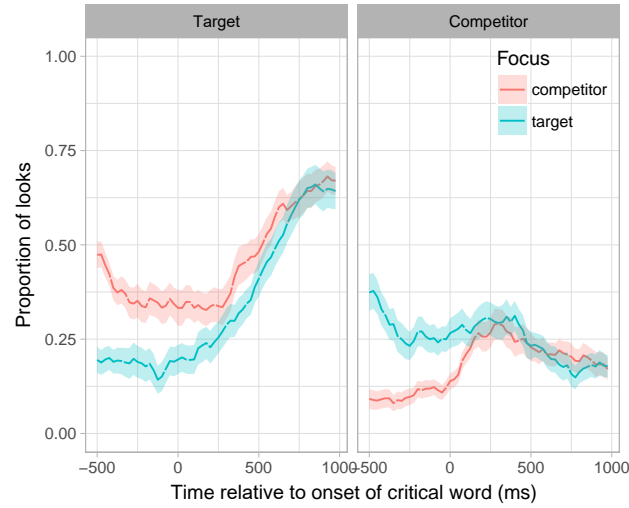


Figure 11: Experiment 3: Effect of focus manipulation on PRO conditions. The non-focused character received more looks in the region prior to the critical word, and this effect carries over into critical region. Similar effects were seen for the other conditions, and there was no interaction between focus and cue. The x-axis represents time in milliseconds from 500 ms before the onset of the critical word to 1000 ms after.

6.4.2 Results

6.4.2.1 Effect of focus

Experiment 3 exhibited a similar effect of focus as in Experiment 1, with a greater proportion of looks to the non-focused character in the region prior to the critical word. Unlike in Experiment 1, this effect spilled over into the critical region. This is illustrated for the PRO condition in Figure 11. The effect was similar in the pronoun conditions, and there was no interaction between cue focus. Because of this, and in order to allow a more direct comparison with the results of Experiment 1, the focus manipulation was again removed from further analysis.

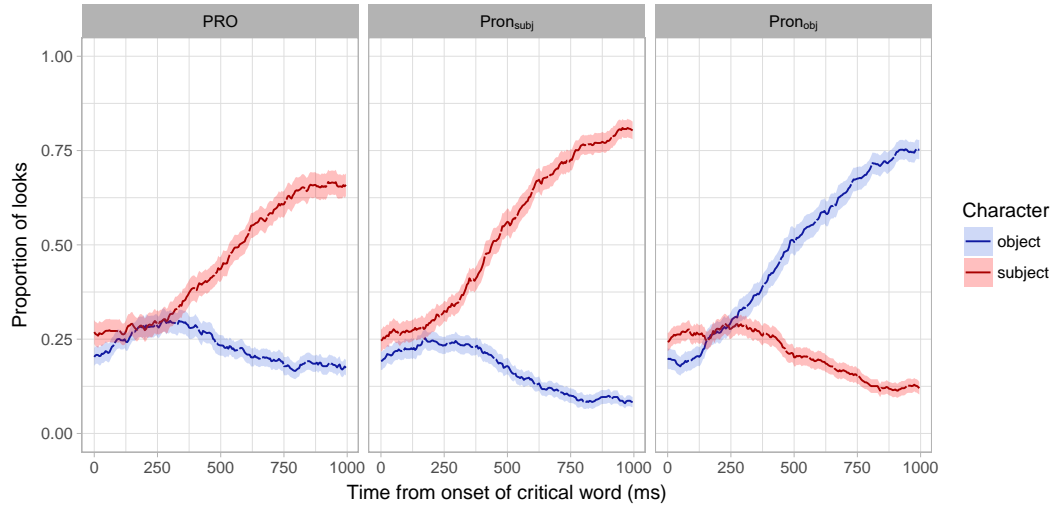


Figure 12: Experiment 3: Divergence point. Proportion of looks to the character corresponding to the main clause subject (red) or object (blue) for the PRO, pron_{subj}, and pron_{obj} conditions. The x-axis represents time in milliseconds from the onset of the critical word.

6.4.2.2 Estimating time of interpretation

Looks to the subject or object at the critical word based on condition are plotted in Figure 12. Cluster-based analyses revealed that looks to the subject and object diverged significantly in the PRO condition at 410 ms after the onset of the non-finite verb, in the pron_{subj} condition at 240 ms after the onset of the pronoun, and in the pron_{obj} condition at 365 ms ($p < 0.05$ pre-clustering, $p < 0.001$ clustering from this time to the end of the window, in each case).

6.4.2.3 Effect of cue

The effect of cue is illustrated in Figure 13. A mixed-effects growth curve analysis revealed a significant effect of cue, with the PRO condition receiving signif-

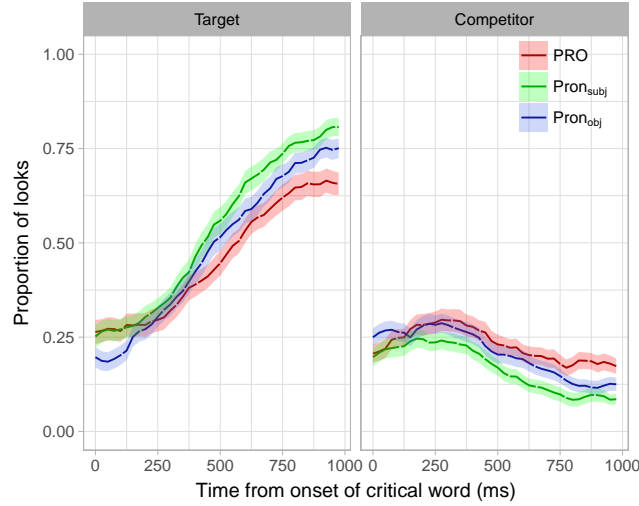


Figure 13: Experiment 3: Effect of Cue. Proportion of looks to the target or competitor characters. In the PRO (red) and $\text{pron}_{\text{subj}}$ (green) conditions, the target corresponds to the main clause subject, and the competitor to the main clause object; in the pron_{obj} (blue) condition, this is reversed. The x-axis represents time in milliseconds from the onset of the critical word.

icantly fewer looks to the target than the $\text{pron}_{\text{subj}}$ condition ($t = -3.577$, $p < 0.001$) and significantly more looks to the competitor ($t = 3.112$, $p < 0.01$). There were also marginally more looks to the target in the $\text{pron}_{\text{subj}}$ condition than the pron_{obj} condition ($t = -1.672$, $p = 0.096$). Additionally, there was a significant difference in the Time variable between the PRO condition and the $\text{pron}_{\text{subj}}$ condition ($t = -2.368$, $p < 0.05$), with looks to the target having less overall increase in the PRO condition.

6.4.2.4 Effect of cloze

The effect of predictability of a control structure based on the cloze results of Experiment 2 on looks in the PRO condition of Experiment 3 are given in Figure 14.

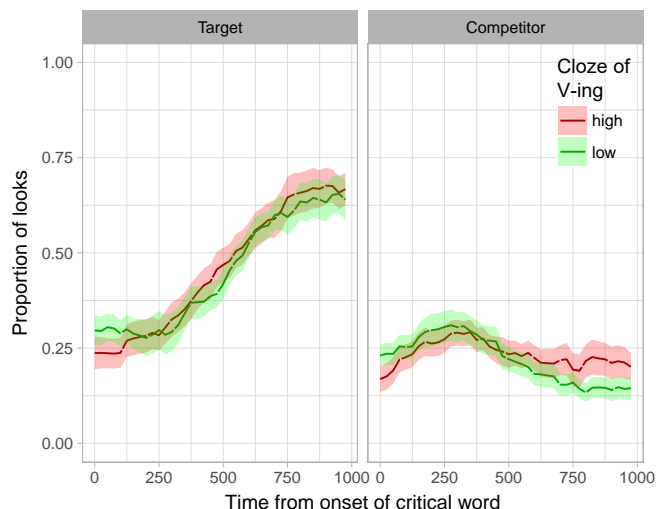


Figure 14: Effect of cloze on Experiment 3. Proportion of looks to the target character in the PRO condition of Experiment 3 based on the cloze probability of a control structure in each item in Experiment 2.

Cloze had no significant effect on looks to the target or the competitor in the PRO condition. The only marginal effect was an interaction between the cloze value and the Time variable in looks to the competitor ($t = 1.704$, $p = 0.094$).

6.4.2.5 Plotting from offset of critical word

Additional analyses were performed plotting the data from the offset of the critical word until the grand mean across conditions of looks to the target began to decrease (950 ms after the offset), as illustrated in Figure 15. Looks to the subject and object characters diverge significantly in the PRO condition 115 ms after the offset of the non-finite verb. In the $\text{pron}_{\text{subj}}$ condition, they diverge at 120 ms after the offset of the pronoun, and in the pron_{obj} condition, at 195 ms.

Growth curve models revealed a significant difference in the Time variable in

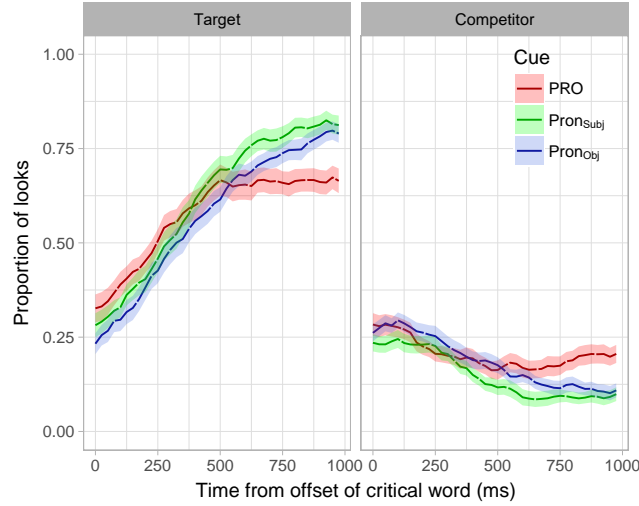


Figure 15: Experiment 3: Results from offset of critical word. Proportion of looks to the target or competitor characters. The x-axis represents time in milliseconds from the offset of the critical word.

looks to the target between the PRO and $\text{pron}_{\text{subj}}$ conditions ($t = -4.166$, $p < 0.001$). In looks to the competitor, there was a significant main effect of cue, with more looks in the PRO condition than the $\text{pron}_{\text{subj}}$ condition ($t = 2.336$, $p < 0.05$), as well as a significant difference between the PRO and $\text{pron}_{\text{subj}}$ conditions in the Time variable ($t = 2.008$, $p < 0.05$) and a marginal difference in Time^3 ($t = -1.667$, $p = 0.097$). However, these differences were largely due to the leveling off of looks in the PRO condition by 500 ms after critical word offset. If the data are limited to a 500 ms window, there is no significant difference between conditions in looks to the target, but looks to the competitor still show a difference between PRO and $\text{pron}_{\text{subj}}$ in the Time^2 variable ($t = 2.142$, $p < 0.05$).

6.4.3 Discussion

6.4.3.1 *Summary of findings*

The results of Experiment 3 show slower anaphora resolution in the PRO condition than the pronoun conditions (see Figure 12). To reiterate, however, differences across conditions in divergence points in looks to the target and competitor were not tested directly. However, the results of the growth curve analyses are also consistent with slower resolution of the implicit subject. The PRO condition saw fewer looks to the target and more looks to the competitor overall, and the increase in looks to the target was lower for PRO (see Figure 13). This pattern of results contrasts with the pattern seen in Experiment 1, where there were fewer looks to the competitor in the PRO condition than the pronoun conditions, and where the divergence in looks was earlier. This suggests that participants were waiting longer to resolve the anaphora in the PRO condition of Experiment 3. We attribute this to the reduced probability of control structure continuations in this experiment and its potential affect on participants' predictions. The difference between divergence points in the two pronoun conditions may have been due to a remaining preference to interpret the pronoun as referring to the subject, despite the greater number of items with object-oriented pronouns within the experiment, as evidenced by the marginal difference in looks to the target in the $\text{pron}_{\text{subj}}$ and pron_{obj} conditions.

Although PRO now appears to be interpreted more slowly than an overt pronoun, despite a possible preference for subject reference, this difference may be largely due to differences in the length of the cue to anaphora (the non-finite verb

vs. the overt pronoun). When plotting from the offset of the critical word to control for cue length, differences between conditions disappear.

6.4.3.2 Effect of prediction

Prediction of a control structure seemed to contribute to the rapid interpretation of PRO in Experiment 1. There were two potential sources for such a prediction. First, with one third of the items in Experiment 1 containing control structures in the temporal adjunct, participants may have learned to predict such structures within the experiment. Or, it may have been that the items themselves, along with their associated pictures, may have simply had a high probability of containing control structures. Evidence for this second possibility was the fact that in Experiment 2, continuations at the adjunct clause were more likely to contain a control structure than a pronoun referring either to the subject or object. In addition, the cloze value of control structures in the items of Experiment 2 had a significant effect on looks in the PRO condition of Experiment 1.

In Experiment 3, since the same experimental items were used, it is possible that participants made the same predictions about upcoming control structures. However, the probability of control structure continuations within the experiment was reduced by adding fillers with adjuncts beginning with subjects other than PRO or pronouns. This reduced the within-experiment probability of control. Furthermore, even if individual item contexts still led to prediction of a control structure, it would still have been necessary for participants to listen longer in order to verify that prediction.

That prediction played a lesser role in Experiment 3 is evident in the fact that the cloze probability of a control structure had no significant effect on looks in the PRO condition (see in Figure 14), in contrast to what was seen in Experiment 1. This fact provides further evidence that prediction was involved in Experiment 1, but not (or to a lesser extent) in Experiment 3. But it is not clear whether this is due to a reduction of the within-experiment proportion of control structures, or to the fact that listeners would have had to listen longer to verify predictions about individual items. In either case, when the experimental context reduced the likelihood of control structures, interpretation of PRO was slower.

6.4.3.3 *Effect of cue length?*

The point of divergence in looks to the target or competitor in the PRO condition was 170 ms later than in the $\text{pron}_{\text{subj}}$ condition. This is comparable to the difference between the duration of the cue in the two conditions: the non-finite verb in the PRO conditions was on average 160 ms longer than the pronoun in the $\text{pron}_{\text{subj}}$ condition. Therefore, even if resolution of the different forms of anaphora took the same amount of time after the relevant bottom-up input, the PRO condition could still be roughly 160 ms slower than the $\text{pron}_{\text{subj}}$ condition.

In order to better control for differences in cue length, the data were also compared beginning at the offset of the critical word, as illustrated in Figure 15. In this comparison, there is no significant difference between initial looks in the PRO and pronoun conditions. If anything, looks to the target in the PRO condition are numerically higher. Major differences only emerge after around 500 ms, at which

point looks in the PRO condition level off as participants interpret the remainder of the sentence. The divergence points between looks to the subject and object are also similar in the PRO and pron_{subj} condition, becoming significant at 115 ms and 120 ms, respectively, after the offset of the critical word. This suggests that listeners were able to resolve the anaphora in the PRO condition as fast as feasibly possible given the bottom-up input.

Interestingly, the pron_{obj} also differed from the pron_{subj} condition, with looks to the subject and object diverging 125 ms later than in the pron_{subj} condition when plotted from the onset of the critical word, and only 45 ms earlier than the PRO condition. From the offset of the critical word, the pron_{obj} condition showed significant divergence at 195 ms, roughly 75 ms slower than the PRO or pron_{subj} conditions. This may have been due to a subject bias in the resolution of the anaphora leading to fast interpretation in the pron_{subj} and PRO conditions. If, on the other hand, this subject bias were specific to overt pronouns in this experiment, then the speed of interpretation for PRO would be even more impressive, being only slightly slower than an overt pronoun, and even faster when measured from the offset of the critical word.

Although plotting from the offset of the critical word does provide some control over the effect of cue length, this type of analysis admittedly may be problematic, since the interpretation of any given word may begin before the end of the word. This may be especially true for the verbs in the PRO condition, in which listeners may have been able to identify the verb and begin interpreting it before the final syllable (*ing*). A different approach to control for cue length would be to normalize

it in the actual auditory stimuli by lengthening the duration of the pronouns and shortening the verbs. This would allow us to plot from the onset of the critical word and still control for cue duration, but it would also not completely solve the problem; it would remain unlikely that participants would require the same amount of time to correctly identify the target word.

6.5 General discussion

The experiments reported here provide evidence for the rapid interpretation of PRO in temporal adjuncts, suggesting that structural information can be used quickly in reference resolution. Using pronoun interpretation as a baseline, we found that when listeners may believe an upcoming control structure to be likely, their interpretation of PRO is slightly faster than their interpretation of overt pronouns. When the experimental context reduced the likelihood of a control structure, PRO is interpreted more slowly, but only insofar as the cue to anaphora is longer. After the relevant bottom-input is received, listeners are able to resolve both the implicit anaphora in adjunct control structures and pronominal anaphora at the same rate.

This result is interesting for a number of reasons. First, there are many different kinds of referential expressions and types of anaphora. Each may rely on syntactic, discourse, and conceptual sources of information in different ways. The interpretation of PRO in adjunct control structures is heavily dependent on structural features of the sentence, while pronouns, restricted by their ϕ features, rely more on discourse information. These experiments provide evidence that structural

information can be used in absence of other features just as efficiently as information guiding the interpretation of overt pronouns.

One of the differences between PRO and pronouns that make the results of this experiment surprising is that the cue that a referential dependency is needed in the PRO sentences, namely the nonfinite verb, does not itself have reference to an individual as its semantic function. Lexically, the verb expresses an event concept, or the concept of a relation to an event. The signal of anaphoric reference to an individual bearing that relation consists in the verb's grammatical context, a nonfinite context lacking a subject. While comprehenders interpret the verb, they must simultaneously find one of its participants in order to establish the referential dependency necessary to interpret PRO. This is one instance where, as Van Berkum (2008, p. 376) put it, it is not the case that “[f]irst you recognize each of the words, then you look up their meaning in your mental dictionary, and then, using syntax to guide the combination, you simply combine the meanings so that you know what I said.” Instead, recognition of the nonfinite verb in this particular context activates both the event concept lexically expressed by the verb, and the cue to anaphoric resolution of the subject argument.

The non-finite verb does not even unambiguously indicate that a control relation is necessary. As was seen in the example in (5), repeated in (9), at the non-finite verb, the sentence could still have a continuation that does not require a referential dependency between the implicit subject of the adjunct and the main clause subject. If (9a) is continued with (9b), the implicit subject receives an arbitrary

interpretation, no anaphora being necessary, but this only becomes clear later in the sentence, long after the non-finite verb.

- (9) a. Mickey talked to Minnie before eating pizza at the park on Sunday...
b. ... was forbidden.

And of course, as was seen in Chapter 2, a non-finite verb in a temporal adjunct could also be part of an NOC structure, which would also not require a syntactic dependency.

Although all of the examples in our experiment did require control by the main clause subject, it is still possible that participants in principle would wait to interpret the implicit subject until it was clearly necessary. However, this was not the case; participants quickly looked to the character corresponding to the main clause subject upon hearing the non-finite verb, evidently establishing the anaphoric control dependency at the earliest possible indication that it might be necessary.

6.5.1 Prediction in the resolution of anaphora

The role of prediction in the resolution of anaphora has been well documented. For example, Kehler et al. (2008) provide evidence that pronoun interpretation is incrementally influenced by predictions listeners make about what coherence relations are likely to be at play as well as what discourse entities are most likely to be next mentioned (see also Kehler & Rohde, 2013). In the examples in (10) from Caramazza, Grober, Garvey, and Yates (1977), for example, listeners predict that an

explanation for the first clause will be given, and their interpretation of the pronoun is biased towards whatever interpretation will satisfy that prediction. In (10a), this explanation is likely to be a description of something Mary did, and in (10b), it is likely to be about Jane, and listeners may be quick to assign those referents to the pronoun, despite the fact that the rest of the sentence may favor an alternative interpretation, as does (11). Kehler et al. also demonstrate that the same biases are at play even without the presence of words like *because*, suggesting even more strongly that prediction of coherence relations is driving pronoun resolution.

- (10) a. Jane hit Mary because she had stolen a tennis racket.
 b. Jane angered Mary because she had stolen a tennis racket.

- (11) Jane hit Mary because she reacts violently to criticism.

(Kehler et al., 2008)

The present experiments give evidence that not only conceptual sources of information, but also predictions about the upcoming structure of a sentence may affect the timing of anaphora resolution. When listeners may be likely to predict an upcoming control structure, resolution of its implicit subject is faster. This is in line with the arguments of (Kehler, 2008) that reference resolution is not a purely reactive process, with participants always waiting for cues before retrieving potential antecedents. Instead, listeners may actively predict upcoming structure and likely referents before any cue for reference is received.

One question that still remains from these experiments is the extent to which

these kind of structural predictions influence reference resolution in real-world language use. Individual item contexts in Experiments 1 and 2 appeared to favor prediction of control structures. But was that due to properties unique to these items or to the simple image and discourse context? Or are control structures predicted in similar sentences more generally? Did adding additional fillers in Experiment 3 lead to more naturalistic processing of PRO, or did it reduce the predictions that listeners make in sentence processing outside the lab? Although these experiments do not answer these questions, it is clear that listeners *can* use structural predictions to aid anaphora resolution, and that when the context changes those predictions, the use of structural information in the resolution of PRO takes no more time than the use of morphological information in pronoun resolution once the bottom up input is heard.

6.5.2 Additional implications

The results of these experiments have at least two other relevant implications. First, they call into question a previous claim that the interpretation of PRO in adjuncts involves a “most-recent filler strategy.” As mentioned in Chapter 5, based on the results of an eyetracking-while-reading study, Betancort et al. (2006) (following Frazier et al., 1983; Nicol & Swinney, 1989) suggest that upon encountering PRO, comprehenders first consider the most (linearly) local potential antecedent, even if they must later revise that initial interpretation to establish an anaphoric dependency between PRO and the main clause subject.

If such a strategy were active in the current experiment, we would expect ini-

tial looks during the critical region in the PRO condition to be to the competitor, as it was the most recently mentioned potential antecedent. However, in Experiment 1, looks to the target began to rise immediately after the onset of the critical word, while looks to the competitor quickly began to decrease, suggesting that comprehenders were at no point considering the more recently mentioned character over the main clause subject in the PRO conditions. Even in Experiment 3, when interpretation of PRO was slower, looks to the competitor were never higher than looks to the target in the critical region of the PRO condition. It is therefore possible that both characters were under equal consideration, which on its own would counter the garden-path theory. But it is also possible that interpretation of the anaphora had simply not begun at that point, and that once resolution of the anaphora began, the subject was quickly recognized as the only potential antecedent.

Finally, previous research on the processing of PRO has left open the possibility that it is not actually resolved. These experiments give evidence that at least in some contexts, PRO is resolved quickly during incremental sentence processing.

6.6 Conclusion

This chapter used visual-world eyetracking to investigate the processing of the implicit subject in adjunct control. It has shown that the implicit subject can be interpreted at least as quickly as overt pronouns, especially when participants may be predicting an upcoming control structure. Studying different forms of reference can shed light on how different sources of information are implemented during sen-

tence processing, and this study contributes by providing evidence that structural information can be immediately utilized in reference resolution.

Chapter 7: Conclusion

This dissertation has explored the syntax and processing of adjunct control. Part I demonstrated in detail that temporal and rationale adjuncts allow both OC and NOC, as do some other adjuncts, contrary to prior assumptions about the complementarity of OC and NOC. But the same is not true for all adjuncts. Some appear to be strictly OC and others strictly NOC, contrary to implicit predictions of the TTC as instantiated in Landau (2017). I have argued that the MTC is able to better explain the distribution of OC and NOC in some adjuncts, as long as it is assumed that not all adjuncts are phases. However, the MTC also struggles in capturing the full range of data. Thus, although this dissertation does not present a full theory of the syntax of adjunct control, it does highlight some of the difficulties associated with it for two modern theories of control.

Part II summarized some of the previous literature on the processing of adjunct control and presented a set of experiments investigating the timing of the resolution of PRO in subject-controlled temporal adjuncts. It was shown that PRO can be interpreted in temporal adjuncts just as quickly as an overt pronoun can be, once the relevant bottom-up input is received to cue the referential dependency. This timing

information provides important foundational knowledge for future research into the processing biases relevant to the interpretation of adjunct control more generally.

This concluding chapter discusses implications of this research and some remaining questions, setting an agenda for future research.

7.1 Implications of this research

7.1.1 Adjuncts

The study of control has most frequently focused on cases where the controlled clause is the complement of a main clause verb. Theories of the control relation and of controller choice have been built largely on the properties of complement control, and adjuncts have often been ignored to a significant extent. In syntactic theories of control such as the predominant version of the MTC, it is assumed that adjunct control will display the same properties as complement control. Even some semantic theories of control make the same assumption. For example, Farkas (1988) argued that controller choice is determined by a Responsibility relation (RESP)-relation in complement control as well as in adjuncts, although her discussion of the latter is limited to RatCs. Other semantic theories of control such as that of Sag and Pollard (1991) do admit that the mechanism of controller choice in adjuncts may differ from the one involved in complement control, since they are not selected by any element of the main clause, but the discussion of adjuncts is stated as an aside, with no detailed analysis.

This dissertation has provided evidence that adjuncts do not all behave in the

same way as complements, contrary to what Hornstein (1999) and Boeckx et al. (2010) assume. While complements require OC, some adjuncts, including temporal adjuncts and RatCs, allow both OC and NOC. It is also not the case, though, that all adjuncts uniformly behave differently from complements, as is implicit in Landau (2017). Several adjuncts require strict OC. Although some of these seem to behave like quasi-arguments, it is likely that some of them (SPCs and telic clauses, at least), are true adjuncts.

It is unclear as of yet how the processing of adjunct control relates to the processing of complement control. There are some reasons to expect that adjunct control would be processed more slowly, which is in fact what Betancort et al. (2006) found for one type of adjunct. In complement control, the embedding verb selects a control structure, and therefore provides a highly predictive cue to the upcoming PRO. Adjuncts, on the other hand, are not selected by any element of the matrix clause. But there may still be cues to an upcoming control structure, such as the temporal prepositions *before*, *after*, and *while* that were used in the experiments presented here. Although there was no comparison with complement control in these experiments, it seems unlikely that PRO in complement control could have been interpreted any quicker. But although the adjuncts in the experiments reported here were interpreted quite quickly, the same may not be true for other adjuncts, such as those that have no prepositional cue, as with the absolutive clause in (1), or in settings where NOC is more likely, as in (2).

- (1) Mickey₁ flirted with Minnie outside the schoolhouse, [PRO₁ having put on his finest suit].
- (2) The hamburgers₁ became much more popular at the school carnival after. . .
 - a. PRO₁ cooking just a little bit longer.
 - b. PRO cooking them₁ just a little bit longer.

7.1.2 The OC/NOC distinction

This dissertation also has implications for what we mean by the terms “obligatory” and “non-obligatory” control. Williams (1980) applied the term “OC” to any case of control having the properties in (3). Sentences with “NOC” were argued to have none of these properties.

- (3) OC1. Lexical NP cannot appear in the position of PRO.
- OC2. The antecedent precedes the controlled PRO.
- OC3. The antecedent c-commands the controlled PRO.
- OC4. The antecedent is thematically or grammatically uniquely determined.
- OC5. There must be an antecedent.

In short, “OC” was used to define any case of control where a control dependency was required between an obligatory PRO and a unique antecedent.

The definition of “OC” and “NOC” in the MTC is different. According to Hornstein (1999), OC simply entails that the relation between PRO and its antecedent is syntactic—specifically, that it is a movement relation. NOC entails that

PRO's interpretation is not determined syntactically. A similar definition just for adjuncts is given in Landau (2017), but with OC entailing a predicative relation and NOC a logophoric one. Under these definitions, a sentence that can exhibit OC would not necessarily require that its antecedent be uniquely determined or that it c-command PRO. Nor do these definitions strictly require PRO in such sentences to have an antecedent, if NOC is also available for the same sentence (although according to Boeckx and Hornstein (2007), "parsers" will rarely allow both OC and NOC).

These more modern versions of the notions of OC and NOC are what I have used: OC involves some sort of grammatical dependency (movement, binding, or coargumenthood) between PRO (whatever that label represents) and its antecedent, while in NOC, PRO's interpretation is determined without a grammatical dependency. This definition of OC does not require that there be an antecedent in every case. In other words, OC does not preclude NOC, contrary to what (3) suggests; some adjuncts allow but do not require OC antecedents, permitting NOC as well.

However, there is some merit in maintaining a Williams-style concept of OC and NOC. In complements and in some adjuncts, the antecedent is both required and uniquely determined. In other words, OC is the only option. I have labeled this "strict OC." Some adjuncts allow both syntactic OC and non-syntactic NOC. And others still require strict NOC. Landau (2015) also noted that traditional notions of OC and NOC did not adequately capture distinctions in the types of control that are possible. In the terms of the TTC, complement control is strictly OC, which can be instantiated as either a predicative or a grammatically-determined

logophoric relation. Some adjuncts require strict predicative OC and others strict NOC, while others allow both predicative OC and logophoric NOC. Instead of a binary OC/NOC distinction, we need at least a three-way categorization, including strict OC, strict NOC, and optional OC/NOC.

Within the third category, even though both types of control are possible, OC is strongly preferred, all else equal. I have argued that this is due to processing preferences. For example, parsers may prefer OC because of its simpler structure, if the TTC (Landau, 2015) is correct. Or, under the the MTC, parsers may prefer to posit a trace when they encounter a gap, resulting in OC, rather than a null pronominal for NOC (Boeckx & Hornstein, 2007; Boeckx et al., 2010). In addition to or instead of these, OC may be more preferred to NOC to a more general preference for bound variable readings (Reinhart, 1983, 2006), or a preference for local (Cunnings & Sturt, 2014) or recent (Cunnings et al., 2014) antecedents. Factors favoring NOC may include the availability of a non-local perspective-holding potential antecedent, whether OC would result in a strange interpretation (Landau, 2017), attachment site of the adjunct (Landau, 2013), or other factors.

In the experiments in Chapter 6, despite the fact that temporal adjuncts sometimes allow NOC, participants only appeared to consider OC interpretations, quickly resolving PRO to the referent of the main clause subject. Of course, within the experiments, there were no cases of intended NOC. Still, the results give some indication that the preference for OC may be strong enough that NOC is not even considered an option if the OC reading is likely.

7.1.3 Constraints on reference

This research has additional consequences in the study of constraints on reference more generally. In remote control of RatCs, for example, the referent of PRO can be restricted quite strongly, even when it is not done through grammatical means. In (4a), control by the object is ruled out without further supporting context. When the object is raised to the subject position in (4b), however, it can remotely control PRO. But this cannot be because a syntactic dependency between *Sam* and PRO is possible in (4b) but not (4a), since there can be no such dependency in either case.

- (4) a. *The police arrested Sam₁. The goal was PRO₁ to get himself off the streets.
- b. Sam₁ was arrested by the police. The goal was PRO₁ to get himself off the streets.

This provides evidence that there can be strong constraints on reference that are non-grammatical but that are nevertheless highly sensitive to grammatical structure. In prior literature, pragmatic constraints on reference in general have been described as sensitive to syntactic structure only inasmuch as it effects information structure. Examples from Kehler (2004), repeated in (5), for example, showed that the referent of a pronoun can be constrained by topichood. Because the subject of a passive is a strong topic, the pronouns in (5a) and (5b) are much more likely to refer to the demonstrators than to the city council, even if resolution of the pronoun to the

demonstrators results in a less coherent discourse. When the sentence is in active voice in (6), on the other hand, conceptual constraints play the lead role, and we simply resolve the pronoun in whichever way yields the more likely story.

(5) The demonstrators were denied a permit by the city council because...

- a. ...they *feared* violence.
- b. ...they *advocated* violence.

(6) The city council denied the demonstrators a permit because...

- a. ...they *feared* violence.
- b. ...they *advocated* violence.

Although PRO in a remote RatC is something like a free pronoun, its interpretation is not constrained solely on the basis of coherence and information structure. This can be seen in examples such as (7) and (8).

(7) *An alarm woke the boy₁ up early. The goal was PRO₁ to wash himself before school.

(8) The demonstrators were denied a permit by the city council. The goal was PRO to reduce violence.

In (7), if coherence were the only issue, then it would be surprising that PRO could not refer to the object of the first sentence, as this would result in a sensible discourse; boys are much more likely than alarms to wash themselves before school. Similarly,

if information-structural constraints were as important in RatCs as they are in examples such as (5), without additional constraints, then the strongly preferred interpretation of (8) should be one where PRO refers to the demonstrators. This does not seem to be the case. PRO in (8) seems much more likely to refer to the city council, despite the information-structurally strong position of *the demonstrators*.

Even more strikingly, the same interpretation is the most likely in (9). Here information structure still favors control by *the demonstrators*, and this could even arise through OC, which should further increase its likelihood. Yet we still find that PRO is much more likely to refer to the city council.

- (9) The demonstrators were denied a permit by the city council in order PRO to reduce violence.

PRO in a RatC, then, is subject to constraints on reference that go beyond coherence and are sensitive to structure for reasons other than information structure, and beyond the preference for OC when possible. Sentence structure can apparently affect who can easily be seen as responsible for a fact. This in turn affects the reference of PRO. A. Williams and Green (2017) state that objects are generally unable to control PRO in a RatC, even when syntactic OC is completely unavailable, as in remote control, because they are represented as non-responsible. Thus, control may be determined through a conceptual notion that is independent of information structure but is nevertheless sensitive to syntactic structure.

In sum, constraints on reference can be conceptual as in (6), or purely struc-

tural, as with reflexives or cases of OC. Or they can also be sensitive to structure, but still not grammatical. This can arise through the effect syntactic structure has on information structure, as in (5), or it can be due to how syntactic structure affects the way individuals and events are represented, as is relevant for RatCs.

7.1.4 Prediction in reference resolution

Finally, the experiments in Chapter 6 provide insights into the types of predictions comprehenders may utilize during reference resolution. Previous research has shown that pronoun resolution is influenced by predictions about coherence relationships, about which discourse entities are most likely to be mentioned, and which entities are most likely topics (Kehler & Rohde, 2013). In the experiments reported here, PRO's resolution may also have been influenced by participants' predictions about upcoming structure. In Experiment 1, participants may have been predicting upcoming control structures, which led to faster resolution of PRO than in Experiment 3, when control structures were less likely. Crucially, the influence of such predictions must have been independent from predictions about the next likely referent. In Experiment 1, if participants were simply predicting that the subject was most likely to be next mentioned, then looks to the target character and away from the competitor should have been just as fast for pronouns coreferring with the subject as for PRO. This was not the case. Instead, participants may have predicted an upcoming control structure, which entailed in this experiment coreference with the main clause subject, but when the onset of a pronoun was heard, the

structural prediction was abandoned, along with its corresponding subject reference prediction.

7.2 Remaining questions and future work

In this dissertation, I have not attempted to provide a conclusive theory of the syntax of adjunct control or of its processing. Although I believe it provides important progress, there are many open questions. Here I discuss just a few.

7.2.1 Variability in adjunct control

As demonstrated in Chapter 4, neither the TTC nor the MTC can adequately handle the whole range of adjuncts that allow control. The TTC predicts that all adjuncts will allow both OC and NOC, which is not the case. The MTC as formulated here allows for some adjuncts to be strictly OC, as long as they attach low enough and have a small enough structure, but this also fails to account for telic clauses. Further research is therefore needed to develop a comprehensive theory of adjunct control, situated within a broader theory of control.

Additionally, both the TTC and the MTC accounts predict that similar patterns will be seen cross-linguistically. Many adjuncts should allow both OC and NOC. What may differ, however, is the weighting of factors favoring OC interpretations over NOC in processing. As just one example, Español-Echevarría (2000) argues that Modern Greek does not allow NOC, and that therefore implicit control

of RatCs is impossible (compare (10a) and (10b), from Español-Echevarría (2000, pp. 101–102)).

- (10) a. O Yannis vithise to plio ya na voithisi tin vassilisa.
the Yannis sank the boat for NA help-ACT-3S the queen.
‘Yannis sank the boat in order to help the queen.’
- b. *To plio vithistike ya na voithisi tin vassilisa.
the boat sink-PASS-3S for NA help-ACT-3S the queen
‘The boat was sunk in order to help the queen.’

A complete restriction against NOC would require there to be no logophoric control under the TTC, which is unlikely, at least for complement control. Under the MTC, there would have to be no last-resort pronominalization option in the derivation of control structures. Or, it may be possible that NOC is actually still allowed by the grammar, but that OC is simply more heavily favored in Greek than in English. This would be consistent with Kotzoglou (2016), where it is argued that NOC is possible in gerundive adjuncts, but only if PRO is understood to refer to an implicit argument of the matrix clause.

It is certain that other languages will also show distinct characteristics with respect to the possible forms adjunct control may take and its possible interpretations.

7.2.2 Biases contributing to OC preference

Along these lines, a major question that remains is what the specific biases leading to the preference for OC are, both in English and cross-linguistically. I

have argued that the preference is due to processing biases, but clearly structural and other factors may contribute to the probability of choosing OC or NOC during processing. I have speculated here about some possible factors, as well as what kinds of sentences may favor NOC, but a more detailed exploration of these biases is needed. One way to start would be with a systematic acceptability judgment task where sentence-structural features can be controlled and compared. Processing experiments targeting the preference for local antecedents, the preference for syntactic versus discourse relations, and other potential factors would also be useful.

Perhaps, contrary to my assumptions, the preference for OC is not strictly due to processing, but is in fact encoded in the grammar of adjunct control. If that is the case, then additional experiments investigating potential processing biases would still be enlightening. If the experimental design were to control for all possible processing factors (e.g. frequency of OC and NOC in a given structure, topicality of potential OC and NOC antecedents, etc.), and yet there is still a preference or advantage for OC, this may serve as compelling evidence that it is not simply a processing effect. Instead, this would suggest a grammar-internal preference, either for OC over NOC specifically, or for binding over discourse coreference more generally.

7.2.3 Preference for upward movement

A related question relevant to the MTC account of adjunct control put forth in Chapter 4 is the source of the preference for upward movement over sideward movement. I speculated that this was due to a derivational penalty being assigned to sideward movement, which in turn reduces the relative preference for OC over NOC.

However, why sideward movement should incur such a penalty remains unclear. It could perhaps, simply have to do with the fact that sideward movement requires forming a syntactic dependency between two separate workspaces, so to speak, in the derivation. Or it could have something to do with constraints on proper movement. This question deserves greater attention and research.

7.2.4 Interaction of different sources of information

An additional question that merits further study is the extent to which different sources of information interact in prediction and the resolution of anaphora. For example, Kehler et al. (2008) found that expected coherence relations can strongly affect the interpretation of pronouns (see also Hobbs, 1979; Kehler & Rohde, 2013). In (11), listeners/readers expect that the second clause will provide an explanation for the first. Therefore, the pronoun *she* is interpreted in the way that will result in the most sensible explanation; in (11a), *she* is interpreted as ‘Mary’, but in (11b), as ‘Jane’.

- (11) a. Jane hit Mary because she had stolen a tennis racket.
b. Jane angered Mary because she had stolen a tennis racket.

But what happens when the coherence relation is incongruous with the structural constraints of the sentence? How do structural and conceptual sources of information in anaphora resolution interact? In (12), for example, the referent of the pronoun is most likely to be determined based on the coherence relation between

the two clauses, with *he* in (12a) referring to Donald, and *he* in (12b) to Mickey. But in (13), even though the same coherence relation is likely to be predicted, PRO in both (13a) and (13b) is much more likely to refer only to Mickey, given the strong preference for OC. How quickly can syntactic information from the sentence override the conceptual expectations listeners have?

- (12) a. Mickey got really angry at Donald outside the schoolhouse after he stole the new red ball he got for his birthday.
- b. Mickey really angered Donald outside the schoolhouse after he stole the new red ball he got for his birthday.
- (13) a. Mickey got really angry at Donald outside the schoolhouse after PRO stealing the new red ball he got for his birthday.
- b. Mickey really angered Donald outside the schoolhouse after PRO stealing the new red ball he got for his birthday.

Exploring the real-time processing of sentences such as these can help inform us about prediction in language processing and how the mind integrates different sources of information. It may also shed additional light on the interpretive biases that lead to the preference for OC and what factors contribute instead to NOC.

7.2.5 Processing and representation

Further work could also be done to determine whether syntactic and discourse dependencies have different processing profiles. Implicit in the work of Mauner and

Koenig (1999, 2000) is the assumption that differences between syntactic and non-syntactic dependencies will result in differences in processing. But the experiments in McCourt et al. (2015) cast doubt on that conclusion. At least for self-paced reading times, syntactic OC in local RatCs adjoined to active matrix clauses and non-syntactic NOC in remote RatCs do not exhibit different processing profiles.

Still, it is possible that in other measures, differences between syntactic and non-syntactic anaphoric dependencies will be reflected in real-time processing. Such measures may lead to a greater understanding of the grammatical representation of these dependencies as well as how these dependencies are encoded and accessed in memory.

7.2.6 The acquisition of adjunct control

One final area that merits further inquiry is how and when children acquire adjunct control. Gerard (2016) demonstrated that by the age of four, children assume that PRO in temporal adjuncts is controlled by the matrix subject, while at the age of three, children accept both object and subject control equally. However, Gerard only tested sentences that adults unanimously agreed were subject control. The acquisition of non-subject controlled temporal adjuncts and of other types of adjunct control is a completely open question.

7.3 Conclusion

This dissertation represents the beginning of a research program that aims to increase our understanding of implicit and explicit forms of reference both in English and cross-linguistically. It may ultimately illuminate how the mind integrates syntactic and non-syntactic sources of information in anaphora resolution. In so doing, it will contribute to our knowledge about the use of prediction in language processing and the process by which referential expressions access their antecedents in memory.

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