

# Split-scope effects in definite descriptions

by

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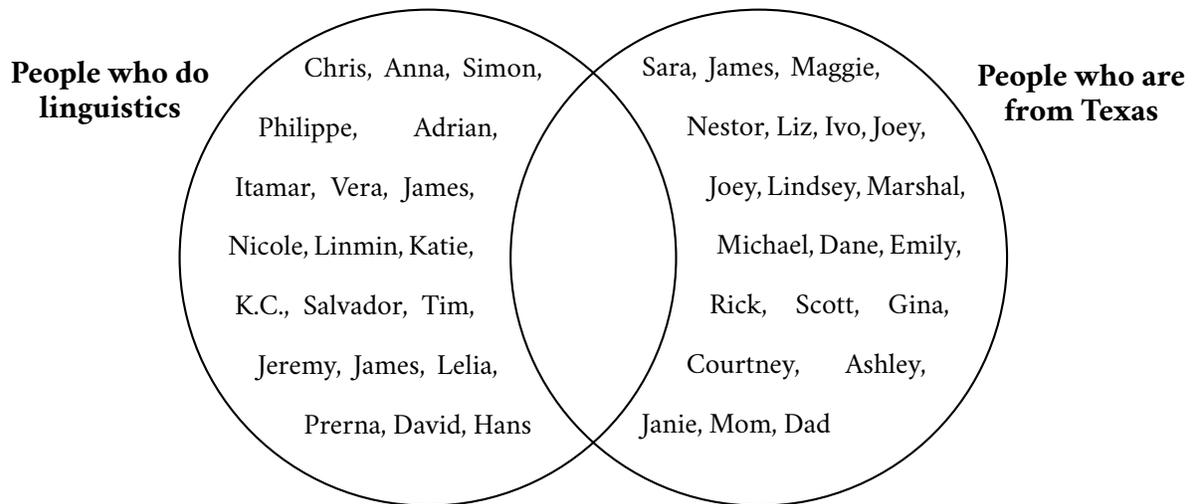
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Chris Barker

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I have a lot of people to thank for this dissertation. The following diagram of my social network may prove useful.



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## Abstract

This dissertation argues for a specific semantic decomposition of morphological definiteness. I propose that the meaning of ‘the’ comprises two distinct compositional operations. The first builds a set of witnesses that satisfy the restricting noun phrase. The second tests this set for uniqueness. The motivation for decomposing the denotation of the definite determiner in this way comes from split-scope intervention effects. The two components — the selection of witnesses on the one hand and the counting of witnesses on the other — may take effect at different points in the composition of a constituent, and this has non-trivial semantic consequences when other operators inside the determiner phrase take action in between them. In particular, I analyze well-known examples of mutually recursive definite descriptions like ‘the rabbit in the hat’ (when there are two rabbits and two hats but only one rabbit in a hat and only one hat with a rabbit in it) as examples of definites whose referent-introducing and referent-testing components are interleaved rather than nested.

I further demonstrate that this picture leads to a new theory of so-called relative superlative descriptions like ‘the kid who climbed the highest tree’ (when there is no highest tree, *per se*, only a highest tree-climbing kid), which explains the previously mysterious role of the definite determiner in licensing such readings. Building on this approach to superlatives, I develop a split-scope treatment of focus-marking and show that certain interpretations of exclusive adjectives may also be characterized as relative readings. Finally, I present new data based on binding patterns in definite and possessive descriptions that provide evidence for scope-theoretic treatments of relative readings, and especially for the analysis described in this dissertation according to which relative readings are a consequence of delayed evaluation of determiners.

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## Chapter 1

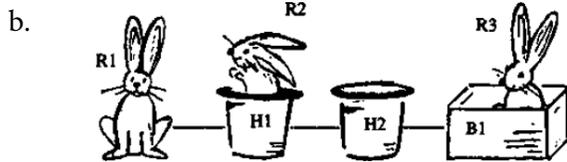
### Introduction

This dissertation argues for a specific semantic decomposition of morphological definiteness. I propose that the meaning of ‘the’ comprises two distinct compositional operations. The first builds a set of witnesses that satisfy the restricting noun phrase. The second tests this set for uniqueness. The motivation for decomposing the denotation of the definite determiner in this way comes from split-scope intervention effects. The two components — the selection of witnesses on the one hand and the counting of witnesses on the other — may take effect at different points in the composition of a constituent, and this has non-trivial semantic consequences when other operators inside the determiner phrase take action in between them.

The chapters that follow consist primarily in demonstrations of exactly this sort of intervention. In Chapter 2, I argue that the two components of definiteness sometimes in fact interfere with each other. As a result, one of the operations that can intervene between the two steps of definite determination is the introduction of a second discourse referent further restricts the values that might witness a description. The canonical instance of this, and the launching point for the dissertation, is an example due to [Haddock \(1987\)](#). He observes that the description in (1) can be used felicitously and unambiguously in a model that contains multiple salient hats, like that in (1b), so long as it contains just one hat that contains a rabbit. If so, the description refers to the unique rabbit in that unique rabbit-containing hat.

(1) the rabbit in the hat

a. ✓ the rabbit of the rabbit-hat pair such that the former is in the latter

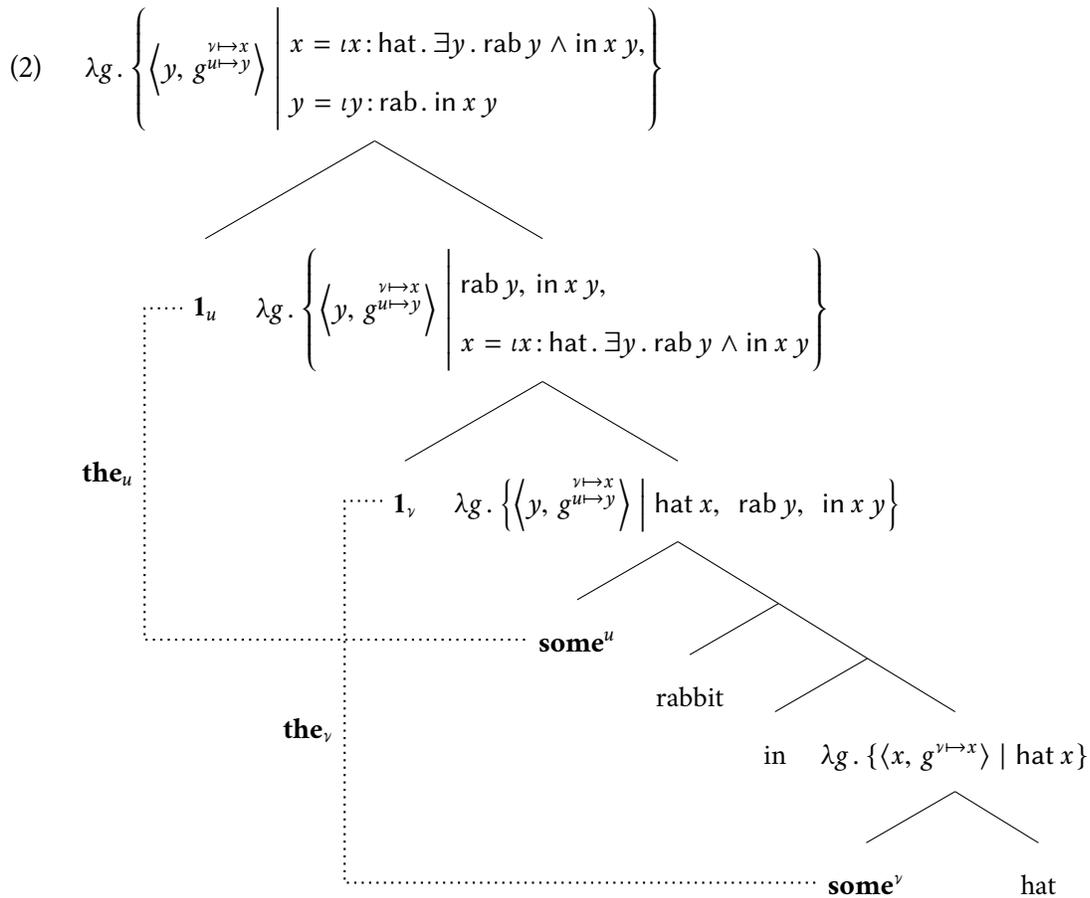


Examples like (1) pose an immediate challenge to compositional semantic interpretation, since the embedded description — ‘the hat’ — is not well defined in (1b). Which hat it is that the prepositional object refers to in fact seems to be a function of which rabbit it is that the host description refers to; it’s the hat that that rabbit is in. But of course to identify the right rabbit, one needs to know which hat one ought to be looking in; it’s the rabbit that’s in that hat. There doesn’t seem to be any place to start in piecing together the meaning of this phrase, since all the pieces depend on each other.

If nothing else, this thesis aims to provide a means of breaking out of the semantic loop that (1) threatens to put us in. The goal is to try and slip the pass between the rock of undefinedness and the hard place of mutual recursion. As mentioned at the outset, the basic hypothesis is that each of the two definites encodes a multi-step computation, and in the case of (1), those two computations are braided. Schematically, it plays out as follows. The inner description allocates a referent  $u$  in the discourse memory and considers in parallel all the potential ways of mapping that referent onto an object in the model satisfying the content of the inner nominal, i.e., onto a hat. Normally at this point, the second phase of the definite determiner would test that all of the potential assignments in the output of the first phase *agree* on the choice of hat that they assign to  $u$ . This would guarantee the existence of just a single hat in the model.

But in this example, processing of the outer description begins before the uniqueness test of the inner definite is executed. Like the inner description, the outer definite also introduces a referent  $v$  and considers the various ways of witnessing that referent in the model consistent with the descriptive content it heads. Because part of that content subsumes the nondeterministic choice that the first

definite has just made, it binds the two choices together, yielding only rabbits  $v$  that are in the hat that the inner definite selected for  $u$ . At this point the unicity tests of the two determiners fire. But because the choice for the hat is now tied to the choice for the rabbit, and since there is now only one possible mapping of  $u$  and  $v$  that satisfies the simultaneous constraints imposed by the noun phrases, the uniqueness tests are independently satisfied. The inner test sees that only a single hat remains as a live candidate for the value of  $u$  (the one with a rabbit in it), and the outer test sees that only a single rabbit remains as a candidate for the value of  $v$  (the one in a hat). The entire process is sketched in (2).



Crucially, the entire description ends up with the felicity conditions paraphrased in (1a) as a result of entirely compositional processes. That is, neither of the determiners is semantically vacuous, and there is no actual quantification over pairs. By defining the unicity tests as tests over specific coordi-

nates of *assignments* — which encode multiple pieces of information at once — the truth conditions simulate polyadicity in exactly the way that seems to be empirically required.

Of course, conceiving of determiners as operations on assignments is not new; it is the oldest trick in the dynamic playbook. It *is* the dynamic playbook. What is new is the conception of the definite as split into components that take scope at different levels of the computation. It is only by delaying the force of the comparative component of the inner definite until further operations — here, the introduction of rabbits and the constraint that the hat in question have a rabbit in it — have acted to restrict the available assignments that the uniqueness test has a chance to succeed, given all the hats.

Building on the schematic logical structure in (2), I go on in Chapter 2 to demonstrate that this approach leads to a new theory of *relative readings* of superlative descriptions. One such reading is illustrated by the phrase in (3), understood as in (3a). The intuition that researchers have been chasing for decades regarding constructions like (3) is that though the superlative adjective syntactically modifies the embedded noun phrase ‘tree’, it seems nevertheless semantically to be comparing *kids*. That is, rather than comparing trees with respect to their heights, it seems to have a reading on which it compares kids with respect to their tree-climbing performances.

- (3) the kid who climbed the highest tree
  - a. ✓ the kid who climbed a tree higher than any tree climbed by any other kid

The compositional challenge here is less severe than in the mutual definition case above, and accordingly there are many well-defended theories of how such relative readings emerge. What Chapter 2 demonstrates is that relative readings come for free, as it were, once the [Haddock](#) problem is solved! If one can explain how it is that ‘the rabbit in the hat’ comes to refer to the rabbit that’s in the hat that a rabbit is in, then it is a small step to explain how ‘the rabbit in the biggest hat’ can refer to the rabbit that’s in the biggest hat that a rabbit is in.

That small step is to render the denotation of superlative adjectives as *filters* over dynamic outputs, exactly like the uniqueness test of the definite determiner. So where the cardinal component of ‘the’

looks across all of the live candidate assignments of discourse referents to real-life objects and tests that there is no confusion about which object its particular referent ought to be assigned to, the superlative component of ‘highest’ looks across all of these potential assignments, and rules out any of them that do not maximize the height of the object assigned to their particular referent. In other words, any assignments that choose for *u* a tree that is not as high as what some other assignment has chosen for *u* should be abandoned as a way of interpreting the description.

Formally, this is interesting because it pushes the denotation of superlative morphology into a kind of *postsupposed* test on dynamic information states, very much like recent proposals for cardinal vocabulary (Brasoveanu 2012, Charlow 2017a). Conceptually, it is interesting because it ties the delayed evaluation of the superlative to the delayed evaluation of the determiner that hosts it. One of the great puzzles for scope-theoretic treatments of relative readings is how to explain the role of the definite article in licensing them, given that the relative superlative description itself is by all measures behaviorally indefinite (Szabolcsi 1986), as is hinted at by the paraphrase in (3a) (i.e., the ‘*a* higher tree’ part). This analysis provides a couple of answers to that question. First, and most importantly, the definite is itself responsible for any apparent scope-taking on the part of the superlative. The superlative adjective is not typed for scope-taking, and so couldn’t even if it wanted to, assuming that things that take scope leave traces. The “scope” of the superlative is instead a function of the alternatives still in play by the time it is evaluated, and like the uniqueness test of the definite, this is sometimes offset from the time that the referent is introduced.

Chapter 3 extends the treatment of relative superlatives to exclusive adjectives like ‘only’. Descriptions of the form ‘the only NP’ have been claimed to show that the “exactly one” presupposition often supposed to accompany morphological definiteness is too strict. For example, if all descriptions of the form ‘the X’ presupposed that the model contained just a single X, then the sentence in (4) would entail that any model validating it includes exactly one ‘only author of *Waverley*’. But the most natural interpretation of (4) is as in (4a), which certainly does not entail the existence of exactly one solo author; on the contrary, it entails the absence of any such people.

- (4) Scott is not the only author of *Waverley*
- a. ✓ Not only Scott is an author of *Waverley*

In Chapter 3 I show that examples like (4) are part of a larger paradigm that mirrors the patterns of superlative descriptions introduced in Chapter 2. For example, where (4) says that Scott is not alone in being an author of *Waverley*, the sentence in (5) says that the Super Bowl is alone in being a game that the Patriots lost. This cannot merely be a matter of ‘the’ entailing something weaker than exact unicity of the Patriots’ games (as a matter of fact, they played 19 games that year); one way or another, the exclusive clearly quantifies over the set of games that the Patriots *lost*.

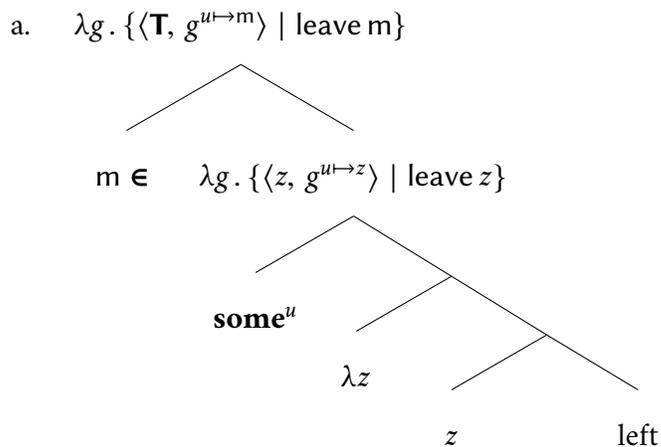
- (5) The Patriots lost the only game of their season in the Super Bowl
- a. Only in the Super Bowl did the Patriots lose a game

I collect attested examples like this and argue that the only way to make sense of them is to adopt ideas from the superlative literature. In particular, I show that it is straightforward to extend the techniques of Chapter 2 to incorporate these relative exclusives. The first task is to recast the denotation of ‘only’ as a filter on alternatives, in the mold of the earlier superlatives and cardinality tests. The second is to reanalyze focus-marking as a process that forks a computation into two parts — one that generates a function from alternatives to truth values, and another that applies the function to the uttered alternative. Mathematically, neither of these moves represents a particularly radical departure from current theorizing about focus or exclusive denotations, but they acquire new significance in light of the broader conceptualization of multistratal meanings and quantificational adjectives as dynamic tests. In any case, the same sort of delayed-definiteness derivations introduced in Chapter 2 suffices to generate the relative readings of exclusives. For instance, the sentence (5) comes out as asserting that the only value that satisfies the property of being a game that the Patriots lost is the Super Bowl.

Following up on the promise of focus as a two-step computation, in Chapter 4 I unfold a full-bore split-scope treatment of focus-marking. I argue that focused phrases denote bipartite computations

very much like that of the definite determiner. In the first step, a number of alternatives are generated, which again introduces a nondeterministic mapping of a discourse referent to objects in the model. This much is exactly as with ‘the’. But in the second step, rather than counting the number of distinct witnesses that the first step was able to find in the model, the focus marker tests to see whether the denotation of the actually uttered phrase has survived the updates imposed by the constraints in the phrase’s scope. For example, the sentence in (6) with focus on the subject, is derived as in (6a). First, a dynamic indefinite generates alternate mappings for the argument of the predicate, keeping only those assignments that map  $u$  to an individual that did in fact leave. Second, the focus filter checks to see whether the remaining alternative mappings still include Mary. Effectively, the sentence is true if Mary is one of the people who left.

(6) MARY left



With this semantics for focus in place, I present a suite of novel data based on binding patterns in definite and possessive descriptions that provide evidence for scope-theoretic treatments of relative readings, broadly construed, and especially for the analysis described in this dissertation according to which relative readings are a consequence of delayed evaluation of determiners. The essential contrast is given in (7) and (8).

(7) John asked MARY about the fewest of her papers

a.  $\checkmark \forall z \neq m. \max \{n \mid j \text{ asked } m \text{ about } n \text{ of } m\text{'s papers}\} < \max \{n \mid j \text{ asked } z \text{ about } n \text{ of } m\text{'s papers}\}$

b.  $\checkmark \forall z \neq m. \max \{n \mid j \text{ asked } m \text{ about } n \text{ of } m\text{'s papers}\} < \max \{n \mid j \text{ asked } z \text{ about } n \text{ of } z\text{'s papers}\}$

(8) \*John asked MARY about her fewest papers

With focus again on ‘Mary’, the sentence in (7) is ambiguous between the *strict reading* in (7a) and the *sloppy reading* in (7b). The former entails that of all people that John asked about *Mary’s papers*, he was most shy when asking Mary herself. The latter that of all the people that John asked about *their papers*, he was shyest with Mary. I point out that many theories of superlatives struggle to derive the sloppy reading. Essentially any theory that does not give the superlative enough semantic perspective to see that the extension of the phrase ‘of her papers’ ought to co-vary with the focus alternatives will not be capable of generating a reading on which various people’s *respective* papers are compared.

However, the class of theories that fares best with respect to the data in (7) predicts that (8) should be ambiguous in precisely the same way. This is because such theories rely on ignoring the force of the determiner and scoping the superlative morpheme itself, in which case it shouldn’t much matter whether the bound pronoun is in the complement or the specifier of the superlative description. In contrast, the theory developed in Chapter 2, because it identifies the scope of the superlative as parasitic on the scope of the determiner, correctly predicts that there couldn’t possibly be a sloppy relative reading of (8). For (8) to be interpreted relatively, the superlative would have to be evaluated after the focus introduces its alternatives, but before the focus tests to see whether Mary is among the survivors. But if the superlative is interpreted outside of the scope of the focus alternatives, then there’s no way for the determiner it is connected to to be bound by the indefinite that generates the alternatives in the first place.

Though Chapters 3 and 4 extend and broaden the empirical reach of the essential hypothesis laid out in Chapter 2, they are intended to be self-contained. Each provides the definitions and derivations needed to describe a compositional analysis for the data it presents. So readers interested only in mu-

tual definiteness, focus, exclusives, possessives, or sloppy anaphora should have no trouble beginning and ending their time with this dissertation in the relevant chapter.

In particular, none of those modules depend on the fragment developed in Chapter 5. Issues of scope splitting are tricky to work on without committing to a number of assumptions about the syntax-semantics interface. I have tried to spell out what I think is responsible for the relative readings on display throughout the dissertation in fairly conceptual terms, with just enough formalization to make it clear what I am saying and how the derivations might be carried out. I think there is great value in separating the mathematical techniques from the empirical hypotheses, to the extent that this is possible. But of course I also think there is great value in the assembly of complete and explicit compositional theories. To that end, the fragment of Chapter 5 provides the official reference implementation for the analyses that precede it.

That said, the fragment does not exactly mimic any of the denotations given in any of the papers, so all of the derivations from the earlier chapters are redone in the official style. The reason for this is simply that for any of the modular issues dealt with in the individual chapters, a simpler presentation of the ideas suffices to make good on all of the data at play, but to handle everything simultaneously, several of the denotations need to be generalized or lifted to slightly higher types, etc. There are on occasion empirical consequences of these denotational scrubblings, and wherever possible I comment on these predictions in the expository interstices.

## Chapter 2

### Polyadicities in definite description<sup>\*</sup>

#### 2.1 Introduction

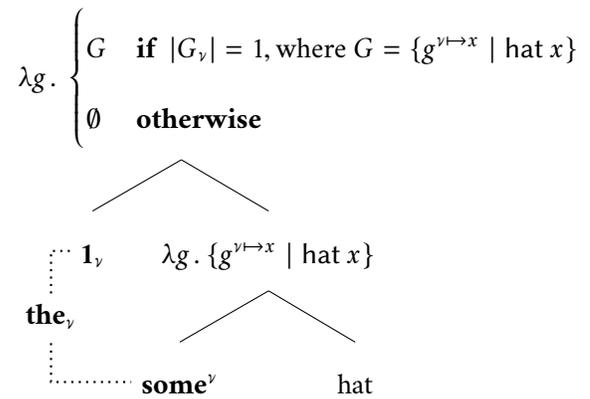
Definite determiners are commonly supposed to denote partial, trivial choice functions, defined only on singleton sets. The ‘the’ of ‘the hat’, for instance, might encode the function in (9). If there is one hat,  $\llbracket$ the hat $\rrbracket$  refers to it; otherwise the description is ill-defined. In this chapter, I argue that this is an illusion, that really *two* things happen every time ‘the’ occurs felicitously in a sentence, and it is only when those two things happen in immediate succession that the computation reduces to the partial function defined below.

$$(9) \lambda P. \begin{cases} d & \text{if } P = \{d\} \\ \# & \text{otherwise} \end{cases}$$

First,  $\llbracket$ the $\rrbracket$  introduces a discourse referent satisfying the descriptive content of its nominal complement. It allocates an address in the discourse state and reserves that address for a hat, say. The number of potential updates to any given initial state will be equal to the number of ways of instantiating that new ad-

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**Figure 2.1** Schematic depiction of bipartite semantics for the definite determiner (where  $G_\nu$  abbreviates  $\{g \nu \mid g \in G\}$ )




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<sup>\*</sup> The bulk of this chapter is reproduced with permission from Dylan Bumford (2017) ‘Split-scope definites: Relative superlatives and Haddock descriptions’, *Linguistics and Philosophy*.

dress with a particular (relevant) hat. This part of the definite determiner’s meaning is equivalent to a dynamic semantic *indefinite* determiner, like ‘a’. But then, over and above this referent-introduction, it inspects the set of potential outputs, checking whether there is any lingering uncertainty as to the value of the newly allocated discourse referent. If all of the outputs indeed assign the designated variable to the same entity, then the computation proceeds. But if there are multiple candidates for that variable across the various potential outputs of the update, the computation crashes. Figure 2.1 schematizes this configuration.<sup>1</sup>

The reason for supposing that definiteness consists in these two separable subprocesses is that occasionally, I will argue, things happen in between the first operation and the second. Consider the example in (10). Haddock (1987) observed that this expression could well be meaningful in a context with multiple salient, relevant hats, so long as only one of them contains a rabbit, and in that hat sits exactly one rabbit.

- (10) the rabbit in the hat [Haddock 1987: (1)]
- a.  $\nu :=$  the rabbit in  $u$
- $u :=$  the hat that  $\nu$  is in

At first glance, (10) appears to present a kind of nested Bach-Peters paradox, something that might be described by the semantic equations in (10a). But I will show that this sort of apparent mutual definedness is just what happens when the cardinality-testing component of the inner definite is enforced between the existential and uniqueness components of the outer definite. In other words, it is a situation in which the two semantic processes are interleaved rather than nested.

In a nutshell, the compositional computation of (10) unfolds as follows, depicted in the quasi-LF of Figure 2.2. Given any input  $g$ , the inner article introduces a referent  $\nu$  and generates a set of outputs, one for each way of mapping  $\nu$  to a salient hat. Composition proceeds through the prepositional

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<sup>1</sup> NB: For presentational purposes, the denotations in the figures of this section are slightly simplified from the forms they will take in Section 2.3.

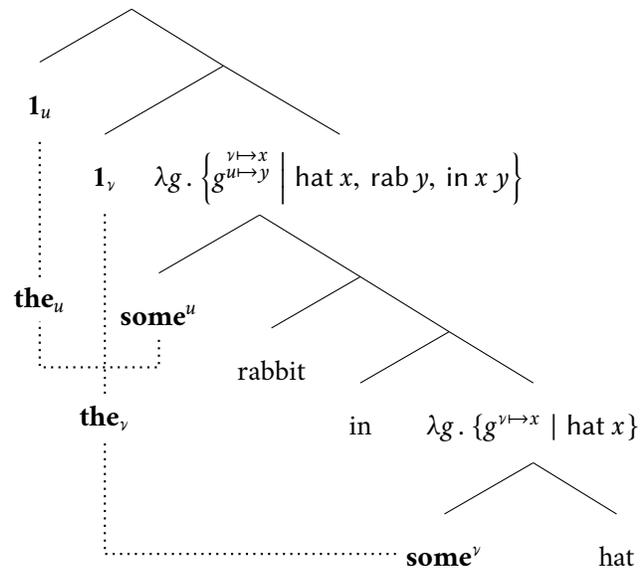
phrase and nominal adjunction, accumulating further constraints on the value assigned to  $v$ . When the outer article combines with this dynamic restrictor, it introduces another referent  $u$ . The result of this introduction is a new set of assignments, each of which extends an output from the restrictor by mapping  $u$  to some rabbit in whatever that output assigned to  $v$ . It is at this point, after both articles have updated the context with potential witnesses for these variables that the uniqueness tests are enforced. First the inner definite presupposes that all outputs agree on the value of  $v$ . Crucially, all of the remaining candidate assignments at this point map  $v$  to a *rabbit-containing* hat. The cardinality test guarantees that there is only one such entity of relevance. Then the outer definite presupposes unicity in the value of  $u$ , ensuring the presence of exactly one rabbit in that one hat with rabbits in it.

The key to this analysis is that assignment functions (or any analogous notions of dynamic state) are by their nature expected to satisfy all predicative constraints in view *simultaneously*. For instance, if we consider the denotation of ‘he <sub>$u$</sub>  likes her <sub>$v$</sub> ’ not as a function from assignments to truth values, but as the characteristic set of that function, then it will include only assignments that map  $u$  to a male and  $v$  to a female *that  $u$  likes*. Of course dynamic frameworks often take this notion of a denotation as a set of assignments very liter-

ally, and in general the set of outputs at any given point in a semantic derivation will include only those assignments that map referent variables to entities in accordance with the predicates that relate them. This is the sense in which the discourse referents  $u$  and  $v$  mutually define each other.

Even more dramatically, superlative adjectives may also take semantic action between the existential and cardinal operations of a definite article, leading to what are commonly called *relative readings*.

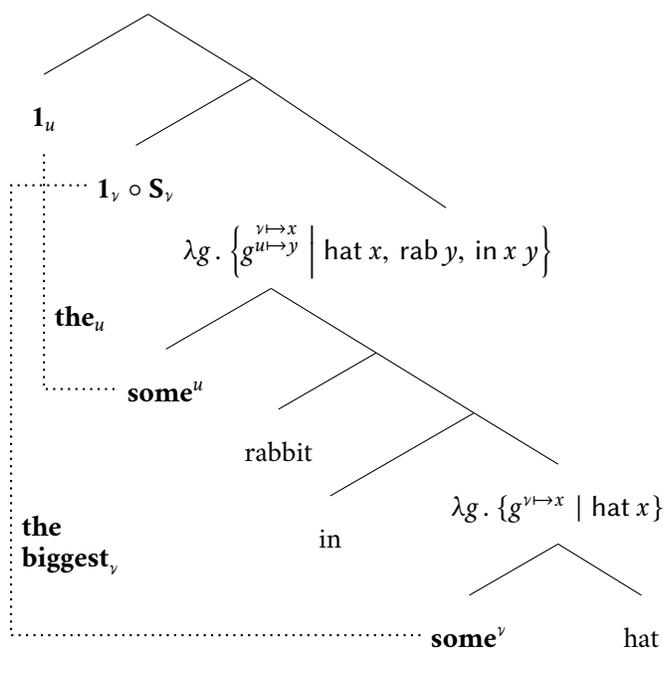
**Figure 2.2** Schematic depiction of interleaved definiteness in (10)



The description in (11), for instance, may be felicitous even if the biggest relevant hat in the context has no rabbits in it, or even if there are several equally-sized hats all larger than any others (and thus no straight-up “biggest hat”), as long as one of the rabbits is in a bigger hat than any of the other rabbits is in. Thus the superlative is understood to quantify not over hats *simpliciter*, but only over hats containing rabbits.

(11) the rabbit in the biggest hat

**Figure 2.3** Schematic depiction of (11)’s relative reading



The meaning of (11) is computed exactly as in Figure 2.2, except that the maximality test encoded in the superlative also shoots the gap between the outer determiner’s definite and indefinite components (see Figure 2.3). I assume the superlative denotes a filter on outputs, roughly of the form

$$S_v \approx \lambda G . \{g \in G \mid \neg \exists g' \in G . g' \nu > g \nu\},$$

where  $\nu$  indexes the referent introduced by the superlative’s DP. The outputs generated by the nominal complement are the same as they are for the interesting reading of (10). So filtering out all but the  $\nu$ -maximal assignments in this

set amounts to keeping only those assignments that map  $\nu$  to a *rabbit-containing* hat at least as large as any other *rabbit-containing* hat (and  $u$  to a rabbit in that hat). Finally the uniqueness test of the outer definite guarantees that all of the biggest such hats are inhabited by the same rabbit, i.e., that there is a single rabbit winner of the biggest-hat inhabiting contest.

As far as I am aware, this paper is the first to connect Haddock-type polyadic descriptions and relative superlatives. In the service of drawing that connection out, Section 2.2 presents a handful of

the interesting semantic properties that relative superlatives are known to exhibit, and establishes that [Haddock](#) readings display the same telltale behaviors. Section 2.3 steps through the analysis sketched above in more detail, primarily with an eye toward demonstrating how the parallel mechanics of the phenomena work, and how they derive appropriate felicity conditions on reference. One important corollary of this connection is that a lot of the semantic technology often attributed to the superlative morpheme itself is absorbed into the semantics of the definite article. This, I'll argue, explains the role of the determiner in licensing relative readings, which is a sore spot for many analysis of superlatives, most notably [Heim 1999](#) and its derivatives.

This is also the first analysis to treat superlatives as filters on outputs, or dynamic tests. In so doing, it connects superlatives (and definites) to recent dynamic approaches to bare and modified numerals. [Brasoveanu 2012](#) in particular has argued for bipartite denotations of DPs like 'exactly five boys', which behave locally like dynamic indefinites but impose "delayed" restrictions on what output contexts can look like. The analysis here then is interesting both in that it forges a theoretical link between definite determiners and other cardinality-testing determiners, and in that it re-engineers the notion of a delayed test, or *postsupposition*, in terms of split scope.

Finally, there are conceptual correspondences between this split-scope approach to definiteness and recent ideas stemming from the work in [Coppock & Beaver 2015](#). As here, [Coppock & Beaver](#) break the process of definite interpretation into two steps. Definite determiners themselves, they contend, return indeterminate denotations, sets of individuals. Determinate individuals are then secondarily extracted from those denotations by an independent type-shifter. To some extent, the fragment here is a concrete dynamicization of this sort of process, but there are also important differences between their analysis and this one, especially regarding the timing and scope of uniqueness testing.

All of these formal and conceptual connections are taken up in Section 2.4. Finally, Chapter 5 provides the official reference fragment for the core data points of the paper.

## 2.2 Data

In this section, I characterize several of the empirical patterns that separate superlative descriptions from the general class of definite descriptions, highlighting along the way parallels between superlative descriptions and the [Haddock](#) phenomenon. All discussion of the theoretical importance of these particular data points is deferred to Section 2.4. For the time being, I am going to concentrate exclusively on superlatives in relative clauses. This brings the connection between relative superlatives and [Haddock](#) definites into sharp relief, and it allows me to abstract away from the details of focus semantics, question semantics, and the other sources of semantic indeterminacy that are known to bleed descriptions of their uniqueness ([Tomaszewicz 2013](#), [von Heusinger 2007](#)). Chapters 3 and 4 will extend the superlative analysis to focus-sensitive relative readings in matrix clauses.

### 2.2.1 Essential empirical pattern

The scenes in Figure 2.4 depict several snapshots of a bookshelf in the process of being loaded up with books. The sentences 2.4a, 2.4b, and 2.4c are all reasonably natural things to say in their particular stages of the event, despite containing expressions that, taken at face value, might be expected to be undefined. Given that there are four equally salient shelves in each figure, the phrase ‘the shelf’ in 2.4a should be infelicitous. Likewise, ‘the three shelves’ in 2.4c should fail to isolate any particular triple of shelves from the four options. In contrast, ‘the highest shelf’ in 2.4b is well-defined, as there is a single shelf higher than all the others, but it does not contain any books, so the entire object DP of 2.4b should be meaningless.

Yet these sentences are all perfectly interpretable. This is because, intuitively, the embedded DPs of Figure 2.4 do not presuppose the existence of any unique (highest) shelf or set of three shelves in the scene. Instead, they target the (highest) shelf/shelves *on which there are books*. For instance, what 2.4a seems to mean is not that I’ve read the book on the one true shelf in the picture, but rather that I’ve read the book on the shelf that has a book on it. Similarly, 2.4b doesn’t require anything of the

2.4a I've read the book on the shelf



2.4b I've read the book on the highest shelf



2.4c I've read the seven books on the three shelves



**Figure 2.4** Relative readings of various definite descriptions. In each of Figures 2.4a, 2.4b, and 2.4c, the inner description is additionally restricted to those shelves *that contain books*.

very highest shelf in the bookcase, the one with the picture on it; it just requires that the highest shelf with a book be such that the book on it, I've read. And then again with 2.4c. All that the object of the sentence commits to is the existence of exactly three book-supporting shelves, containing in total seven shelved books.

Following the literature on superlatives, from which this phenomenon is most well-studied, I will call interpretations like these *relative readings* of the embedded DPs. Descriptively speaking, what the readings have in common is that the quantificational force of the determiner (and adjective) is restricted to those elements that — in addition to satisfying the property denoted by the nominal —

stand in some relation to other objects in the scene, where the appropriate relation is determined by the syntactic context of the phrase.

In the following subsections I will try and flesh out the parallel here by showing that a number of the interesting behavioral properties of relative superlatives are mirrored by relative definites.

### 2.2.2 Definiteness effects

Szabolcsi (1986) identified a battery of syntactic environments that are tolerant of relative superlatives despite being generally hostile to definite descriptions. One such environment is the object of so-called *relational 'have'*. For example, the definite variant of (12a) is ungrammatical, though the indefinite variant is perfectly fine. In the same context, the morphologically definite relative superlative 'the meanest sister' is felicitous; (12b) describes the student whose sister is meaner than any other student's sister. Perhaps surprisingly, (12c) is also felicitous if it is known that there is exactly one student-sister pair  $\langle x, y \rangle$  of which  $y$  is mean. Notice that this presupposition is stronger than what would be expected if the object were, for whatever reason, interpreted merely existentially. That is, (12d) might well describe a Cinderellan student with two mean sisters, but not (12c).

- (12) a. Do any students here have {a, \*the} mean sister?
- b. the student who has the meanest sister
  - c. the student who has the mean sister
  - d. the student who has a mean sister

It is also worth observing in this respect that familiarity with the mean sister's existence is not sufficient for the restrictions of relational 'have'. Consider (13) in this regard. The object of the second clause is familiar — anaphoric, in fact — but the sentence is nevertheless deviant.<sup>2</sup>

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<sup>2</sup> Note that (ia) as an improvement over (13). This is consistent with Prince's (1992) observation that 'the same' DPs are acceptable in existential clauses, as in (ib). To this, I can only say that it seems plausible that adjectives of identity like 'same' and 'different' denote the sorts of delayed filters on dynamic outputs that Section 2.3 will assign to superlatives,

(13) \*John has a mean friend, and his sister has the mean friend too

Another definite-averse environment that supports relative superlative descriptions is the pivot of the existential ‘there’ construction. The question in (14a) illustrates this. Even if it is known that there was only one (relevant) battle in Louisiana, the definite variant of (14a) is quite marked. In contrast, the superlative description in (14b) is entirely natural; it characterizes the battle that is the subject of more movies than any other battle. Again surprisingly, the description in (14c) is also well-formed if indeed there’s exactly one (relevant) movie *y* about *x*, where *x* is the unique (relevant) battle that *y* is about. Once more the presupposition here represents the *joint* definiteness of the two nominals, linked by the about relation. It is more demanding than the presupposition of (14d), say, which requires only that there be a unique battle featured in *at least one* movie, possibly in several.

- (14) a. When was there {a, \*the} battle in Louisiana?
- b. the battle that there are the most movies about
- c. the battle that there’s the movie about
- d. the battle that there’s a movie about

### 2.2.3 Intensional environments

Another important data point in the superlative literature comes from constructions of the form in (15a) (see Heim 1999 for original discussion). The meaning of interest for the study of superlatives is the one in which (15a) describes John, when John needs a 50 inch shovel, Fred a 40 inch shovel, and Bill a 30 inch shovel, but none of them have any particular shovels in mind. The reason this interpretation is interesting is that the there does not appear to be any unicity or familiarity associated with the

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in which case ‘the same mean sister’ would merely introduce a discourse referent at the time that definiteness effects are enforced, exactly like the relative superlative and polyadic article of (12b) and (12c), respectively.

- (i) a. John has a mean friend, and his sister has the same mean friend
- b. There were the same people at both conferences

[Prince 1992: (5a)]

intensional object; the boys will be satisfied with *any* appropriately-sized shovels. Instead, what the superlative targets is something like the boys' respective shovel-needs, where the size of each boy's need is measured by the size of shovel that he's after.

Interestingly, the description in (15b) may also be well-formed even when there is no particular shovel under discussion, or even any shovel that any boy has his eye on. For instance, (15b) could describe John if it is known that John needs a shovel, Bill needs a hammer, and Fred needs a drill. It would still be felicitous if Mary needed a shovel as well as John, so long as Mary is not a boy. The attested examples in (15) are similar.<sup>3</sup>

- (15) a. the boy who needs the biggest shovel
- b. the boy who needs the shovel
- c. <sup>ʔ</sup>If you are convicted of driving while intoxicated [...] you are required to install an Ignition Interlock Device (IID) in any vehicle that you own or use. [...] If you do not own the car that needs to have the IID, get a notarized statement from the owner [...]
- d. <sup>ʔ</sup>I feel sick to the pit of my stomach [...] Even *she* has someone. I guess *I'm* the one who needs the boyfriend.

One potential explanation for the felicity of (15b)–(15d) is that the intensional objects are genuinely definite, but subordinated to a known modal context. The text in (16) illustrates the possibility of this. It is perfectly coherent to maintain that the description in the second clause is definite though its unicity is relative to the world (and perhaps binding index) in which it is evaluated.

(16) John wants a shovel, and he wants the shovel to be big

But as established in the previous subsection, anaphoric descriptions are no better than other determinate DPs in the object of relational 'have'. This is true for modally-subordinated anaphoric descriptions as well, as evidenced by the ungrammaticality of (17).

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<sup>3</sup> The <sup>ʔ</sup> diacritic marks naturally-occurring examples.

(17) \*John wants to have a friend, and he wants his sister to have the friend too

Nevertheless, (18a) is felicitous in the same sort of context as (15b): if John wants a little brother while Fred and Bill want sisters, then (18a) refers to John. Other examples appear in (18b) and (18c), and arguably the same point is made by (15d) if 'have' is implicit in the complement of the intensional transitive (den Dikken et al. 1997).<sup>4</sup>

(18) a. the boy who wants to have the little brother

b. the girl who wants to have the gold tooth

c. <sup>?</sup>A gestational surrogate has no genetic link to the couple that wants to have the child

This means that the acceptability of the embedded description cannot simply be a matter of subordinated definiteness. My intuition is that much like the superlative in (15a), whatever uniqueness is imposed by the second definite in (15b), it seems to have less to do with shovels (in this world or any other) and more to do with *shovel-needs*. That is, (15b) characterizes the boy *whose unique (relevant) need* is for a shovel.

#### 2.2.4 Scope islands

A number of researchers have contributed judgments of island boundaries for relative superlative readings (e.g., Szabolcsi 1986, Farkas & Kiss 2000, Chacón & Wellwood 2012). For instance, while (19a) refers to the doctor who has cured more rabies patients than any other doctor, (19b) cannot refer to the doctor who maximizes the following function:  $\lambda xn. x$  knows which treatment cured at least  $n$  patients. This latter description would refer to John if, for example, John knows which treatment cured 10 patients, Mary knows which treatment cured 8 patients, and Bill knows which

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<sup>4</sup> Note that while (18c) quantifies generically over surrogates, the object description is not a generic definite. On its most plausible reading, (18c) says that an arbitrary prototypical surrogate is unrelated to the couple *that she is a surrogate for*. The object is thus an instance of *associative definiteness* (Hawkins 1978) or *bridging* (Clark 1975). The theory of such associative inferences is well beyond the scope of this article, but I think the example (18c) still illustrates the pattern of interest: within any generic surrogacy situation, there will be a single couple whose desire is for *a child* (not \*the child).

cured 4 patients. Instead, (19b) unambiguously refers to the doctor who knows which treatment has the property of having cured more patients than any other treatment has.

Exactly analogously, the description in (19c) may be used to pick out the unique doctor to cure a rabies patient, regardless of how many rabies patients have been admitted to the hospital, as long as only one such patient was cured. Yet (19d) presupposes the existence of a singular rabies patient, and describes the doctor who knows which treatment cured that person. It has no reading on which it characterizes the doctor of the unique doctor-patient pair  $\langle x, y \rangle$  such that  $x$  knows which treatment cured  $y$ .

(19) I'm looking for...

	<b>No Island</b>	<b>Island</b>
<b>Superlative</b>	a. ✓ the doctor who cured the most rabies patients	b. # the doctor who knows which treatment cured the most rabies patients
<b>Haddock</b>	c. ✓ the doctor who cured the rabies patient	d. # the doctor who knows which treatment cured the rabies patient

(20) I'm looking for ...

	<b>No Island</b>	<b>Island</b>
<b>Superlative</b>	a. ✓ the gum sticking to the biggest balloon	b. # the gum that fell after sticking to the biggest balloon
<b>Haddock</b>	c. ✓ the gum sticking to the balloon	d. # the gum that fell after sticking to the balloon

The paradigm is repeated in (20). The description in (20b) will fail to refer in any context in which the absolute biggest relevant balloon was never besmirched by gum. But the description in (20a) may still be sensible in such a context if it is understood to describe the wad of gum sticking to a balloon

bigger than any balloon hosting any other wad. Likewise, (20c) could characterize the gum sticking to the only balloon with gum on it, even if there are multiple balloons around. But in such a scene, (20d) would be infelicitous; it cannot refer to the gum that fell off of the unique balloon to have had gum fall off of it.

In both cases, what we see then is that an embedded description, whether superlative or not, resists *relativization* to content beyond the scope island on which it finds itself. That is, in (19b,d) ‘the (most) rabies patients’ cannot quantify over or associate with the property of being a doctor who knows which treatment cured a (*d*-sized sum of) patients, because that property properly contains the embedded finite clause island, ‘which treatment cured ...’. In (20b,d), ‘the (biggest) balloon’ cannot in any way operate over the property that gum has when it falls after sticking to a (*d*-big) balloon, since that subsumes the adjunct island ‘after sticking to ...’.

That said, there is a wrinkle here. It is standardly assumed that relative clauses are *themselves* scope islands. This ought to prevent the head nouns of these (a) and (c) examples from influencing the interpretation of the embedded descriptions. For instance, ‘the most rabies patients’ in (19c) ought to compare all individuals whatsoever with respect to their success rate with rabies victims, not just doctors. Likewise, we might expect for ‘the rabies patient’ in (19a) to check the uniqueness of  $\langle x, y \rangle$  pairs in the cure relation, where *y* ranges over rabies patients, and *x* is completely free. That is, we might expect the description to require a unique *cured* patient, regardless of whether the curer was a doctor. But in my judgment, which I believe is the standard judgment in the literature, the head nouns do restrict the embedded descriptions on their relative/Haddock readings. I will return to this point at the end of Section 2.3.

### 2.2.5 Possessive DPs

The final parallel I want to draw attention to is the lack of relative readings for possessive descriptions, both plain and superlative. It has occasionally been observed that superlatives in DPs with prenominal possessors strongly resist relative readings (Schwarz 2005: p. 200, Bos 2009: Section 4.1). The example

in (21a), for instance, can only be understood to describe the student who read *Hamlet*, not the student who chose to read a longer play than any of the others. This absence is rather striking when juxtaposed with (21b) and (21c), which are ambiguous in the now familiar way. The only investigation that I have been able to find into this intriguing contrast comes from unpublished work by Chacón & Wellwood (2012). They point out that this contrast is robust across English, Japanese, Spanish, and Russian.

- (21) a. # the student who read Shakespeare's longest play  
b. the student who read the longest Shakespeare play  
c. the student who read the longest play of Shakespeare's

Prenominal possessors also resist Haddock readings. Compare (22a) and (22b). The latter may describe a student who chose as the subject matter for her assignment a play by Shakespeare (any play), assuming that student is the only one to have done so. The former cannot. It presupposes a unique play associated with Shakespeare, and describes the student who read that play.

- (22) a. # the student who read Shakespeare's play  
b. the student who read the Shakespeare play

This is especially puzzling in light of the fact that possessive DPs are generally *more* receptive to indeterminate interpretations than plain definite DPs (Partee & Borschev 2001, Barker 2011, Coppock & Beaver 2015). For instance, (23a) asserts that *Edward II* should be counted among Marlowe's works, rather than those of Shakespeare; which is to say, it is one of Marlowe's plays, rather than one of Shakespeare's. The sentence in (23b), however, identifies *Edward II* as the unique play associated with Marlowe, not to be confused with whatever is the unique play associated with Shakespeare.

- (23) a. *Edward II* is Marlowe's play, not Shakespeare's  
b. # *Edward II* is the play by Marlowe, not the play by Shakespeare

Thus it appears that even though possessive DPs sometimes admit of indeterminate interpretations, they do not license relative readings. Definite DPs on the other hand do not readily shed their definiteness requirements, but do submit to ready relativization.

### **2.2.6 Summary of data**

The brief presentation of data in this chapter has attempted to bolster the hypothesis that relative readings of superlatives and definites are reflexes of the same semantic mechanism. Both kinds of definite descriptions are felicitous in existential and relational ‘have’ constructions, both can have locally indeterminate force in intensional environments, both are subject to locality effects like the scope islands introduced by tensed clauses and adjuncts. Furthermore, relative readings were shown to depend on the definite determiner, in that they were unavailable to nearly identical variants with possessive rather than definite descriptions. The next section spells out this dissertation’s vision for what that common mechanism of relative readings might be.

## **2.3 Analysis**

### **2.3.1 Core proposal**

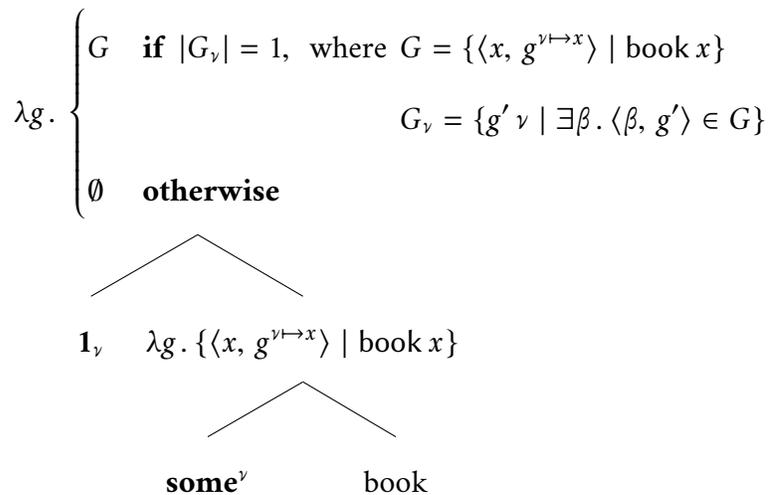
At the heart of the fragment I will propose is a compositional dynamic semantics in the style of [Charlow 2014](#). The definite article interacts with the dynamics in two ways. Like an indefinite, ‘the’ non-deterministically allocates a discourse referent to some variable of its input context. Then like a numeral (or negation, or quantifier, or modal), it tests that across its output contexts the entity assigned to that variable is constant; i.e., that all outputs agree on the value of that variable. Moreover, just as ‘the’ tests for consistency across outputs, superlatives may test outputs for maximality with respect to some ordering. For instance, ‘biggest’ will pit outputs against one another with respect to the size of the value they assign to some index, filtering out all but the maximal such assignments.

Crucially, the introduction of the discourse referent and the evaluation of uniqueness across the potential assignments of values to that referent may happen at different points in the computation of the sentence. Relative readings of superlatives emerge when properties imposed by intervening lexical material constrain the set of assignments that the superlative compares.

### 2.3.2 Haddock definites, singular and plural

The derivation in (24) depicts the manner in which simple, isolated definite descriptions compose. The indefinite component **some**<sup>*v*</sup> combines with the restrictor ‘book’ to produce a dynamic indefinite update. Given an input assignment, it returns a set of ⟨individual, output-assignment⟩ pairs, one for each entity in the domain satisfying the predicate book. This set of outputs is then tested for global uniqueness: **1**<sub>*v*</sub> is an abbreviation for the identity function, *if* the update *m* it inspects is constant across its assignments for the discourse referent *v* (at some input *g*); otherwise, it throws a wrench in the compositional gears by returning the degenerate update  $\lambda g. \emptyset$ .

(24) the book



Since the indefinite generates a distinct output for every book in the relevant contextual domain, **1**<sub>*v*</sub> will fail unless the set of books in the domain is a singleton set, i.e., unless there’s a unique salient book. This guarantees that in this simple case  $\llbracket \text{the book} \rrbracket = \lambda g. \{\langle x, g^{v \mapsto x} \rangle \mid x = \iota \text{ book}\}$ , assuming

the  $\mathbf{1}_\nu$  test is passed. Effectively, the description denotes the determinate update that assigns  $\nu$  to the unique relevant book in the context.<sup>5</sup>

Readers familiar with dynamic approaches in the tradition of Groenendijk & Stokhof 1991 and Muskens 1996 might find the type for these updates, which pair output states with individuals, somewhat exotic. I will set aside the mechanical issues of composition until Chapter 5, but for now, I'll mention that the pairing is a consequence of Charlow's (2014) monadic conception of enriched meanings. In this case, pairing outputs with individuals opens the door to a non-quantificational lexical entry for the indefinite (i.e.,  $\llbracket \mathbf{some}^\nu \text{ book} \rrbracket$  above does not take a nuclear scope argument). As a result, we are free to conceive of the uniqueness component of definiteness,  $\mathbf{1}_\nu$ , as a test on updates, essentially as a cardinal *postsupposition* (Brasoveanu 2012), rather than a function from dynamic generalized quantifiers to dynamic generalized quantifiers. If nothing else, I hope this will greatly simplify the presentation of the ideas, both in the text and in the official fragment.

Things get more interesting in the Haddock-type cases, where one definite is nested within another. Such descriptions are in principle ambiguous between *absolute* and *relative* readings. Example (25) diagrams what I take to be the source of the ambiguity. For simplicity I only provide the denotations of nodes that illustrate the semantic action of the determiners, again omitting details about composition until Chapter 5. Also from here on out, I will write the denotations assuming that uniqueness tests are passed.

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5 There are clear conceptual affinities between this decomposition of definiteness and Russell's (1905) classic analysis of 'the', which also famously distinguished existential and exhaustive components in the denotations of definite descriptions. But because he did not have dynamic technology at his disposal, Russell was forced to put the exhaustive operation in the scope of the existential one, essentially as in (ia). With the advent of dynamic conjunction, Russell's existential and exhaustive operations become self-contained, modular subcomputations, as in (ib), a caricature of one of Brasoveanu 2007's hypothesized lexical entries. From there, the contribution of the present analysis is the addition of the continuation variable in (ic), a higher-order crease between existence and uniqueness where the crumbs of other operators may accumulate.

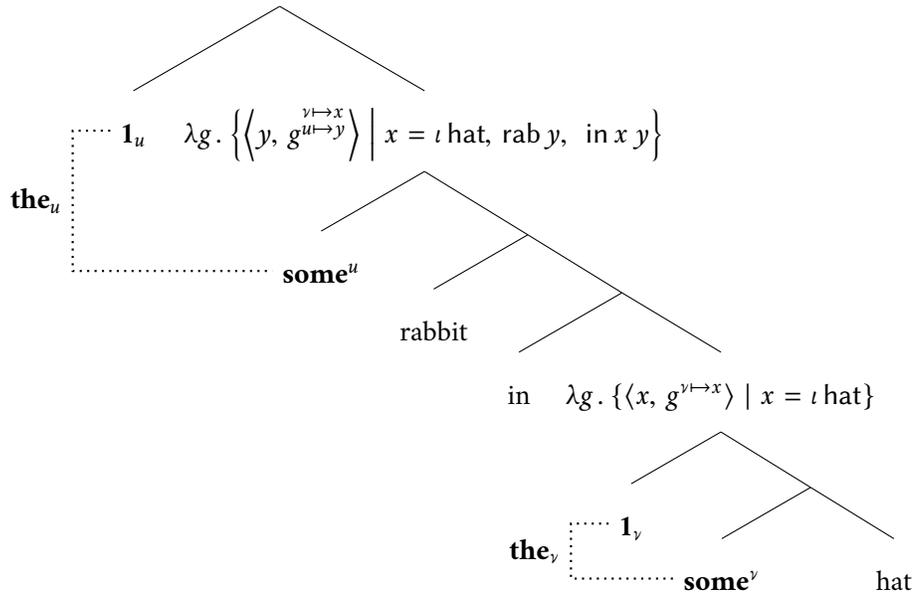
- (i) a.  $\llbracket \text{the} \rrbracket = \lambda PQ. \exists x. P x \wedge Q x \wedge (\forall y. P y \Rightarrow y = x)$  [cf. Russell 1905: p. 482]  
 b.  $\llbracket \text{the}_u \rrbracket = \lambda PQ. \mathbf{max}^u(P u) ; \mathbf{1}_u ; Q u$  [cf. Brasoveanu 2007: Ch. 5, (51c)]  
 c.  $\llbracket \text{the}_u \rrbracket = \lambda k. \mathbf{1}_u (\lambda P. k \mathbf{some}^u (\lambda x. P x))$  [cf. Chapter 5]

First, consider the absolute reading of (25), depicted in (25a). The uniqueness tests associated with both definite determiners are enforced immediately after their respective discourse referents are introduced. As in (24), this has the expected effect of crashing the computation unless the two syntactic complements — ‘hat’ and ‘rabbit in the hat’ — denote singleton sets. In a little more detail, the denotation of the inner definite node is exactly as in (24). If it succeeds, it will be the deterministic update from an input  $g$  to the single output  $g^{v \mapsto x}$ , where  $x$  is the unique salient hat in the context. The outer *indefinite* then pairs each rabbit  $x$  together with an output that remaps the variable  $u$  to that rabbit. Finally, the outer uniqueness test ensures that this set too is a singleton, and thus that there is exactly one such rabbit in  $x$ .

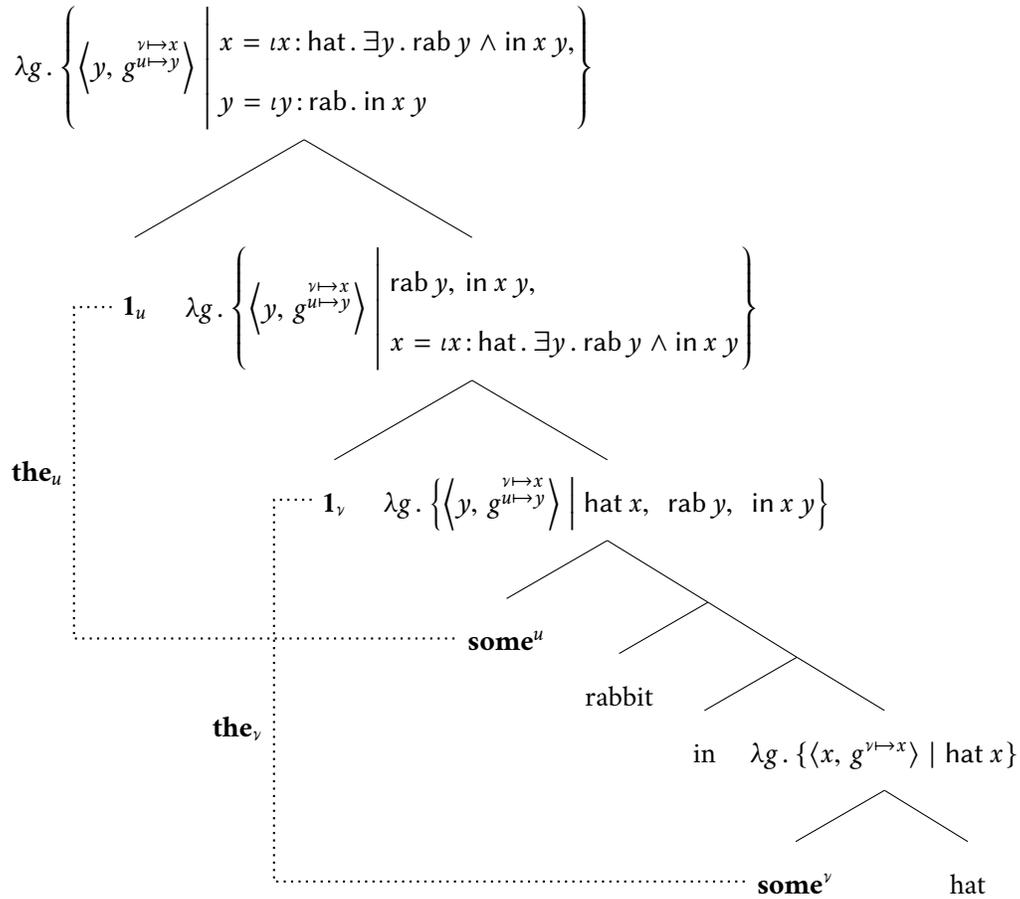
(25) the rabbit in the hat

a. Absolute reading: exactly one hat, with exactly one rabbit in it

$$\lambda g. \left\{ \langle y, g^{u \mapsto y} \rangle \mid x = \iota \text{ hat}, y = \iota y. \text{rab } y \wedge \text{in } x \ y \right\}$$



b. Relative reading: exactly one rabbit-hat pair<sup>a</sup>



<sup>a</sup> A note on notation: variables bound by quantifiers and lambdas are sometimes formally restricted, so that  $\iota y : \text{rab} . \text{in } x y$  is equivalent to  $\iota y . \text{rab } y \wedge \text{in } x y$ ; and  $\forall y : \text{rab} . \text{in } x y$  equivalent to  $\forall y . \text{rab } y \Rightarrow \text{in } x y$ ; etc.

In contrast, the relative reading of (25) is depicted in (25b). In this configuration, the numerosity test of the inner determiner actually splits the scope of the outer determiner's indefinite and numerosity requirements. Composition up to these tests proceeds as if the two definite determiners were in fact standard, discourse-referent-introducing indefinite determiners. This now is the crux of the analysis, and the reason to insist on dynamic entries for the determiners: each output assignment at this node isolates a portion of the model simultaneously satisfying the constraints hat  $x$ , rabbit  $y$ , and in  $x y$ . So the complement of the first test,  $\mathbf{1}_v$ , is the function that sends an assignment  $g$  to the set of outputs  $g^{u \mapsto y}$  where  $x$  is some hat, and  $y$  is some rabbit *in that hat*.

As a result, checking that each of these outputs agrees on the value of  $\nu$  is tantamount to checking that there is exactly one rabbit-containing hat. Subsequently, checking that each of these outputs agrees on the value of  $u$  is tantamount to checking that this unique enrabbitted hat is inhabited by the unique so habited rabbit. The net effect is then equivalent to checking that there is a single pair  $\langle x, y \rangle$  such that  $x$  is a hat,  $y$  is a rabbit, and  $y$  is in  $x$ , which is exactly the felicity condition of the whole complex description.

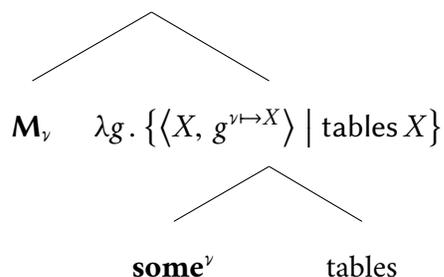
In this fashion we achieve the kind of polyadic definiteness that DPs of this form seem to evoke without giving up any of the normal principles of compositionality. The two definite determiners mean what they always mean; they both contribute discourse referents, and they both ensure that their referents are uniquely instantiable within the model. The only thing that is unusual about these constructions, from the standpoint of the current proposal, is that those operations take scope over different subportions of their syntactic contexts, so that their effects are interleaved rather than nested.

This technique extends immediately to other sorts of relative readings. The simplest such examples are just the plural variants of [Haddock](#) cases, as outlined in (28) below. The first step is generalizing the definite determiner to test for maximality rather than uniqueness, following [Sharvy 1980](#), [Link 1983](#), and many others since. The plural DP ‘the tables’ should generate a discourse referent pointing toward the complete set of salient, relevant tables, rather than some arbitrary subset of them. Fortunately, since the size-checking component of ‘the’ already looks at the entire set of potential outputs — thereby effectively inspecting the entire range of possible legitimate values for the discourse referent it is tied to — it is straightforward to formulate a *max* operator in the vein of our uniqueness test: (26).

$$(26) \mathbf{M}_\nu := \lambda mg. \{ \langle \alpha, h \rangle \in mg \mid \neg \exists \langle \beta, h' \rangle \in mg. h \nu \sqsubset h' \nu \}$$

(27) the tables

$$\lambda g. \{ \langle X, g^{\nu \mapsto X} \rangle \mid \text{tables } X, \neg \exists Y : \text{tables}. X \sqsubseteq Y \}$$

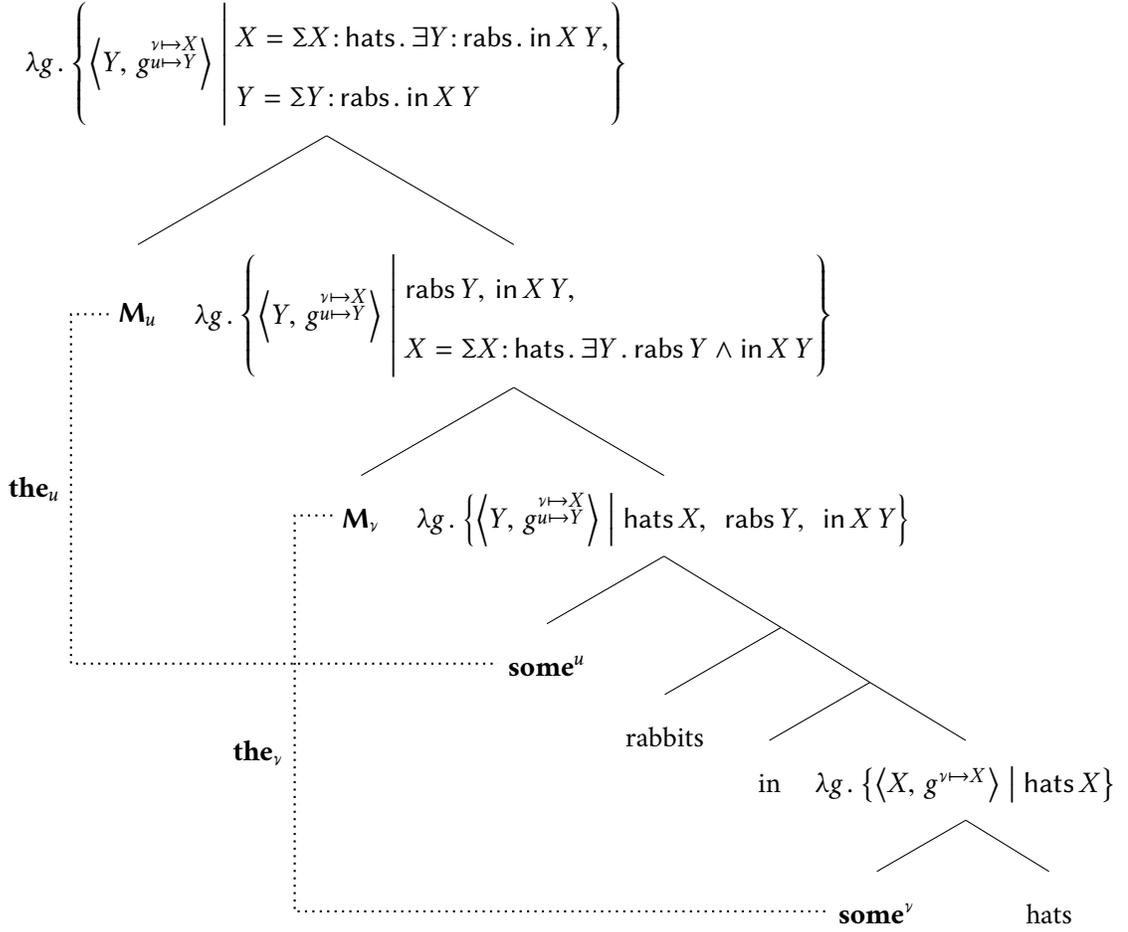


The indefinite generates a variable that ranges over sums of tables. At an input  $g$ , the max operator looks at all of the outputs  $h$  that remap  $\nu$  to one of those sums, and throws away any such outputs that aren't “maximal” sums. That is, it keeps only those outputs that assign  $\nu$  to an individual that is not a subpart of any individual assigned to  $\nu$  by another assignment. In this simple case, given that the indefinite will generate one output for every possible sum of (relevant) tables,  $\llbracket \text{the tables} \rrbracket$  will be equivalent to  $\lambda g. \{ \langle X, g^{\nu \mapsto X} \rangle \mid X = \Sigma \text{ table} \}$ , where  $\Sigma$  is the generalized mereological fusion operator over individuals.

In (28) then are the plural constructions analogous to those in (25). On the absolute reading (28a), the inner description immediately maximizes over its discourse referent, loading the complete set of relevant hats  $X$  into the variable  $\nu$ . The outer indefinite then generates, for each sum of rabbits  $Y$  that are in  $X$ , an output assignment mapping  $u$  to  $Y$ . I assume that relations are interpreted cumulatively (e.g., Beck & Sauerland 2000), so that in  $X Y$  will only be true if every  $y \sqsubseteq Y$  is in some  $x \sqsubseteq X$  and every  $x \sqsubseteq X$  has some  $y \sqsubseteq Y$  in it. What the outer indefinite ranges over, then, are the rabbit-sums  $Y$  such that: (i) each atomic part of  $Y$  is in at least one hat, and (ii) taken together, the parts of  $Y$  inhabit the entire set of hats. Finally the outer max operator discards all but the largest such sum of rabbits. This guarantees that the entire phrase is interpreted deterministically: the only individual in its denotation is the set of *all* those rabbits that are (cumulatively) in *all* of the hats. If there is no such rabbit-sum — because, e.g., one of the hats is sans rabbit — then the denotation fails to refer.



b. Relative reading: largest set of rabbits in the hats that have rabbits in them



The first several steps of the relative reading (28b), up to the maximality test  $\mathbf{M}_v$ , are exactly as in (25b), except that the discourse referents  $u$  and  $v$  are mapped to sums of rabbits and hats, respectively. So just before the first maximality filter, the set of outputs includes all possible assignments that pair a sum of rabbits  $Y$  — stored at  $u$  — with a sum of containing hats  $X$  — stored at  $v$ . This again is the crucial bit that the dynamic framework buys us; as we build out the denotation of the phrase, we keep only those slices of the world that satisfy the constraints imposed by predicates and relations on discourse referents. So when it comes time to check for cardinality and/or comparative maximality of certain variables, we are comparing only live candidates for those values. In this case, that means that when we maximize over  $v$ , we compare only rabbit-holding hats.

The actual maximization then filters out any assignments that choose a dominated sum of such hats, that is, a sum of hats that is a proper subpart of some other sum of hats. Because the property of cumulatively containing a sum of rabbits is, well, cumulative, there is guaranteed to be exactly one such undominated hat sum. So after  $\mathbf{M}_v$ , the set of outputs contains only those assignments that send  $v$  to  $X$ , the top of the hats-that-have-rabbits-in-them lattice, and  $u$  to a sum of rabbits in  $X$ . Then at  $\mathbf{M}_u$ , we perform a similar maximization, this time over the set of rabbit-sums that are in  $X$ . Again, since the property of being a rabbit-sum in  $X$  is cumulative, we're guaranteed to end up with a single remaining choice for  $u$ , namely  $Y$ , the largest possible collection of rabbits in the largest possible collection of rabbit-containing hats. On the relative reading here, just as in the singular case (25), there may well be hats that are completely bereft of rabbits; it is of no consequence, since we do not begin filtering/counting until we have learned more about what sort of thing we are looking for.

### 2.3.3 Numerals

The absolute and relative readings of definite numeral descriptions are structurally identical to those of plain definites and definite plurals, except that the numeral introduces its own cardinality filter, to be executed immediately prior to the maximality test of its hosting definite. For instance, consider the absolute and relative readings of (30), sketched in (30a) and (30b), respectively.

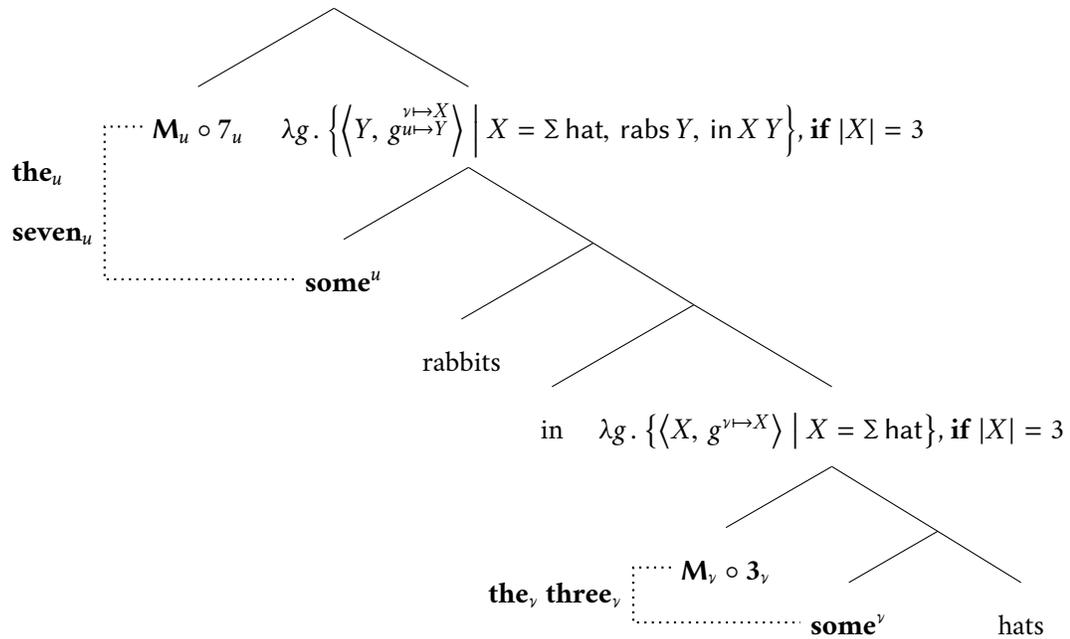
Setting  $3_v$  as in (29), and  $7_u$  accordingly, the absolute derivation proceeds as usual without much surprise. The inner description serves up all sums of hats in the scene, and then tests that this set of hat-sums was generated from a set with exactly three atoms. If so, it throws away all but the single output that assigns  $v$  to the mereological top of this set, the sum of all three hats. Then given this determinate mapping of  $v$ , the outer description guarantees in the same fashion the existence of exactly seven rabbits cumulatively located in those three hats.

$$(29) \mathbf{3}_v := \lambda m g. \begin{cases} G & \text{if } |\text{atoms}(\Sigma G_v)| = 3, \text{ where } G = m g \\ & G_v = \{g' v \mid \exists \beta. \langle \beta, g' \rangle \in G\} \\ \emptyset & \text{otherwise} \end{cases}$$

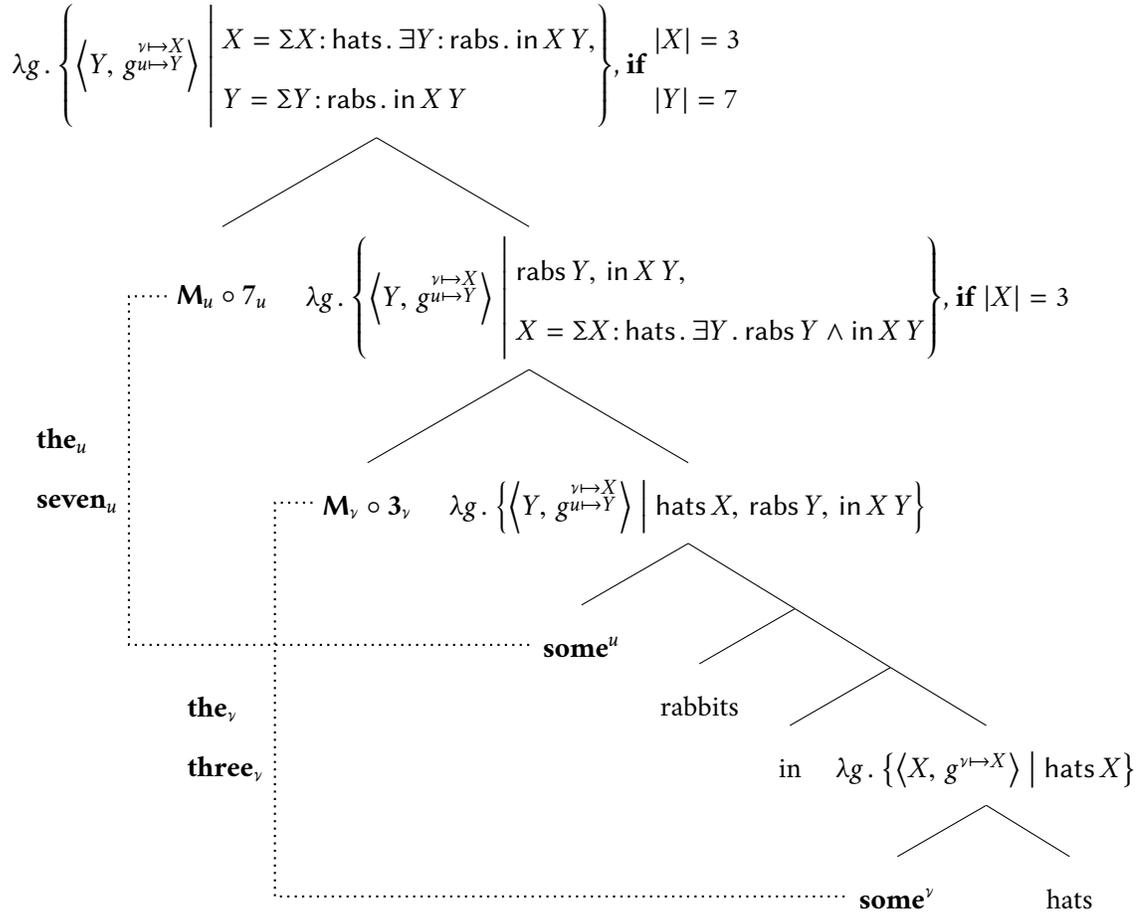
(30) the seven rabbits in the three hats

a. Absolute reading: exactly three hats, with exactly seven rabbits between them

$$\lambda g. \left\{ \left\langle Y, g^{u \mapsto Y} \right\rangle \mid X = \Sigma \text{ hat}, Y = \Sigma Y : \text{rabs. in } X Y \right\}, \text{ if } \begin{matrix} |X| = 3 \\ |Y| = 7 \end{matrix}$$



b. Relative reading: exactly seven rabbits in the three hats that have rabbits in them



The relative reading, however, delays the force of the inner cardinality tests until the dynamic composition has weeded out any sums of hats that do not between them contain some set of rabbits; i.e., any hat-sums at least one element of which is rabbitless. Once this more restricted collection of hats has been isolated, the cardinality tests ensure a single trio of such rabbit-containing hats and a single septet of hat-contained rabbits.

### 2.3.4 Superlatives

Scaling up to absolute and relative superlatives is now just a matter of generalizing the maximization filter used for plurals. Searching for outputs that assign  $u$  to something that is not a proper part of what any other output assigns to  $u$  is a bit like searching for the outputs with the “most uncontained”

$u$ -values. But *parthood* is just one among many relations that might be used to partially order the outputs. They might just as easily be ordered by height or age or ability to start a campfire without lighter fluid.

For simplicity, I assume that comparative adjectives denote exactly these sorts of partial orders. For instance, ‘older’ denotes the relation between two individuals that holds when the latter’s age exceeds the former’s (31a). Superlative adjectives lift these comparative orders to filters on outputs by excluding any assignments that fail to map the relevant discourse referent to an order-maximal value. Sticking with age, (31c) denotes the function that modifies an update so that its outputs include only those assignments that map  $u$  to an individual no younger than the individuals assigned to  $u$  by other remaining outputs.

- (31) a.  $\llbracket \text{older} \rrbracket := \lambda yx . \text{age } x > \text{age } y$
- b.  $\llbracket \text{-est}_u \rrbracket := \lambda fmg . \{ \langle \alpha, h \rangle \in mg \mid \neg \exists \langle \beta, h' \rangle \in mg . f(hu)(h'u) \}$
- c.  $\llbracket \text{oldest}_u \rrbracket \equiv \llbracket \text{-est}_u \rrbracket \llbracket \text{older} \rrbracket = \lambda mg . \{ \langle \alpha, h \rangle \in mg \mid \neg \exists \langle \beta, h' \rangle \in mg . \text{age}(h'u) > \text{age}(hu) \}$

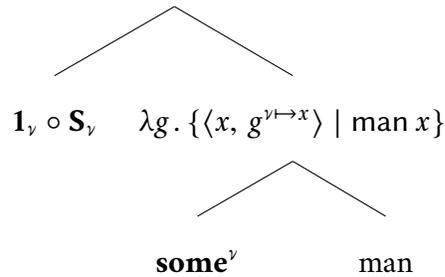
Two remarks in passing about this definition of ‘-est’. First, as with the comparative, it is degree-free.  $\llbracket \text{older} \rrbracket$  is simply a relation over individuals, which  $\llbracket \text{oldest} \rrbracket$  uses to restrict dynamic outputs. This means semantic models for constituents containing these phrases needn’t include any degree objects or degree properties (see, among others, Klein 1980, Larson 1988, van Rooij 2011, Djalali 2014 for defenses of this view). Second, the semantic decomposition of  $\llbracket \text{oldest} \rrbracket$  into  $(\llbracket \text{-est} \rrbracket \llbracket \text{older} \rrbracket)$ , rather than  $(\llbracket \text{-est} \rrbracket \llbracket \text{old} \rrbracket)$ , respects the cross-linguistic generalization that superlative adjectival forms are morphologically built up from comparative rather than positive forms (Stateva 2002, Bobaljik 2012, Szabolcsi 2012).

With these pieces in place, the analysis of absolute and relative superlative DPs unfolds exactly like that of the absolute and relative plural DPs in (28). To get things started, (32) depicts a basic superlative structure in the vein of (27). As ever, the indefinite supplies a discourse referent that ranges over individuals in the extension of its restrictor. The superlative filter  $\mathbf{S}$ , then throws out any assignments

that map  $\nu$  to a man with at least one elder, leaving  $\lambda g. \{\langle x, g^{\nu \mapsto x} \rangle \mid \text{man } x, \neg \exists y: \text{man}. \text{older } x y\}$ . Taking this as input, the usual  $\mathbf{1}_\nu$  test supplied by the definite determiner demands uniqueness of this remaining set of elderless men. The whole DP, if it doesn't fail, thus denotes the update that reassigns  $\nu$  to the unique man in the context who is older than all others.

(32) the oldest man

$$\lambda g. \{\langle x, g^{\nu \mapsto x} \rangle \mid x = \iota x: \text{man}. \neg \exists y: \text{man}. \text{older } x y\}$$

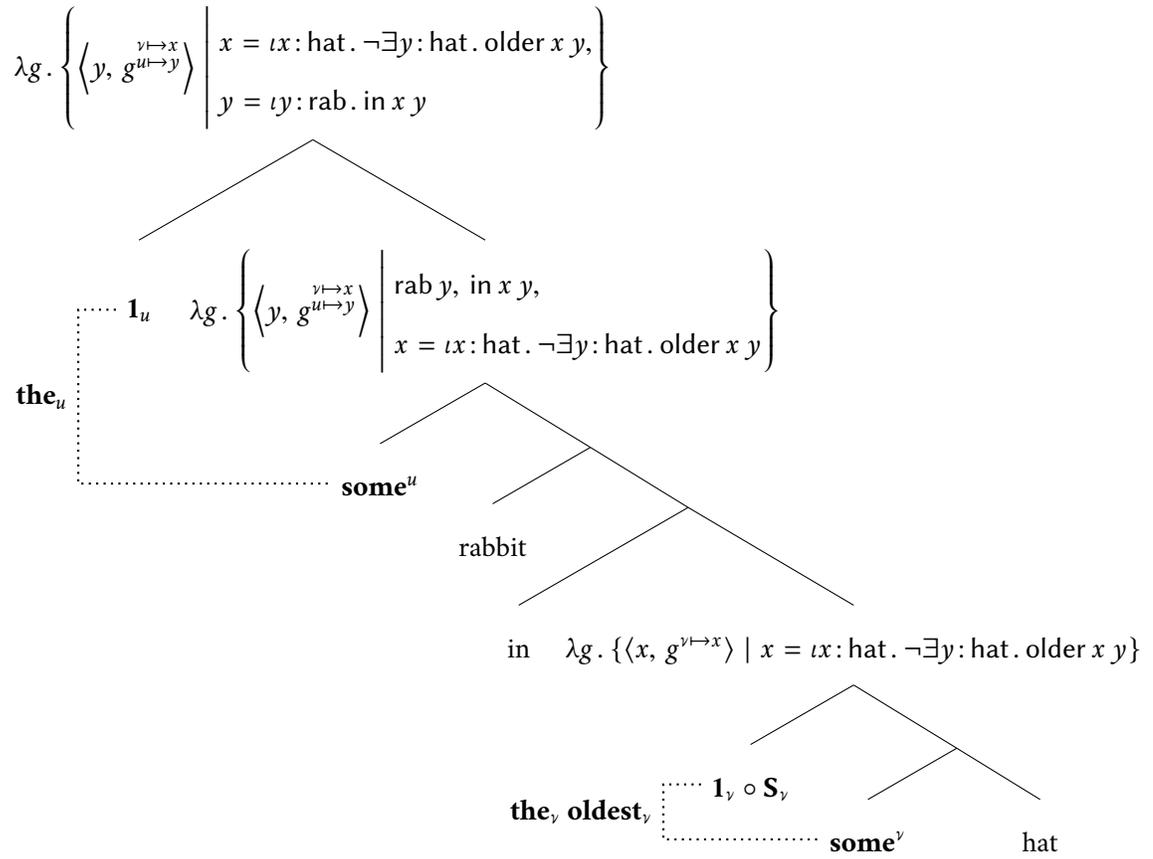


The absolute reading of (33) is by now unsurprising. Assuming uniqueness of the relevant characters is satisfied, it denotes the update that assigns  $\nu$  to the oldest hat, and  $u$  to the particular rabbit in it. See (33a).

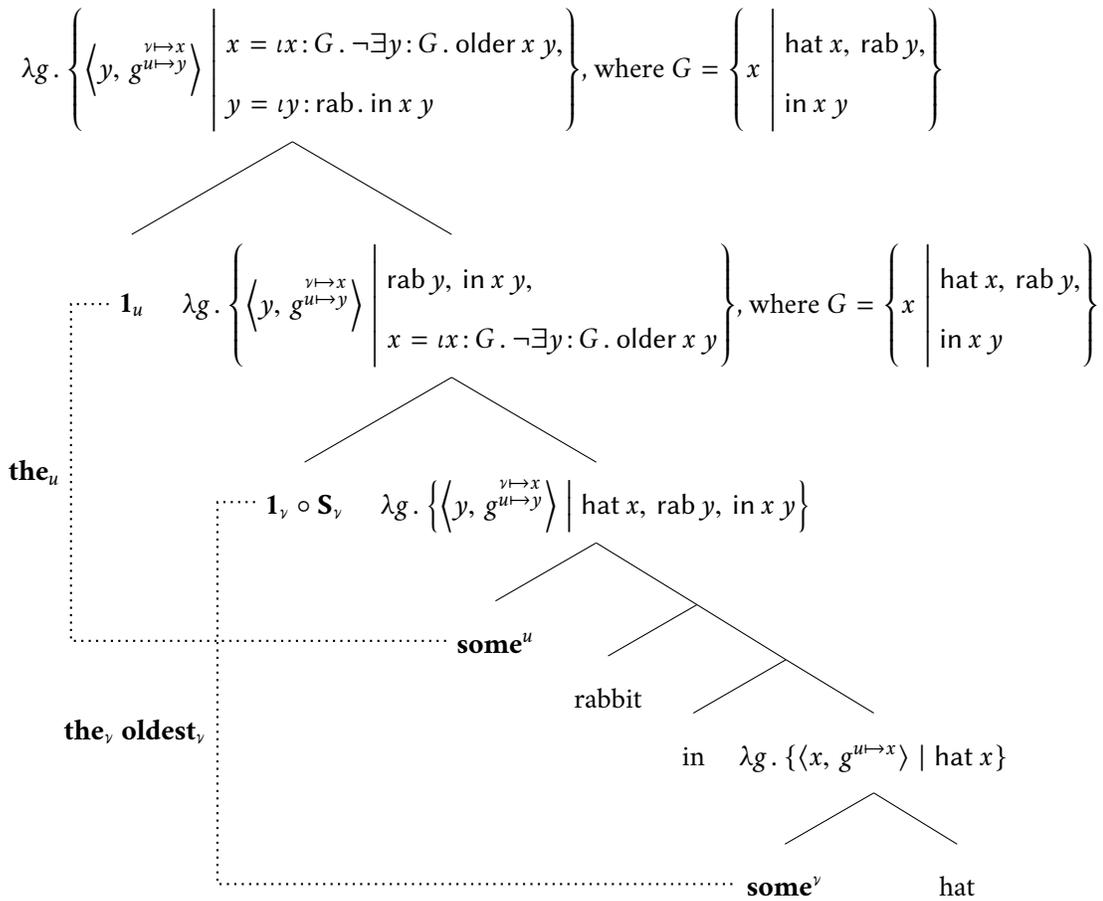
The relative reading shown in (33b) is very much like the relative readings of (25) and (28). Before either the superlative or uniqueness filters are executed, the set of outputs is restricted, solely by the lexical items, to those that map  $\nu$  to a hat and  $u$  to a rabbit in it. Only those hats that contain some rabbit or other are up for consideration when the  $\mathbf{S}_\nu$  test goes to work. When that happens, the test discards any outputs that send  $\nu$  to one of these hat that is not as old as some other of these hats. From there,  $\mathbf{1}_\nu$  imposes the restriction that there be a single such unrivalled hat. And subsequently  $\mathbf{1}_u$  guarantees that there is a single rabbit in this oldest hat.

(33) the rabbit in the oldest hat

a. Absolute reading: the oldest of the hats, with exactly one rabbit in it



b. Relative reading: of the hats that contain rabbits, the rabbit in the oldest



To wrap up the presentation of the analysis, consider again the island-boundedness paradigm of Section 2.2.4. There it was claimed that scope islands enforce the limits of relative readings. For instance, (34a) requires that the boy it refers to have a comparative belief about John, so to speak, namely, that John out-bought the other boys on belts. It cannot refer to the boy whose beliefs about John happen to involve a belt whose price exceeds that of any belt attributed to John by any other boy. This is a direct consequence the hypothesis that relative readings happen when the superlative and quantificational component of the determiner take scope (this prediction is shared by many analyses in the scopal spirit of Szabolcsi 1986 and Heim 1985).

(34) a. # the boy who thinks John bought the most expensive belt

- b. the boy who bought the most expensive belt

However, as mentioned in Section 2.2.4, even when relative clauses do support relative readings, the embedded operators seem to quantify over the semantic content of the head nominal. The relative reading of (34b), for instance, refers to the boy who bought a more expensive belt than any other *boy*, rather than the person who is a boy and bought a more expensive belt than any other *person*. This is also predicted by the derivations above, which generate relative readings by interleaving the operations of the outer determiner and those of the superlative DP, in effect giving the superlative scope over the entire host noun phrase, including the head noun.

But this appears to violate well-known constraints on scope-taking out of relative clauses (Rodman 1976). I hope that further research will properly resolve this tension, but for now, I'll just point out that the standard empirical judgments concerning relative clause scope islands merely show that operators in relative clauses cannot outscope the quantificational force of the *determiners* that host them; they are silent as to whether those operators outscope the nominals that their relative clauses modify. For example, (35) has no reading which would be true if John's interviewees vary with professors.

(35) John interviewed some student who worked with every professor

That (35) lacks such a reading guarantees that 'every professor' does not scope over 'some student who worked ...'. But this alone doesn't rule out the possibility that the universal quantifies over the NP 'student who worked ...', perhaps along the analytical lines of Heim & Kratzer's (1998: Ch. 8) surface-linking derivations: [some  $\lambda x$  [ev.prof  $\lambda y$  [student  $x \wedge$  work-with  $y x$ ]]]. The point is that we just can't tell whether the universal outscopes the nominal or not, since it doesn't bind into any argument of that nominal. But superlatives are different in this regard: because a superlative quantifies over a particular coordinate of the dynamic output, and that coordinate will be (incidentally) restricted by the information in the noun, supranominal scope has detectable semantic consequences.

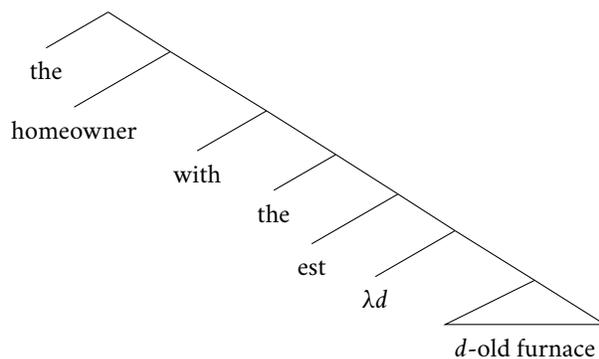
## 2.4 Discussion and comparison

### 2.4.1 The scope vs. restriction superlative debate

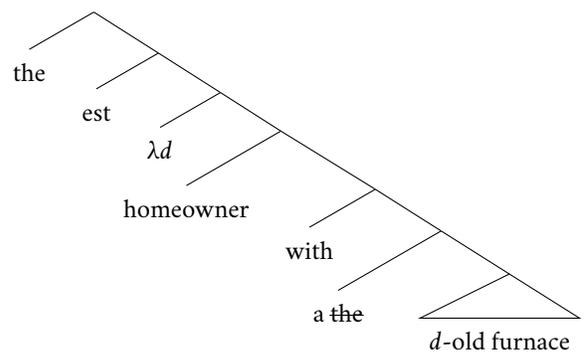
There are two major themes in the semantic literature on superlatives, both with many variations. The first hypothesis, following lines of thought spelled out in Szabolcsi 1986, Heim 1985, and Heim 1999 is that the absolute/relative ambiguity is a traditional semantic scope ambiguity. If the superlative morpheme is interpreted inside its own DP, the meaning is absolute. If however it is interpreted at a position outside of its containing DP, the meaning is relative. Figure 2.5 provides a minimal fragment illustrating the essential account.

**Figure 2.5** Schematic scope-based treatment of abs/rel superlative ambiguity (cf. Szabolcsi 1986, Heim 1999, Bhatt 2002, Hackl 2009, Romero 2013, Sharvit 2015):  $\llbracket \text{est} \rrbracket = \lambda R x . \exists d . \{x\} = R d$

**2.5a** Absolute: ‘est’ compares furnaces with respect to size.



**2.5b** Relative: ‘est’ compares homeowners with respect to the sizes of their furnaces.

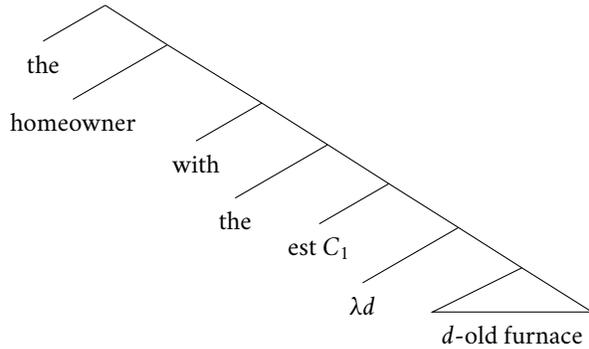


The second hypothesis, also sketched (and rejected) in Heim 1999, but developed in Farkas & Kiss 2000 and Sharvit & Stateva 2002, contends that the absolute/relative ambiguity results from pragmatic flexibility in how the quantificational domain of the superlative is restricted. Figure 2.6 provides a corresponding bare bones fragment with illustrative derivations.

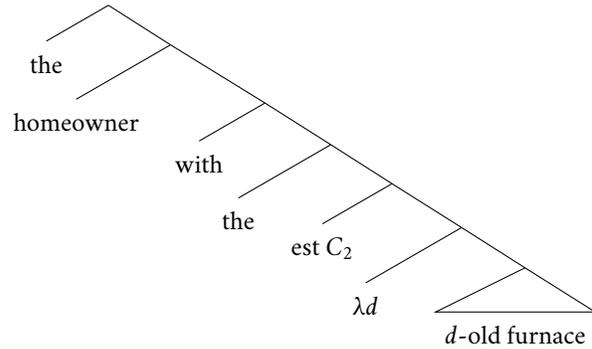
Theories in the mold of Figure 2.5 that attribute relative readings to the scope of the superlative morpheme suffer from the following well-known peculiarity: in order to generate appropriate truth conditions, it is necessary to assume that the definite article is actually semantically *indeterminate* (see

**Figure 2.6** Schematic restrictionist treatment of abs/rel superlative ambiguity (cf. Heim 1999, Farkas & Kiss 2000, Sharvit & Stateva 2002, Herdan & Sharvit 2006, Tomaszewicz 2015):  $\llbracket \text{est} \rrbracket = \lambda CRx. \exists d. \{x\} = R d \cap C$

**2.6a** Absolute:  $C_1$  is the domain of relevant entities.



**2.6b** Relative:  $C_2$  is the domain of relevant entities that some homeowner is with.



Szabolcsi 1986 for original discussion of this point and Coppock & Beaver 2014 for recent confirmation). This is all the more surprising in light of the fact that sentences like (36) lack relative readings, to the extent that they are acceptable at all (Herdan & Sharvit 2006). Why the definite article should have merely existential force precisely when the superlative morpheme takes wide scope is left unexplained by traditional scope-based treatments of superlatives (Heim 1999, Hackl 2009, Romero 2013, Sharvit 2015), as is the absence of relative readings when ‘the’ is replaced by a determiner that really does have merely existential force.

(36) This year, semantics is the field with a best student

# This year, semantics is the field with a student better than any student in any other field

On the flipside, theories in the mold of Figure 2.6 that attribute relative readings to covert domain restriction generally suffer from a different peculiarity: they do not generate appropriate truth conditions. The denotations in Figure 2.6b predict that ‘person who climbed the highest mountain’ will denote a property true of *any* individual who climbed the highest climbed mountain; it is not offended by ties. This predicts that if John, Mary, and Fred all end up climbing the very same mountain, which turns out to be higher than the one Carl climbs, then it will be true to say that John climbed

the highest mountain. In general, as Farkas & Kiss (2000) point out, DPs like the one in (37) do not even seem to be well-formed, though the generic theory in Figure 2.6 predicts that it should mean that John knows one of the people who climbed as few mountains as anyone.

(37) \*John knows a person who climbed the fewest mountains

Even more tellingly, Heim (1999) argues that no choice of individuals  $C$  can be used to restrict the superlative description in (38) so that it generates the relative reading characterized below. This is the reading on which (38) singles out John, given that this year John needs to publish at least one paper (any one will do), Mary at least two, and Bill at least three (cf. (15b)).

(38) the student who needs to publish the fewest papers

- ✓ the student whose requirements are the least demanding; i.e., the student  $x$  with the lowest number  $n_x$ , where  $n_i$  is the number of papers such that it is required for there to be at least  $n$  papers that  $i$  gets published

In a nutshell then, the essential explanatory tradeoff between the approaches is this. Restrictionist analyses of relative superlatives are simple and natural; essentially all uses of quantificational language are contextually restricted, so there is very little analytical overhead in postulating that relative “readings” emerge when the domains of superlative DPs are restricted in a particular way. Yet, it is a bit suspicious that the relevant, extremely robust pattern of relative readings should depend so systematically on the syntactic context of the superlative DP (Farkas & Kiss 2000, Coppock & Beaver 2014), without any semantic mechanism for capturing that context. In addition, there are well-described cases like (38) in which superlative DPs are indubitably at least locally indeterminate, and cannot therefore simply denote *the* element of their NP that maximizes some property (for further discussion of the indefiniteness of relative superlatives, see especially Szabolcsi 1986, 2012, Farkas & Kiss 2000, Coppock & Beaver 2014).

On the other hand, scopal analyses of relative superlatives explain how superlatives come to depend on the denotations of their syntactic contexts, as this is just what it means to take scope. How-

ever, to avoid the truth-conditional sting of indeterminacy, they are forced to stipulate an otherwise unattested alternation in the semantics of the definite article: exactly when the superlative morpheme scopes outside of its hosting DP, the article is interpreted indeterminately. Of course this last theoretical move — the assumption that there are semantically indeterminate uses of the definite article — is open to restrictionist theories as well. Variants along these lines are explored in Coppock & Beaver 2014 and Krasikova 2012, discussed in Sections 2.4.4.1 and 2.4.4.2 respectively.

Before I compare these approaches with the one presented here (Section 2.4.3), I want to introduce the small literature on Haddock descriptions to emphasize the similar choice points that have emerged from competing analyses.

## 2.4.2 Haddock effects

Haddock (1987) originally observed that in the context of a model like Figure 2.7a, the description in (39) successfully refers to the rabbit R2, despite the fact that there are multiple salient hats and multiple salient rabbits in the scene.

(39) the rabbit in the hat [Haddock 1987: (1)]

Working at the interface of semantics and natural language processing, Haddock took the description in (39) to identify a particular sort of *Constraint Satisfaction Problem* (Russell & Norvig 1995, Dechter 2003). According to his analysis, the phrase is felicitous exactly when the context it is uttered in contains unique values for  $x$  and  $y$  that satisfy the following three simultaneous constraints: (i)  $x$  is a rabbit; (ii)  $y$  is a hat; and (iii)  $x$  is in  $y$ . In particular, the hat that (39) refers to needn't be the only hat in the model for the description to be well-formed, as long as there is exactly one *pair* of a rabbit and hat such that the rabbit is in the hat.

Haddock's CSP serves to highlight two things. First, it provides a nice characterization of the felicity conditions for (39):  $\exists! \langle x, y \rangle : \text{rabbit} \times \text{hat}. \text{in } y \ x$ . Second, it illustrates the compositional trouble that (39) poses for theories of definiteness. The description contains two syntactically distinct

definite DPs, but imposes what appears to be a single presupposition that quantifies *polyadically* over the potential referents of those descriptions.

**Figure 2.7** Models supporting relative readings of definite determiners

2.7a cf. (39) [from Haddock 1987: p. 661]

2.7b cf. (40) [from Stone & Webber 1998: p. 185]



Subsequent work on natural language generation tasks have revealed that the phenomenon is not limited to cases in which a single definite description is nested within another. Horacek (1995) presents an example along the lines of (40), set against the model in Figure 2.7b, to demonstrate that the felicity of a description may depend on the simultaneous resolution of arbitrarily many referents. Here the success of (40) in referring to the rightmost table of Figure 2.7b suggests that the relevant felicity condition is something equivalent to  $\exists!(x, y, z) : \text{apple} \times \text{banana} \times \text{table} . \text{with } z(x \oplus y)$ , where  $x \oplus y$  is the mereological sum of  $x$  and  $y$  (Link 1983).

(40) the table with the apple and the banana

[Horacek 1995]

Stone & Webber (1998) argue that the descriptions don't even need to be nested to co-depend on one another. They observe that the sentences in (41) are perfectly coherent things to say in the context of Figure 2.7a, despite its multiple rabbits and multiple hats. In both cases, though neither definite *c*-commands the other, the sentences appear to impose a single, joint uniqueness condition on rabbits and hats, namely, that there be a single pair such that it is possible to remove the one from the other, or possible for one to have been put in the other; in other words, that there be a single current rabbit-in-a-hat.

(41) a. Remove the rabbit from the hat.

- b. Bill put the rabbit in the hat.

Analyses of Haddock’s relative descriptions split along very similar fault lines as those of relative superlatives. Haddock (1987) himself, and later van Eijck (1993), adopted a dynamic view of referent identification in definite descriptions, which as I’ll argue below, is a concrete (semantic) means of implementing textbook restrictionist analyses. But Haddock and van Eijck are both silent about crucial compositional issues, most notably how to “delay” the effect of the embedded definiteness test until information from higher up in the tree has taken effect on the set of outputs.

For instance, van Eijck characterizes the denotation of (42a) in terms of the formula in (42b) ( $u. \pi$  here is the dynamic analog of the classical  $\iota$  quantifier; it either remaps the variable  $u$  to the only entity  $d$  for which  $\pi g^{u \rightarrow d}$  doesn’t fail, or else it crashes). If defined, the outputs in the denotation of this formula will all map the variable  $u$  to the unique character *that has a unique hat*, like the ‘ $D$ ’ of model (42c). But how this logical form comes about, in which the embedded  $\iota$  has scope over the predicate with, is not explained.

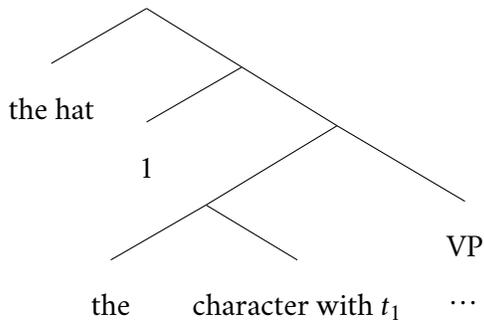
(42) a. the character with the hat [van Eijck 1993: (11–13)]

b.  $u. \text{char } u ; \iota v. (\text{hat } v ; \text{with } v u)$

c.  $\ddot{A} B \hat{D} \wedge E C \ddot{F}$

Champollion & Sauerland (2010) address precisely this issue. They argue that the embedded description is inversely linked to its host, relying on independently motivated assumptions about presupposition accommodation in the scope of quantifiers. For example, van Eijck’s (42b) would correspond to the LF in (43). The scope of the linked definite — i.e.,  $[[\text{the character with } t_1] \dots]$  — presupposes the existence of a unique character with  $t_1$ . This presupposition is locally accommodated as an additional restriction on the wide-scoping determiner, so that ‘the hat’ in this configuration refers to the  $x$  such that  $x$  is a hat and there is exactly one character with  $x$  (see von Stechow 1994, Beaver 2001, Barker 1995, among others, for further discussion and examples of this sort of local accommodation).

(43)



Setting aside the formal kinks of this analysis,<sup>6</sup> it makes at least three bad empirical predictions. First, it predicts a correlation between the DP structures that license inverted interpretations of quantifiers and those that license relative interpretations of definites. In particular, if [Champollion & Sauerland](#) are right, then inverse linking ought to be possible in structures analogous to (40) and (42b) above, both canonical examples of the [Haddock](#) phenomenon. Yet inverse linking is systematically unavailable to quantifiers in the object position of ‘with’ ([Gabbay & Moravcsik 1974](#), [May & Bale 2005](#)). For instance, according to [May & Bale \(2005\)](#), (44a) can only mean that the door was opened by a person who has total dominion over skeleton keys, which is to say the universal cannot outscope its host DP. In contrast, (44b) admits of the same sort of polyadic reading that we see in (42b); it does not presuppose unicity of skeleton keys, only of key-wielding guards.

- (44) a. Someone with every skeleton key opened this door [[May & Bale 2005](#): (19)]  
# Every skeleton key that someone has is such that someone who has it opened this door
- b. The guard with the skeleton key opened this door  
✓ The skeleton key that a guard has is such that the guard who has it opened this door

Second, the inverse linking account of [Haddock](#) definites predicts the description in (42a) will refer to the unique hat that sits atop *exactly one* character (if such a hat exists).<sup>7</sup> This is too weak. The proper felicity condition for such relative descriptions, as established by [Haddock \(1987\)](#), is that

<sup>6</sup> The presupposition of the nuclear scope contains a bound variable. Conjoining this presupposition to the restrictor of the raised DP *unbinds* that variable!

<sup>7</sup> Note that [van Eijck \(1993\)](#) makes the same prediction, though [Haddock's \(1987\)](#) original dynamic fragment does not.

there be a unique *pair*  $\langle x, y \rangle$  with  $x$  a hat,  $y$  a character, and  $y$  with  $x$ . Example (45) illustrates the difference. Champollion & Sauerland predict that the sentence in (45a) will be true in the model of (45b), as the only character with exactly one hat, ‘D’, is indeed a consonant. But in fact the sentence is not defined, since there are too many character-hat pairs that satisfy the subject.

(45) a. The character with the hat is a consonant

b.  $\widehat{A B} \widehat{D} \widehat{E C F}$

Third, Champollion & Sauerland predict that relative readings should disappear when the embedded definite appears in a full relative clause, rather than an argument or prepositional phrase, because a DP in a relative clause cannot outscope the quantificational force of its host (see the final paragraphs of Section 2.3.4). It is easy to find attested counterexamples to this prediction, as in (46). In fact when Champollion & Sauerland forced participants in an experimental study to choose between sentences like (47a) and (47b) as descriptions of a relative-reading model with multiple squares, they found that fully 76% of nearly 800 informants preferred to use the definite article to the indefinite one.<sup>8</sup>

(46) a. <sup>?</sup> Metta World Peace is now friends with the guy who threw the beer at him

[at a basketball game, where there were presumably hundreds of beers ]

b. <sup>?</sup> Or maybe it’s the tiny Laughing Buddha who’s sitting there in front of the planter, throwing off little sparks of positive energy, that’s keeping the plant so hale and hardy.

[describing an image with two planters, one of which is behind a Buddha figurine ]

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<sup>8</sup> Champollion & Sauerland actually take these results to argue *for* the inverse-linking analysis of relative readings, as the preference for (47a) over (47b) is slightly but significantly lower than the preference for (ia) over (ib) below. This drop notwithstanding, it is hard to see why 3 out of 4 speakers would still prefer a description which Champollion & Sauerland predict to be either undefined or island-violating to an alternative which is both shorter and clearly true.

(i) a. The circle in the square is white

b. The circle in a square is white

- (47) a. The circle that's in the square is white  
 b. The circle that's in a square is white

So relative readings of embedded definites do not pattern with inverse readings of embedded quantifiers, which are indeed unavailable when the quantifier is trapped in a relative clause (Rodman 1976, May 1977). What's more, as illustrated in example (41), relative readings are not even limited to DP embeddings. In the context of Figure 2.7a, the rabbit and hat referents of (41) are just as mutually defining as they are in Haddock's classic nested example (39).

### 2.4.3 Synthesizing intuitions

I suggest that the proposal here synthesizes scopal and restrictionist intuitions regarding relative readings of definites and superlative adjectives, avoiding some of the defects of both.

The first thing that I think is important to recognize is that essentially all DRT-ish dynamic fragments are restrictionist with respect to *indefinite* reference. The guiding principle behind such semantic frameworks is that indefinites introduce discourse referents, and predicates introduce constraints on the values of those referents. Thus when a predicate takes two indefinite arguments, the discourse referents will be in effect mutually constraining. Take the DRS in (48) for example. This diagram implicitly represents the set of models (or situations or assignment functions) in which there are referents for  $u$  and  $v$  that satisfy the simultaneous constraints girl  $v$ , boy  $u$ , and see  $v u$ .

- (48) a. A boy saw a girl

b.

$u, v$
girl $v$
boy $u$
see $v u$

In other words, the outputs of dynamic systems by their nature encode the relational constraints that constituents impose on potential witnessing models. That is, as bits of meaning are built up, the assignments left open in the denotation of the structure are more and more constrained, which is to say, the set of outputs is increasingly *restricted* by the predicates that relate discourse referents. As a result,

the long-hypothesized restriction of superlative descriptions to the constraints denoted by the predi-

cates that surround them falls out of the assumption that there is a dynamic existential lurking inside every definite article.

Where this analysis breaks ways with the restrictionist camp is that it allows the cardinality test of the definite and/or superlative adjective to take scope over the update denoted by its context. This means that locally, *in situ*, the relative DP behaves just as its indefinite shadow, which is why relative DPs satisfy the array of indeterminacy tests established by Szabolcsi 1986 and others (see Section 2.2.2). It also avoids the truth-conditional issues related to ties, either between highest-climbed mountains or highest-mountain climbers.

But at a distance, when the cardinality/maximality test is invoked, quantification plays out essentially as in Heimian scopal theories of superlatives, except that the set of alternatives that is quantified over is just the set of dynamic outputs generated at that point in the derivation. What's nice is that these outputs are a natural byproduct of the dynamic framework. There's no need to reify the lambdas of QR so that the superlative morpheme can feed on an abstract node derived from movement (cf. Heim 1999: fn. 20). Instead, as in Alternative Semantics (Kratzer & Shimoyama 2002) or Focus Semantics (Rooth 1996), the compositional dynamic machinery itself carries the objects of comparison up to the quantificational operator.

Furthermore, according to this analysis, the definite article plays an important role in deriving relative readings. The superlative morpheme does not take scope in any usual sense, as it does not leave a trace and it does not bind anything. On the contrary, it is semantically quite simple; it filters out non-maximal outputs. It is the definite article that gives the filter scope over a more restricted set of outputs.

This explains several things that are otherwise quite mysterious to the family of theories that attribute relative readings to the scope of the superlative. Most obviously, it explains why definite articles are licensed as determiners for relative superlative DPs, which are by all diagnostics semantically indeterminate. Namely, the definite acts as a springboard for the scope of the quantificational adjective, and when it does so the uniqueness test it contributes does not quantify over the set of

values that satisfy the NP it determines, but some more restricted set of values, and possibly much more abstract.

Second, it accounts for the lack of relative superlatives in the absence of the definite determiner, including indefinite superlatives, à la (37) (Herdan & Sharvit 2006), and possessive superlatives, à la (21a) (Chacón & Wellwood 2012). The possessive case is especially interesting, as neither the restrictionist nor the traditional scope-taking hypotheses have any explanation for the contrast between (21a) and (21c), repeated below. For restrictionist accounts, the question is what prevents the superlative of (49a) from considering only *climbed* mountains, given that it does so in (49b). For scopal accounts, the question is how to prevent the possessive determiner from shedding its definiteness in the presence of a superlative morpheme itching to quantify over the VP, given the capacity of the definite determiner to do so. The latter question is even more pressing in light of the fact that possessive DPs are in general more susceptible to indeterminate interpretations than definite DPs (see, e.g., Coppock & Beaver 2015 for a recent argument of this point).

- (49) a. # the guy who climbed Scotland's highest mountain  
b. the guy who climbed the highest Scottish mountain

Without committing to any particular semantic analysis of possessive DPs at this point, suffice it to say that the story presented here at least has recourse in distinguishing between the scope-taking behavior of 'the' and that of '-s'. In other words, the definite determiner is *special* in comprising two semantic processes, one of which may be delayed relative to the other. There's no reason to think the possessive determiner's semantics can be fractured in the same way. The absence of possessive Haddock readings, as demonstrated in example (22a), in fact suggests that it can not. And without this sort of subcomputational decomposition, there's no way for the cardinality test imposed by the determiner to quantify over anything but its nominal complement, and consequently no rocket with which to launch the superlative adjective into scope.<sup>9</sup>

<sup>9</sup> In fact, in Chapter 4, I will argue that possessive determiners *are* exactly as semantically bipartite as the definite determiner, but that this is masked by the fact that almost all possessive DPs are scope islands. So as we will see, even though the

Here is a good place to own up to an unusual bullet that the present analysis has to bite. It predicts that ‘the’ takes superlative adjectives as arguments (or at least that it *can*), and thus that ‘the’ and ‘longest’, say, form a constituent in the DP ‘the longest book’. This isn’t entirely unprecedented. Szabolcsi (1986) and Krasikova (2012) both explore the possibility that ‘the’ and the superlative operator move together to the exclusion of the rest of the DP (in Szabolcsi’s case, they form a kind of synthetic complex determiner; in Krasikova’s the article takes the result of the superlative applied to a covert comparison class parameter as an argument). And similar constituency claims have surfaced for a handful of other arguably scope-taking adjectives, like ordinals (Svenonius 1994), adjectives of comparison (Svenonius 1994, Schwarz 2006, Kennedy & Stanley 2009), and adjectives of frequency (Larson 1999, Zimmermann 2003).

One suggestive data point in favor of the hypothesis that ‘the’ takes relatively-interpreted superlative adjectives as arguments is that relative readings disappear when a superlative adjective is separated from its definite determiner. To see this, assume that being cheap and being critically-acclaimed are independent intersective properties that a film may or may not have (if it helps, imagine a double-blind film competition with a panel of critics who do not know anything about the budgets of the films that they review). Both (50a) and (50b) seem to me acceptable adjective stackings, and moreover seem to be semantically equivalent. If anything, (50b) is somewhat marked compared to (50a).

- (50) a. {the, a} cheap critically-acclaimed film  
 b. <sup>?</sup>{the, a} critically-acclaimed cheap film

With the superlative form ‘cheapest’, both orderings are again possible, though the meanings are no longer equivalent.<sup>10</sup> If the superlative abuts the determiner, as in (51a), the description is ambigu-

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cardinal/possessive part of a possessive determiner is semantically removed from the referent-introducing part, just as it is for ‘the’, because semantic evaluation is forced at the edge of possessive DPs, these quantificational components never take non-trivial scope. That is, they are always executed immediately after the indefinite components, and so do not give rise to relative readings (with one exception, which is the subject of Chapter 4).

<sup>10</sup> Teodorescu (2006) makes a related point concerning superlatives in indefinite DPs. Though these are never interpreted relatively (Herdan & Sharvit 2006), Teodorescu observes that (ia) and (ib) below are not equivalent: (i) says that among some subclass of Italian students, the dean praised the shortest; (ii) says that among some subclass of students more gen-

ous. On its absolute interpretation, (51a) presupposes that the very cheapest of all the well-received musicals was submitted by a debut director, and it asks for the identity of that director. On its relative interpretation, (51a) carries no such presupposition; it requires instead a comparison among debut directors, and asks which of them directed a good musical cheaper than any good musical directed by any of the others. The question in (51b), however, has no such relative reading. The direct object refers to the cheapest of all the musicals (which it presupposes was critically-acclaimed), and the whole question asks for the identity of its director.

- (51) a. Which debut director submitted the cheapest critically-acclaimed film to feature a song and dance routine?  
 b. Which debut director submitted the critically-acclaimed cheapest film to feature a song and dance routine?
- (52) a. [ [which debut director] [est  $\lambda dx$  [ $x$  submitted [an acclaimed  $d$ -cheap film]]] ]  
 b. [ [which debut director] [est  $\lambda dx$  [ $x$  submitted [a  $d$ -cheap acclaimed film]]] ]

Neither traditional scopal theories nor restrictionist theories of superlatives predict this asymmetry. For instance, the logical forms in (52) are denotationally equivalent. In fact, given the equivalence of these LFs and the initial preference for (50a) over (50b), one might expect (51b) to be the natural way to express the relative question that in fact only (51a) expresses. In contrast, the account presented here predicts that relative readings will depend on ‘the’ picking the superlative adjective up as an argument and (semantically) pied-piping it to a higher perch.

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erally, the dean praised the shortest, who was Italian. A reasonable conclusion to draw from this fact (though Teodorescu seems not to consider it) is that superlative adjectives do not take scope, even within their own DPs. If they did, then ‘Italian shortest student’ ought to generate the LF [est  $\lambda d$  [Italian [ $d$ -short student]]], which would mean the same thing as [est  $\lambda d$  [ $d$ -short [Italian student]]].

- (i) a. The dean praised a shortest Italian student  
 b. The dean praised an Italian shortest student

## 2.4.4 Other points of comparison

### 2.4.4.1 Split definiteness

In a series of recent articles, Coppock and Beaver have pursued the idea that the traditional notion of definiteness conflates two semantically separable properties (Coppock & Beaver 2012a,b, 2014, 2015). Some descriptions are instantiated by at most one individual in a given context, either in virtue of the logical character of the description or in virtue of what information is in the common ground. These descriptions, they say, are *weakly unique* or *semantically definite*. Other descriptions are individual-denoting, type *e*. These they say are *determinate*. They observe that while all morphologically definite descriptions are weakly unique — setting aside the systematic class of so-called *weak definites*<sup>11</sup> — not all such descriptions are determinate. In particular, they point to descriptions in predicative positions and descriptions containing superlative and exclusive adjectives as examples of weakly unique yet *indeterminate* definite descriptions. For instance, the most natural reading of (53) guarantees that there is no unique author of *Waverly*, and so the descriptive content ‘only author of *Waverly*’ cannot be individual-denoting (since there is no such individual). Yet it is still weakly unique; there cannot be two distinct solo authors of the same text.

- (53) Scott is not the only author of *Waverly* [Coppock & Beaver 2012b: (3b)]  
≈ ‘Scott is one of several authors of *Waverly*’

On the basis of such examples, they conclude that definite articles do not encode determinacy.

That is, definite descriptions denote *sets* of individuals, just like indefinite descriptions. The only

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<sup>11</sup> Weak definites are short, largely conventionalized descriptions that invoke the definite article with no presumption of nominal uniqueness (Löbner 1985, Kadmon 1987, Poesio 1994, McNally 1998, Barker 2004). Typical examples are place types (‘the store’, ‘the hospital’, ‘the beach’), media types (‘the radio’, ‘the newspaper’), body parts (‘the finger’, ‘the eye’), and spatial relations (‘the corner of the street’, ‘the side of the building’). It is tempting to imagine that the decomposition of definiteness proposed here could go some way toward accounting for these expressions. At present I can only offer the following speculation. Weak definites do encode uniqueness, not of the nominal that restricts them, but of the DP’s nuclear scope. So when I tell you that I read the newspaper all morning, I am in effect telling you that I read something all morning, and *the thing that I read all morning* was a newspaper, or possibly *the kind of reading that I did all morning* was newspaper-reading (see Schwarz 2014 for an idea along these latter lines). If this is on the right track, then the scope of uniqueness (together with the restrictive content of the nominal!) is indeed displaced from the description’s local position, which merely introduces a referent.

difference is that the sets denoted by definite descriptions are presupposed to have at most one individual in them. These descriptions are then coerced by familiar type-shifting operations to facilitate composition (usually by  $\iota$ -reduction, or in unusual cases like (53) by Partee's (1986) existential 'A').

The decomposition of  $\llbracket$ the NP $\rrbracket$  into two parts —  $\{x \mid \llbracket$ NP $\rrbracket x\}$  and  $\lambda P. \iota P$  — is very much in accord with the proposal here. Interestingly, it is motivated not by examples of intervention effects, but by cases in which the  $\iota$  part just never happens. Yet there are differences between Coppock & Beaver's decomposition and this one, the most important of which is that uniqueness (or, for them, weak uniqueness) is evaluated immediately, as soon as the NP is composed. Like most every other theory of definiteness, this is inconsistent with the Haddock data. There is nothing unique, or weakly unique, about the predicate 'hat' in Figure 2.7a.

It also makes rather dubious predictions about relative superlatives. Concentrating on the relative reading of (54), Coppock & Beaver (2014) propose a denotation for the superlative NP equivalent to (55), assuming the  $y$  variables range over individuals in the comparison class. This is the property of being a mountain climbed by someone which is higher than any mountain climbed by anyone else. This property is indeed indeterminate, as there can fail to be any such mountain when two distinct individuals climb equally high mountains. But it is also *not* weakly unique. If John climbed five mountains (of potentially varying heights), all of greater magnitude than those scaled by any of his competitors, then *all five* of those mountains would meet the criterion in (55). So the alleged presupposition of the definite article here is not trivial. It predicts that (54) should be infelicitous in the context where John not only outclimbs his competitors but actually laps them. This, in my judgment, is not the case; I would say that when Erwin Schneider climbed Jongsong Peak (7,462 m) in 1939, besting the world record that he himself set at Nepal Peak (7,177 m) just two weeks prior, he did not thereby cease to be the alpinist who had scaled the greatest summit (Smythe 2013).

(54) the person who climbed the highest mountain

(55)  $\llbracket \text{highest mountain} \rrbracket =$

$$\lambda x: \text{mtn. } \exists y. \text{climb } x \ y \wedge \exists d. \text{high } x \ d \wedge \forall x': \text{mtn. } (\exists y'. y' \neq y \wedge \text{climb } x' \ y') \Rightarrow \neg \text{high } d \ x'$$

this prediction could be avoided by adopting a more standard restrictionist view for the denotation of ‘highest mountain’, given in (56), on which it is not mountain climbers that are compared but climbed mountains. This is weakly unique, as there is at most one climbed mountain that is higher than all others. But as Coppock & Beaver (2014: fn. 15) themselves point out, this fails to explain why (54) is false when several climbers, including John, all turn out to have scaled that unique highest climbed mountain.

(56)  $\llbracket \text{highest mountain} \rrbracket =$

$$\lambda x: \text{mtn. } \exists y. \text{climb } x \ y \wedge \exists d. \text{high } x \ d \wedge \forall x': \text{mtn. } (x' \neq x \wedge \exists y'. \text{climb } x' \ y') \Rightarrow \neg \text{high } d \ x'$$

So while I am entirely sympathetic to the idea that definite descriptions denote, at some level, *indeterminate* sets of entities, I think it is essential, at least where Haddock and superlative descriptions are concerned, that the cardinality (and maximality) tests take effect later in the composition than the syntactic position of the definite article. Chapter 3 will extend the analysis presented here to cases involving exclusive adjectives like (53).

#### 2.4.4.2 Climber-indexed sets

Some years before Coppock & Beaver 2014, Farkas & Kiss (2000) mooted a very similar denotation for relatively-interpreted superlative DPs. As illustrated in (57), the meaning they hypothesize depends on the contextual resolution of two variables, the relativizing function  $f$  — generally the predicate of which the superlative DP is an argument — and the index  $i$ , which is intended to refer to the *correlate* of the superlative — the “victor” of the competition. The difference between Coppock & Beaver’s superlative and Farkas & Kiss’s is small; where Coppock & Beaver restrict the NP ‘mountain’ to just those that were climbed *by someone*, Farkas & Kiss restrict it to just those that were climbed *by John*, if John is indeed the best climber.

(57)  $\llbracket \text{highest}_i \text{ mountain} \rrbracket = \lambda x . \text{mtn } x \wedge f i x \wedge \forall x' : \text{mtn} . (\exists j . j \neq i \wedge f j x') \Rightarrow \text{height } x > \text{height } x'$

The reason for introducing a second, referential index to the superlative DP is again to guard against ties. Not only is the superlative searching for the largest climbed mountain which could in principle have been climbed by several people, it is looking for a mountain climbed by  $i$  that is higher than any mountain climbed by somebody other than  $i$ , where  $i$  is bound to the superlative's correlate. Unfortunately, while parameterizing the restricting relation  $f$  to an individual climber does indeed provide enough information for the superlative to fail in case of ties, it also predicts infelicity in case the victor climbs *several* mountains all higher than any mountains climbed by his or her competitors, just as with Coppock & Beaver 2014.

Taking a rather different tack, Heim (1999: Section 8) suggests that 'est' might quantify over a contextually determined set of degree properties. For example, returning to the homeowners and furnaces of Figures 2.5 and 2.6, Heim's denotation for 'est' would take as its comparison class  $C$  the set of degree properties containing for each homeowner  $y$  the property  $\lambda d . \exists z : \text{furn} . \text{old } d z \wedge \text{with } z y$ . From there, the full embedding description — 'the homeowner with the oldest furnace' — would pick out the unique homeowner whose degree property in  $C$  properly included all of the other degree properties in  $C$ . Note that as with other scope-centric theories, the embedded definite is interpreted merely existentially in the degree properties of the comparison class.

Krasikova (2012) adopts the same superlative operator as Heim and the same assumptions about the makeup of the comparison class, but proposes a slightly different compositional structure that creates a role for the embedded determiner. It turns out that after Heim's 'est' has applied to a comparison class  $C$ , it returns a generalized quantifier over degrees, true of any degree property in  $C$  that properly includes all of the other degree properties in  $C$ . Krasikova notes that this GQ is necessarily true of at most one degree property, and hypothesizes that the definite determiner actually applies to it directly. So in our running furnace example, according to Krasikova, 'the [est  $C$ ]' denotes the set of all ages achieved by some homeowner's furnace. The full description then refers to the homeowner who for each one of these ages has *some* furnace at least that old.

Parts of [Krasikova's](#) story resonate with the analysis presented here. In particular the coupling of 'the' and 'est', using the latter to filter out non-maximal alternatives and 'the' to require a single winner. But the [Heimian](#) mechanism by which [Krasikova](#) effects these operations is quite different, and potentially problematic. First, there is again a bit of awkwardness with ties. It could be that several relevant mountains, or mountain climbers, attain exactly the same set of heights, in which case their distinct achievements would mistakenly register as a single degree property in  $C$ , since ' $\lambda d$ . John climbed a  $d$ -high mountain' and ' $\lambda d$ . Mary climbed a  $d$ -high mountain' would in this case identify *the same* function.

To sidestep the issue, [Krasikova](#) actually fills the field of comparison  $C$  with *intensional* degree properties, of the form ' $\lambda dw$ . John climbed <sub>$w$</sub>  a  $d$ -high mountain <sub>$w$</sub> '. Of course this relation between degrees and worlds will be different for John and Mary, as it is logically possible that they climbed mountains of different heights (for a finer point on this discussion, see [Howard 2014](#): Section 4.2). The reason I've included [Krasikova's](#) analysis in this subsection is that neither the superlative nor the definite article make any use of the intensions of their arguments; the *only* reason for intensionalizing those constituents is to distinguish between, say, John's degree set and Mary's degree set. In this sense, the intensional denotations act as proxies for climber-indexed alternatives.

However, intensions are a suspect mechanism for keeping degree properties individuated by climber. In the first place, it is odd that the superlative and definite article should be necessarily intensional operators, given that to know who has the oldest furnace, it suffices to know only *actual* facts about people and their furnaces. Why should we even consider other possibilities? And even so, intensions are inadequate as an indexing proxy in the usual tautological situations. The sentence in (58) is predicted to be true, for instance, even though eight and six both maximize the function ' $\lambda dw$ .  $x$  is a one-digit number with <sub>$w$</sub>   $d$ -many divisors <sub>$w$</sub> '. But before chucking this one in the general hyperintensionality basket, I'll just point out that it is not a problem for any other analysis of superlatives. Scopal theories will compare one-digit numbers to one another, searching for the one with more divisors than any other, but they won't find one. Traditional restrictionist theories will equate

this use of ‘the most divisors’ with something like ‘as many divisors as any one-digit number has’, i.e., ‘four divisors’. But then, again, there won’t be any unique one-digit number with four divisors.

(58) Eight is the one-digit number with the most divisors

Neither does the dynamic theory espoused here have any trouble with this example. The denotation of the nominal will consist of a set of one-digit numbers paired with assignments. The assignments, which the superlative operator quantifies over, all map one variable  $u$  to the digit they are paired with and another variable  $v$  to the quantity of that digit’s factors. The test of the outer definite in this case will fail, as there will be assignments with distinct  $u$  values but the same maximal quantities in  $v$ . All intension-free.

And this is the point. Assignment functions are naturally climber-indexed. The superlative does not quantify over mountains *or* mountain climbers. It quantifies over a set of outputs, each member of which is essentially a line in the great mountain-climbing ledger, a record of a single mountain-climbing accomplishment, complete with climber and mountain. This gives the superlative sufficient resolving power to break ties in the way that [Farkas & Kiss](#), [Coppock & Beaver](#), and [Krasikova](#) are careful to arrange, without relying on intensions or enforcing inappropriately strong conditions on how many mountains the best climber climbed.

#### 2.4.4.3 Split numerals

Split-scope analyses of numeral determiners are more common, where modal intervention effects are well established ([Cresti 1995](#), [Heim 2000](#), [Hackl 2000](#), [Takahashi 2006](#), [Abels & Martí 2010](#), [Kennedy 2015](#)). Intriguingly, [Brasoveanu \(2012\)](#) develops a dynamic fragment that decomposes modified numeral DPs like ‘exactly three boys’ into two components very similar to the components that are argued here to underly superlative DPs. Locally, the numeral DP contributes a maximal plural individual (e.g., the sum of relevant boys), assigned to some discourse referent  $u$ . This discourse referent interacts with the context in the expected way, supplying the argument for a verb or preposition or

whatever. But independently, in a separate contextual register, the numeral DP also stashes a test, called a *postsupposition*, on the cardinality of individuals stored at  $u$ . This test is carried alongside the primary computation involving the boys stored in  $u$ , inert to all compositional processes, until the entire computation is evaluated for truth. At that point, the postsuppositions that have lingered in the context are appended (via dynamic conjunction) to the update denoted by the sentence.

Delaying the numerosity test of the numeral in this fashion allows subsequent semantic material to influence the shape of the output context before the cardinality of the relevant referent is evaluated. This is crucial for examples like (59). As indicated in the paraphrase below, (59) has a reading on which the number of movie-watching boys is three and the number of boy-watched movies five. Here the subject and object nominals *jointly* restrict the potential plural witnesses of the subject and object DPs, prior to any counting.

(59) Exactly three boys watched exactly five movies

- a. ✓ Regarding the boys *who watched a movie* and the movies *that were watched by a boy*, there were exactly three of the former and exactly five of the latter

All of this is strikingly reminiscent of the analysis provided in Section 2.3, and the parallels no doubt invite consideration of a unified approach to cardinality-testing vocabulary, including definite articles, in terms of filters on dynamic outputs. In fact, in recent work, Charlow (2017a) leverages the same dynamic split-scope techniques as are used here to derive the cumulative readings of sentences like (59). He further offers a thorough investigation of the tradeoffs between postsuppositions and higher-order dynamic generalized quantifiers, of which the definite in Chapter 5 is a special case. For present purposes, the major difference between a potential postsuppositional approach to split-definiteness and the higher-order approach presented above is that only the latter predicts that cardinality tests should take scope in a way that is familiar — at least in spirit — from other known patterns of scope-taking. They are not accumulated in a special dynamic cache, to be assessed only at the close of the computation. The split-scope analysis thus accounts for the island effects reviewed in

Section 2.2.4; however scope islands are enforced, they will delimit the reach of tests like  $\mathbf{1}_u$  and  $\mathbf{S}_u$ . It is not clear what would prevent postsuppositions, as designed in Brasoveanu 2012, from trickling through island boundaries, given that they are formally invisible to nonpostsuppositional compositional material.

## 2.5 Conclusion

In this chapter, I've explored the hypothesis that definite determiners are semantically comprised of two distinct compositional operations, one that builds sets of potential witnesses on the basis of the determiner's restrictor, and another that tests a set of witnesses for uniqueness along some dimension. In support of this hypothesis, I argued that Haddock readings of singular, plural, and cardinal definite descriptions, as well as relative readings of superlatives are all examples of definites whose witness-introducing and witnessing-testing components take differential scopes within a phrase. Splitting the scope of the determiner in this way explains why both Haddock definites and relative superlatives pattern with indefinites on a range of diagnostics: locally, the portion of the denotation that is visible to the diagnostic environments *just is* indefinite. It also explains why the readings are sensitive to scope islands, as these projections delimit how high the split-off dynamic test can climb. Perhaps most interestingly, it explains why relative readings depend on the definite determiner — viz., the adjective's scope is parasitic on that of the definite's — in contrast with prevailing scope-based treatments of superlatives. Finally, it brings the semantics of definite articles in line with recent ideas about the semantics of other cardinality-testing nominal modifiers, especially numeral determiners.

## Chapter 3

### Exclusive descriptions and split-scope focus

#### 3.1 Introduction

Linguistic markers of definiteness like English's 'the' typically signal that the descriptions they determine are uniquely witnessed in the contexts in which they are uttered: if there is a single salient hat in the scene, 'the hat' refers to it; if on the other hand, there are two hats or no hats in the scene, the description is inappropriate. But this is not always the case. Coppock & Beaver (2012a,b, 2014, 2015) have recently drawn attention to a variety of felicitous uses of the definite determiner that do not require the existence of any particular referent. They argue on the basis of such examples that definiteness markers appear on descriptions that are satisfied (either contextually or logically) by *at most one* entity, rather than exactly one. In this, they say, 'the' guarantees not uniqueness but *weak uniqueness*: if 'the hat' is appropriate, then all we know for sure is that there aren't two salient hats around.

Part of the data that motivates Coppock & Beaver's relaxed constraint of definite marking comes from descriptions containing exclusive adjectives, like the object of (1). The sentence in this example is most naturally read as entailing that Scott is an author of *Waverley*, and that there are other authors as well. On the assumption that the predicate 'only author of *Waverley*' denotes the set of *Waverley* authors who are such that there are no other *Waverly* authors, the entailments of (1) are incompatible with the existence of a referent for the description. Yet crucially, say Coppock & Beaver, there could

not possibly be more than one such lone author (by definition), and so the definite article is perfectly coherent.

(1) Scott isn't the only author of *Waverley* [Coppock & Beaver 2012b: (3b)]

However, motivated by parallels between the construction in (1) and similar constructions involving superlatives, Sharvit (2015) argues that (1) is actually a case of covert degree movement. She contends that surface syntax notwithstanding, 'only' in this sentence does not modify the NP 'author of *Waverley*', but rather the VP 'is ~~the~~ author of *Waverley*', where ~~the~~ represents that the article is uninterpreted. In other words, the exclusive in this sentence quantifies not over authors *per se*, but over competitors to Scott. *Of those people*, (1) says that Scott is not alone in being an author of *Waverley*; that is, not only Scott is an author of *Waverley*. In liberating 'only' from its local DP, Sharvit trades an analytical situation in which the definite appears to quantify anomalously over solo authors — of which there are none — for one in which the definite apparently doesn't quantify at all.

The empirical objective of this note is to try and clarify exactly what the difference is between the sorts of interpretations that Coppock & Beaver's (2015) analysis assigns to sentences containing exclusive descriptions, and those assigned to them by Sharvit 2015. I will suggest that the two proposals are targeting distinct, both real, derivations, which happen to generate equivalent truth conditions in many cases, including (1). But it's not hard to find attested examples where the readings come apart, and on the whole there is evidence both for a weakened uniqueness presupposition, and for a scope-taking 'only'.

In light of this, my theoretical objective is to offer a fragment that reconciles the two ideas about 'only'. The bridge between them comes by way of the hypothesis explored in Chapter 2, that definiteness is semantically split into an indefinite, referent-introducing component and a definite, cardinality-testing component. According to the theory developed there, these two processes needn't be evaluated at the same time. In particular, the cardinality-testing process is sometimes "delayed" relative to the referent-introducing process, and that when this happens there is potential for a mismatch between the content of a description and the set of referents that is actually counted for the purposes

of licensing the definite. In addition, when delayed, the definite may also suspend the force of certain quantificational adjectives, like numerals and superlatives, which act as filters or tests on alternatives, just like the uniqueness presupposition of the article. In this chapter, I demonstrate that exclusive adjectives also fall into this numeral/superlative paradigm, and that Sharvit's interesting readings are a consequence of exactly this delayed (weak) uniqueness.

The upshot of synthesizing these proposals is that it allows us to maintain the intuitive and straightforward ideas in Coppock & Beaver 2015 regarding the division of labor between the presuppositional component of 'the' and the lexical semantics of 'only', while at the same time providing a means for both logical elements to quantify over properties derived from the VPs that contain them, as the Sharvit-style data clearly requires. Moreover, I will argue that this can be done without appealing to degree-movement or 'the'-deletion (*pace* Sharvit), that in fact it can be done without appealing to a special adjectival denotation for 'only' at all. In addition, I will suggest that by generalizing the fragment from alternative to dynamic semantics, it becomes again possible to account for the similarities between superlatives and exclusives that Sharvit and others (Bhatt 1999, Herdan 2005) have observed.

## 3.2 Data

### 3.2.1 Indeterminate exclusives

Coppock & Beaver (2012b, 2015) provide many examples of descriptions of the form 'the only NP' in sentences that entail the existence of multiple salient NPs. The canonical cases are copular predications, like (1) above. On the interpretation of interest, (1) entails that (i) Scott is an author of *Waverley*, and (ii) that someone else is also an author of *Waverley*. In other words, Scott isn't someone who is unique in having the property of being an author. Following Coppock & Beaver, I'll call interpretations of this shape *indeterminate readings* of exclusive DPs. A little more formally, I'll say that an

occurrence of ‘the only NP’ is read indeterminately if it is understood as “an  $x$  which is unique in having the property  $\llbracket \text{NP} \rrbracket$ .”

Coppock & Beaver also argue that there are certain semantic circumstances that license indeterminate interpretations of exclusive DPs in argument positions. For instance, (2) is naturally understood as entailing that there were multiple invited talks, one of which was given by Anna. That is, it ensures that Anna didn’t give something which uniquely has the property of being an invited talk. Assuming Anna did indeed give an invited talk (a point I’ll return to), this condition guarantees the existence of at least two invited talks. Again, this is inconsistent with the hypotheses that (i) ‘only invited talk’ denotes the singleton property of being identical to every invited talk, and (ii) ‘the’ presupposes that its restrictor isn’t empty. Under those assumptions, (2) would require that the conference invited only one talk, in conflict with the empirical entailments of the reading.

- (2) a. Anna didn’t give the only invited talk [Coppock & Beaver 2012b: (31)]
- b. Mary didn’t score the only goal [ibid: (34a)]
- c. Mary didn’t bake the only chocolate cake [ibid: (35a)]
- d. Mary didn’t write the only decent paper [Coppock & Beaver 2015: (101a)]

According to Coppock & Beaver (2012b), such indeterminate interpretations of argumental exclusives are only possible if the predicate that applies to them is non-restrictive, given the content of the NP that the exclusive modifies. In short, all invited talks are given, all goals are scored, and all cakes are baked. More technically, they claim that when  $\llbracket V \rrbracket$  is bijective on the codomain denoted by  $\llbracket \text{NP} \rrbracket$  (i.e., all NPs are Ved by something, and no NP is Ved by two different things), then indeterminate readings are possible for the sentence ‘X didn’t V the only NP’. To demonstrate the force of this criterion, they contrast the examples in (2) with those in (3). None of these sentences, they say, has a reading that would entail the existence of multiple talks/goals/cakes. On the contrary, all of the examples in (3) are *inconsistent* with the existence of more than one element of the post-‘only’ NP.

- (3) a. # Anna didn't see the only invited talk [Coppock & Beaver 2012b: (26b)]  
 b. # Mary didn't cheer for the only goal [ibid: (34b)]  
 c. # Mary didn't taste the only chocolate cake [ibid: (35b)]  
 d. # Mary didn't read the only decent paper [Coppock & Beaver 2015: (101b)]

In subsequent work, Coppock & Beaver (2015) offer a different characterization of the distribution of indeterminate exclusives in argument positions. They claim that the readings are correlated with *entity-introducing verbs*: the more strongly an utterance of 'to V an N' is to "increase the number of salient Ns", the more likely it is that a sentence of the form 'X didn't V the only N' will have a reading that entails the existence of multiple Ns.

### 3.2.2 Relative exclusives

Some years prior to Coppock & Beaver's work on 'the only', Bhatt (1999, 2006) unearthed a very similar, but distinct, construction involving exclusive descriptions. Bhatt claims that the sentence in (4) can describe a situation in which there are many telescopes, perhaps even many telescopes exchanged as gifts, but only one telescope given to Mary, as long as it was John who gave it to her. This is certainly an interesting interpretation of (4), since it is consistent with the existence of multiple salient telescopes (thus posing the same challenge we have seen about the meanings of 'the' and 'only'), but it is *not* an indeterminate reading. If (4) meant that John gave Mary something which uniquely had the property of being a telescope, then (4) actually *would* entail the uniqueness of telescopes in the scene.

- (4) John gave Mary the only telescope [Bhatt 1999: (91a)]

Echoing Bhatt's own suggestions, Herdan 2005 argues that the phenomenon on display in (4) is familiar from the literature on superlatives. She diagnoses Bhatt's interpretation as a *relative reading* of the exclusive adjective. A few examples of relative superlatives are given in (5), mostly taken from Szabolcsi's (1986) foundational work on the topic. The crucial property of these examples is that in

each case the superlative appears to quantify not over the entities described by the NP it modifies, but over alternatives to some other element of the sentence, on the basis of the VP in which it is a part. Take (5b), for instance. There is plainly no such thing as a group of letters that is fewer than all other groups of letters (setting aside the irrelevant possibility that such a thing might be the “empty” group), and accordingly (5b) does not instruct us to console the girl who got such a thing. Instead it tells us to console the girl who got fewer letters than any other girl got. In other words, rather than comparing sets of letters to one another, ‘est’ in (5b) compares letter recipients with respect to the quantity of letters they received.

- (5) a. John has the smartest sister [Szabolcsi 1986: (36c)]  
 b. We should console the girl who got the fewest letters [ibid: (22)]  
 c. When was there the largest box on the table? [ibid: (35c)]  
 d. John gave Mary the most expensive telescope [Bhatt 1999: (105a)]

Likewise with the others. (5a) says that John has a sister who is smarter than any sister of anyone else; crucially the sentence is compatible with him having two equally brilliant sisters, as long as nobody else has a sister more brilliant still. (5c) asks for the time at which there was a box on the table larger than any box on the table at any other time. The sentence is not soured by giant boxes not on the table, nor by the appearance of multiple equally-sized largest boxes on the table at the moment of interest, as long as there is a particular “maximal time”, so to speak, where instants are measured by the sizes of their tabled boxes.

This then is the analogy drawn by Bhatt and Herdan: both (4) and (5d) compare salient alternatives to John with respect to their giving Mary a telescope. What (5d) says of the various competitors is that John exceeds them all in the relevant property, which in this case measures the prices of telescopes given to Mary; what (4) says is that none of the competitors have the property at all, i.e., that only John gave Mary a telescope. Put another way, where (5d) says that John *more than anyone else* gave Mary an expensive telescope, (4) says that John *alone* gave Mary a telescope.

Because the notion of a relative exclusive is quite rare in semantic theorizing, and the distribution of the construction not well understood, I'd like to offer a handful of attested examples of such exclusives in action. These are, as far as I know, the first naturally-occurring examples reported in the literature, much of it taken from googlable sports commentary in newspapers, primarily because quantities and comparisons among competitors are often under discussion in this domain, and the norms of the games make for unambiguous contexts.

- (6) a. <sup>?</sup>Kevin sold the only copy of his book at the very end of the day. Many of the exhibitors had taken down their tables and were leaving. A woman came by and looked at Kevin's books. She said that she *had to buy something*, and here she was in front of one of the last tables. You never know.
- b. <sup>?</sup>Anatoly Karpov related in his 1992 autobiography, in reference to the 1971 Candidates Semi-final match between T. Petrosian and V. Korchnoi, which was tied 4-4 after eight draws: [...] Petrosian, playing White in game 9 of the 10-game match, won the only game.
- c. <sup>?</sup>And you know what, honey? None of those guys came home with a deer! Not one of them! I bagged the only deer on my team, this season! Yes, God is amazing and He cares about every detail of our lives!
- d. <sup>?</sup>They both swung, ducked and charged at each other. When they stopped for a moment, Jimmy felt he had clearly won, having landed the only punch.
- e. <sup>?</sup>On Friday, Sam Deutsch became the winner when he came up with the only answer that was correct in Final Jeopardy!
- f. <sup>?</sup>The Patriots lost the only game of their season in the Super Bowl.
- g. <sup>?</sup>Prior to the evening meal, the Nick McLeod Putting competition took place. [...] It eventually took 5 rounds, with a mandatory nip of whisky for each player before putting, before Andy Rose sunk the only putt.

- h. <sup>?</sup>Johnson, who refused to talk to reporters afterward, missed the only free throw of the night by the Knicks, who were 22 of 23 from the line.
- i. <sup>?</sup>He came on as a substitute in the quarter-final against Uruguay, but he missed the only penalty in the 5-4 shoot-out defeat.
- j. <sup>?</sup>Sean McFann and Brandon Schob handled the Rock Hill pitching and allowed seven hits. They each struck out two and Schob walked the only batter.
- k. <sup>?</sup>Marcus Allen had six points, a team-high seven rebounds, blocked the only shot of the night but did not record a steal.
- l. <sup>?</sup>Mattingly, [...] had come to Johnson county with three brothers, and the four divided to hunt in pairs. [...] When they arose and started walking again through the woods, [...] the rifle suddenly fired and the bullet struck Kevin Mattingly, who was only approximately five feet away. The men called for their other two brothers, and the trio assisted the victim to their automobile, driving him to the hospital. The victim, who was carrying a shotgun, had bagged the only squirrel in the party during the hour the men had been in the woods.

In each of these cases, the textual context makes clear that there are multiple salient witnesses for the descriptive content of the exclusive DP. For instance, the appositive in (6h) tells us that the Knicks took 23 free throws on the night in question, which means that ‘the only free throw of the night by the Knicks’ can’t possibly presuppose that there was a unique free throw taken by the Knicks. Similarly, since a 5–4 shoot-out requires at least 9 shots, the exclusive description in (6i) can’t presuppose that there was just a single penalty.

But it’s easy to see that, as with (4), these are *not* indeterminate readings, since they’re all positive assertions with extensional predicates. Anybody doing anything to “a thing which is unique in being an NP” guarantees that a thing which is unique in being an NP exists, i.e., that there is only one NP. What’s more, at least some of these predicates, e.g., ‘miss’ and ‘lose’, are not entity-introducing, so far as I understand the term. They are presumably in the same semantic class as ‘take’ (in the sense of

‘remove’), which Coppock & Beaver (2015: ex. (102b)) explicitly diagnose as failing to license entity-introduction inferences. Nor are any of the verbs here surjective on the codomains they are paired with. Not every penalty kick is missed, not every putt sunk, and not every punch landed. So they don’t meet either of Coppock & Beaver’s conditions for indeterminacy.

Instead, what I take each of these examples to express is that some DP-*external* element of the sentence is unique among its competitors in having a property derived from the VP. So while The Patriots of (6f) certainly did not play just one game in the 2013 season, they did only lose one game that season, and that game was the Super Bowl; which is to say, in only the Super Bowl did The Patriots lose a game. On the flipside, (6b) tells us not that there was just a single game in the 1971 10-game semifinals, but rather that there was just a single game-winner, namely Petrosian: only Petrosian won a game, as the rest were ties.

In these examples, plausibility and context essentially determine the exclusive’s *correlate*, the DP-external element that it targets. But in general, Bhatt (1999) argues that the choice is focus-sensitive. Similar claims have been made regarding superlatives (Jackendoff 1972, Szabolcsi 1986, Gawron 1995, Heim 1999, Sharvit & Stateva 2002, Tomaszewicz 2015).

- (7) a. JOHN bagged the only/biggest deer in July  
b. John bagged the only/biggest deer in JULY

The examples in (7a) are understood to quantify over people who might have bagged a deer in July; the exclusive variant identifies John as the sole such bagger, while the superlative identifies John as the most impressive. The examples in (7b), in contrast, quantify over potential times that John might have bagged a deer; the exclusive says that the only such time was July, while the superlative says merely that July was most bountiful.

### 3.2.3 Many indeterminate readings *are* relative readings

With these relative readings of ‘only’ in mind, let me return to the initial motivating example for Coppock & Beaver (2012b), repeated below. Again for the moment I take it for granted that (8) entails that Scott actually is an author of *Waverley*, and so set that *prejacent* inference aside.

(8) Scott isn’t the only author of *Waverley* [repeats (1)]

We have now two potential ways of understanding this sentence. The indeterminate strategy described by Coppock & Beaver (2012b) holds that (8) is true just in case it’s false that Scott is a person who was alone in writing *Waverley*. The relative strategy described by Bhatt (1999) and Sharvit (2015) instead holds that (8) is true just in case it’s false that nobody other than Scott is an author of *Waverley*.

Of course, these two interpretations amount to exactly the same truth conditions. And in general, the relative and indeterminate readings of any copular sentence ‘X is (not) the only NP’ will be equivalent. Even more generally, any time the predicate *R* relating the correlate and ‘the only NP’ is functional and surjective — every NP is *Red* and no two NPs are *Red* by the same thing — the indeterminate and relative readings will align.

But things are more interesting when the predicate is not functional. Take ‘Mary didn’t score the only goal’ as a paradigm case. Assuming again that Mary’s being a goal-scorer is not at issue, the indeterminate semantics predicts this sentence to be true as long as there isn’t a single thing which can be said to be a goal; as long as multiple goals were scored. The relative semantics predicts instead that for the sentence to be true, Mary can’t have been alone in scoring; there should be at least one other scorer.

These predictions are not equivalent. The models that distinguish them are those in which Mary scores several goals, but nobody else scores any. In any such game, there would not be any particular thing that counts uniquely as a goal, and *ipso facto* no such thing that Mary scored. So the indeterminate interpretation will come out true. Yet Mary is by assumption the only goal-scorer, regardless of her success, which falsifies the relative interpretation.

Obversely, imagine a family with three children, two boys and a girl. The two brothers are on a soccer team together. None of the other boys on the team have female siblings. An indeterminate interpretation of (9) is false in this model: there is only one sister in the context, and John does too have her. But a relative interpretation is true: John is not unique in having a sister.

(9) On this team, John doesn't have the only sister. His brother has one too, obviously!

The moral here is that much of the data that Coppock & Beaver (2012b, 2015) discuss could be reanalyzed in relative rather than indeterminate terms. Indeed Sharvit (2015) does just that. Even in argumental cases like (2b) above that at least logically distinguish between relative and indeterminate interpretations, Coppock & Beaver seem to assume that the context ensures functionality of the predicate (e.g., see the discussion at Coppock & Beaver 2012b: pg. 541 surrounding Example (40)). But under this assumption, the relative and indeterminate analyses of the sentence again collapse. Nevertheless, I am going to take it for granted that genuine (non-relative) indeterminate readings do exist. For instance, I assume there is a context and a way of pronouncing (2b) that makes it true when Mary scores three goals while everybody else on the field comes up empty handed.

### 3.2.4 Summary

The previous section introduced three distinct uses of DPs beginning with 'the only'. The absolute use, illustrated in (10), is straightforward. The exclusive highlights the uniqueness of capital letters in the sentence, and the definite picks out that single capital letter. Taken together with the rest of the sentence, (10) says simply that John doesn't like the letter 'J'.

(10) John doesn't like the only capital letter in this sentence

The other two uses are more surprising. An indeterminate use of 'the only NP' is understood as "an  $x$  that is unique in being an NP". Sentences that contain indeterminate 'the only NP' under negation do not necessarily entail that the size of  $\llbracket \text{NP} \rrbracket$  is 1, and often, given other contextual and pragmatic entailments, entail that the size of  $\llbracket \text{NP} \rrbracket$  is greater than 1. For instance, assuming that

Anna did give an invited talk, the only way for (11) — understood as “Anna didn’t give a thing which was the only invited talk” — to be true is if there were multiple invited talks. Indeterminate instances of ‘the only’ surface most readily in argument positions of (i) bijective predicates (Coppock & Beaver 2012b) — those for which every member of  $[[NP]]$  occurs exactly once in the predicate’s extension — and (ii) entity-introducing predicates (Coppock & Beaver 2015) — those which increase the number of salient NPs. For pragmatic reasons, sentences with indeterminate exclusives are most likely to be pronounced with stress on ‘only’.

(11) Anna didn’t give the only invited talk [repeats (2a)]

Relative uses of ‘the only NP’ are generally taken to identify the uniqueness not of  $[[NP]]$  but of some property derived compositionally from the larger syntactic context of the exclusive description. This is what we see in (6a), simplified in (12). From the discourse surrounding the sentence, it is clear that Keven brought many copies of his book to the fair, but only managed to sell one of them. Thus what the exclusive marks as unique here is not the set of Kevin’s books, but the set of books that Kevin sold (or, more accurately, the times at which Kevin made a sale). Sentences containing relative exclusives are typically produced with focus on a particular coargument of the predicate that the exclusive description modifies, namely, the coargument whose continuation is the property that is asserted to be unique.

(12) Kevin sold the only copy of his book at the very end of the day [cf. (6a)]

Finally, predicative occurrences of ‘the only’ are potentially ambiguous between indeterminate and relative readings, which amount to the same truth conditions. Likewise, as an argument to certain predicates — those meeting the conditions of lexical/contextual functionality and surjectivity — ‘the only NP’ may give rise to equivalent indeterminate and relative readings, though focus probably favors one derivation over the other; indeterminacy is indicated by stress on the exclusive adjective itself, and relativity indicated by stress on the correlate of comparison.

### 3.3 Towards an analysis: ‘The only’ = ‘the’ + ‘only’

What then could the words ‘the’ and ‘only’ mean such that these sentences might avoid entailing uniqueness of the exclusive DP’s restrictor? Coppock & Beaver (2015) and Sharvit (2015) have already provided robust analyses on this front, the former concentrating on the implications of indeterminacy for the presuppositions of the definite marker, the latter on the implications of relativity for the scope-taking capacity of the exclusive. My goal in the next two sections is to show that these ideas are consistent and in fact symbiotic, and to present a formal mechanism that brings the two ideas together. The unification will turn on the hypothesis that definiteness is semantically decomposed into two components, a local existential component and a delayed or scopal cardinality test.

#### 3.3.1 Coppock & Beaver 2015

As we’ve seen, Coppock & Beaver 2015 argue that cross-linguistically, markers of definiteness are not strictly correlated with constituents that denote singular terms. Based on this, they claim that constituents of the form ‘the NP’ are neither entity-denoting nor uniqueness-presupposing. Instead, the denotations of such descriptions are *indeterminate* — denoting sets of individuals — and *weakly unique* in that they presuppose *no more than one* salient witness. In short,  $\llbracket \text{the} \rrbracket$  is an identity function on maximally singleton properties (13a). Together with this, Coppock & Beaver 2015 assume a very simple entry for ‘only’, along the lines of (13b). Given a property  $P$ , it returns the partial function defined only on the domain of  $P$  that is true of anything that exhausts the extension of  $P$ . If given an empty  $P$ , the property it returns is undefined everywhere; if given a multiply-inhabited  $P$ , the partial property it returns is necessarily false, when defined.

(13) a.  $\llbracket \text{the} \rrbracket = \lambda P: |P| \leq 1. P$  [cf. Coppock & Beaver 2015: (50)]

b.  $\llbracket \text{only} \rrbracket = \lambda P x: P x. \{x\} = P$  [cf. *ibid.*: (57)]

So coming back to an example we’ve seen we’ve seen, (14) most naturally entails that Scott is an author of *Waverley*, and someone else is also an author of *Waverley*. The indeterminate derivation of



and others, Sharvit assumes all nouns denote restrictions on the cardinality function  $|\cdot|$ , the function that relates sum entities with their atom-counts. For instance, (15a) defines the singular noun ‘goal’ as the relation that holds between atomic goals and the number 1. Then the superlative morpheme — pronounced as ‘only’ when it applies to nouns — identifies an individual  $x$  as a victor if there is a degree which sets  $x$  apart from everyone else on the relevant measuring relation  $R$  (15b).<sup>1</sup>

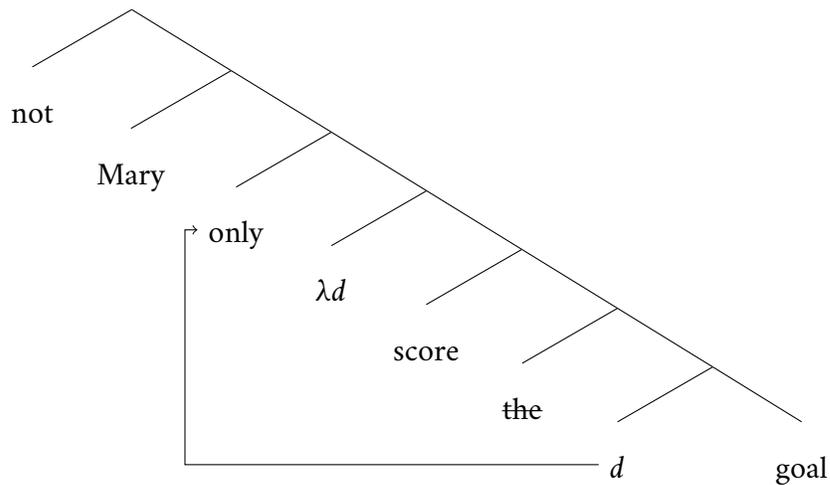
- (15) a.  $\llbracket \text{goal} \rrbracket := \lambda dx . |x| = d \wedge \text{goal } x$  [Sharvit 2015: (38)]  
 b.  $\llbracket \text{only} \rrbracket := \lambda Rx . \exists d . R d = \{x\}$  [*ibid*: (8)]

When the superlative/exclusive morpheme binds into a gradable adjective, the resulting entity-degree relation will be the normal sort of measuring stick that crops up in relative superlative examples, like the relation between an  $x$  and a  $d$  that holds iff  $x$  climbed a mountain at least  $d$ -high. But when the superlative/exclusive morpheme binds into a singular noun, as in (16), we get a somewhat degenerate relation between individuals and numbers. In (16), for instance,  $\llbracket \text{only} \rrbracket$  applied to  $R = \lambda dx . \exists y : \text{goal } y . \text{score } y x \wedge d = |y|$  gives the property of individuals  $x$  for whom there is a  $d$  such that they alone scored a goal of cardinality  $d$ . Clearly there will be no such  $d$  for anyone who didn’t score any goals, since there won’t be a  $y$  such that  $\text{score } y x$ , much less a  $y$  such that  $\text{score } y x \wedge |y| = d$ . But the thing is, all goals have cardinality 1 by virtue of being atomic. So for absolutely anybody who did score a goal, there will be exactly one  $d$  that makes the “measuring” relation  $R$  true, namely,  $d = 1$ . That means there’s no way to distinguish goal-scorers  $x$  with respect to the  $d$ s that satisfy  $R$  restricted to  $x$ . Thus  $\llbracket \text{only} \rrbracket R$  will hold of an individual  $x$  just in case  $x$  happens to be the sole person to score a goal (no matter how many goals they scored).

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<sup>1</sup> This is a massively oversimplified representation of Sharvit’s lexical entry, which includes explicit reference to a comparison class, is generalized to cover plural nouns, and enumerates a slew of carefully considered presuppositions. I’m abstracting away from all of this important lexical semantic content to concentrate on compositional issues.

(16) Mary didn't score the only goal



An important property of this analysis, inherited from the study of superlatives, is that when ‘only’ scopes out into an adverbial position, the definite article is not interpreted. As with Coppock & Beaver, the composition of the verb with the nominal property is facilitated by existential type-shifting. The mysterious LF-deletion of the determiner in relative readings is effectively forced on scopal analyses of superlatives for truth-conditional reasons (Coppock & Beaver (2014) make this point especially clear), but it is still a largely contentious matter. Sharvit herself provides the most explicit discussion of the formal conditions under which ‘the’ may occur vacuously without overgenerating. The most important bit, and in fact the bit that motivates the analysis of ‘only’ in terms of ‘-est’, is the assumption that an occurrence of ‘the’ may be meaningless only if it c-commands a degree-trace.<sup>2</sup>

### 3.3.3 Review of Chapter 2

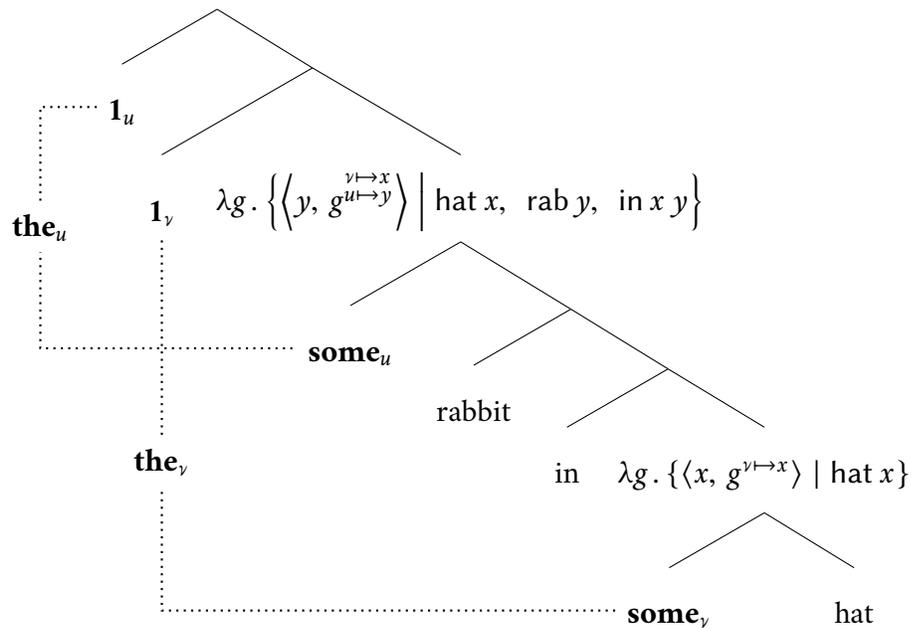
Working in a dynamic perspective, Chapter 2 argues that computations of definiteness are semantically split into two independent, sequentially executed procedures. In the first pass, definite constituents are taken to introduce abstract referents satisfying the requirements of their descriptive content. Subsequently, the set of these potential referents is inspected for the usual definiteness prop-

<sup>2</sup> The full condition is: “An occurrence *O* of ‘the’ is licensed only if there is an *E* such that: (i) *E* is an ‘-est’-chain, (ii) *O* c-commands some element of *E*, and (iii) every DP node that dominates the tail of *E* dominates *O*” (Sharvit 2015: ex (10)).

erties, whatever they may be, including uniqueness. The primary motivation for articulating the semantics in this modular way is to account for situations in which the referent-testing component of a description takes wider scope than the referent introduction. As a consequence, uniqueness in such cases is evaluated relative to a more restrictive set of constraints than just those imposed by the definite’s restrictor.

As a paradigm case of definiteness intervention, Chapter 2 pointed to the well-known case of nested descriptions, like (17), used in a context that includes several salient hats and several salient rabbits, but just one hat that contains a rabbit (with just one rabbit in it). In a scene like this, the inner NP ‘hat’ has many potential witnesses and thus cannot do the referent-selecting work that is expected of definite descriptions on its own. However, the property of being a hat that a rabbit is in is unique in the imagined context, as is, after the fact, the property of being a rabbit in that hat.

(17) the rabbit in the hat



To formalize this technique, Chapter 2 re-purposed the assignment-modifying vocabulary of dynamic semantics to model the multi-step referent-selection process. As the derivation in (17) sketches, the two indefinite components of the definite determiners jointly build up a set of potential partial

models, each containing at one index a rabbit and at another index a hat such that the one is in the other. Only then do the cardinality-testing components of definiteness go to work, ensuring that rabbits and hats left standing after this joint-update are unique.

It was also suggested that various other referent-comparing/counting tests may get delayed along with the uniqueness imposed by the definite article. Plural and cardinal analogs of (17), given in (18a) and (18b), also have what might be called relative readings, in which the referents ultimately selected to witness the inner descriptions are not the maximal sets of salient hats, but rather the maximal sets of hats *that have rabbits in them*.

- (18) a. the rabbits in the hats  
b. the five rabbits in the three hats  
c. the rabbit in the biggest hat

Even more tellingly, Chapter 2 identified the relative reading of (18c) as a case of referent-comparison held up by delayed definiteness. Because the semantics is dynamic, the outputs available for inspection after the two indefinite updates all contain information about both rabbits and hats, and, implicitly, information about which rabbits are in which hats. The superlative, as he defines it, folds over this set of outputs, ejecting all but the largest hats that are still live candidates for the inner description. Crucially, as in the singular, plural, and cardinal cases, this set is already restricted to just the set of hats containing rabbits, so the comparison is only over these rabbit-containing hats. And, by dint of comparing *assignments* rather than individuals, this superlative filtering procedure also kicks out any rabbits that are in size-dominated hats.

### 3.3.4 Bringing it together

These three proposals about the scope and meaning of definiteness are largely compatible and even convergent. If we understand the split-scope hypothesis to adumbrate a sort of plug-and-play architecture for definite modification, then we are free to slot Coppock & Beaver's notion of weak unique-

ness in for the definite’s testing component, and to follow [Sharvit’s](#) lead in evaluating the exclusive complex at an adverbial rather than adjectival position. In the terms of Chapter 2, this amounts to delaying execution of the weak uniqueness test (and, concomitantly, the force of the adjective the definite harbors) until the constraining effect of the predicate that dominates the exclusive DP has been accounted for.

The next section spells this recipe out in detail, but briefly, the way it works is as follows. The indefinite component of ‘the only’ will initially construct a set of alternatives according to the content of its NP. Composition proceeds in ways familiar from alternative and dynamic semantics until these alternatives are eventually closed off at the top of the scope of the exclusive’s correlate. We’re left with the property of being an individual who, like the correlate, VPed some NP. From there, everything is essentially as in [Coppock & Beaver 2015](#), except that the uniqueness-exclusive complex is not inspecting the property denoted by NP, but rather the property of playing the role that the correlate plays in the meaning of the clause. ‘Only’ modifies this property so that it is true just of individuals that exhaust its extension. Then finally the cardinality-testing component of the definite tests that the property returned by ‘only’ is weakly unique, which of course, it must be.

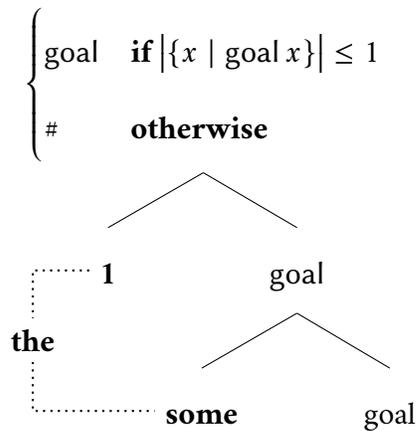
### 3.4 Analysis

The starting point for this analysis is the decompositional conception of definiteness laid out in Chapter 2. However, where in that chapter I considered the cardinal and existential components the determiner to operate in a fully dynamic type space, here I’ll define things in simpler alternatives-oriented terms, ignoring the possibility for state update. This is in part to remain close to the analyses of ‘the’ and ‘only’ on which the current theory is built, and in part because the updates will not play a role in the denotations (at least not until we return to superlatives in Section 3.5).

Adopting the same split-scope notation as in the last chapter, the derivation in (19) depicts the composition of a basic description. Both components are assumed to have the denotations that [Coppock & Beaver \(2015\)](#) argue for. The “existential” is, as in alternative semantics, an identity function.

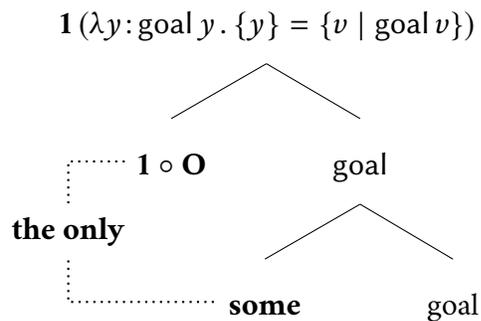
And the cardinality test is weak, in that it merely requires of its complement non-multiplicity of salient referents. If the two procedures are executed in immediate succession, and the weak uniqueness condition on  $\{x \mid \text{goal } x\}$  does not fail, the result is a set containing either a single goal (if there is indeed just one goal in the context) or nothing at all (if there are no goals).

(19) the goal



Basic exclusive descriptions work similarly, as shown in (20). Again, the existential component of the definite builds a set of potential witnesses for the restrictor. Then, if evaluated immediately, the exclusive filter returns a partialized subset of that restrictor: if that restrictor is empty, **O** returns a function that is nowhere defined; if it is singular, **O** returns the function from the restrictor's single element to True; otherwise, **O** returns the function from that element to False. Exactly as in [Coppock & Beaver 2015](#), because this property is logically guaranteed to hold of at most one individual, regardless of the context, the weak uniqueness test cannot fail.

(20) the only goal



So far this is all a very mild re-engineering of Coppock & Beaver 2015. The transition to Sharvit 2015 comes by way of delayed definiteness. Relative readings emerge exactly when the referent-testing subcomputations  $\mathbf{1} \circ \mathbf{O}$  are suppressed until further information from the sentence is used to restrict the set of alternatives under consideration.

Consider the derivation in (21). First, for simplicity I'm representing 'Mary' as having undergone some sort of short movement, exposing a lambda abstract that binds the subject position. The official fragment in Chapter 5 is directly compositional, so the QR depicted here is not essential. What is essential is some way of separating the correlate of the exclusive from that correlate's nuclear scope. In the case of (20), it is conceivable that this comes for free from the extraction of a VP-internal subject. But in the general case, I assume that the semantic knife that cleaves constituents from their continuations is focus.

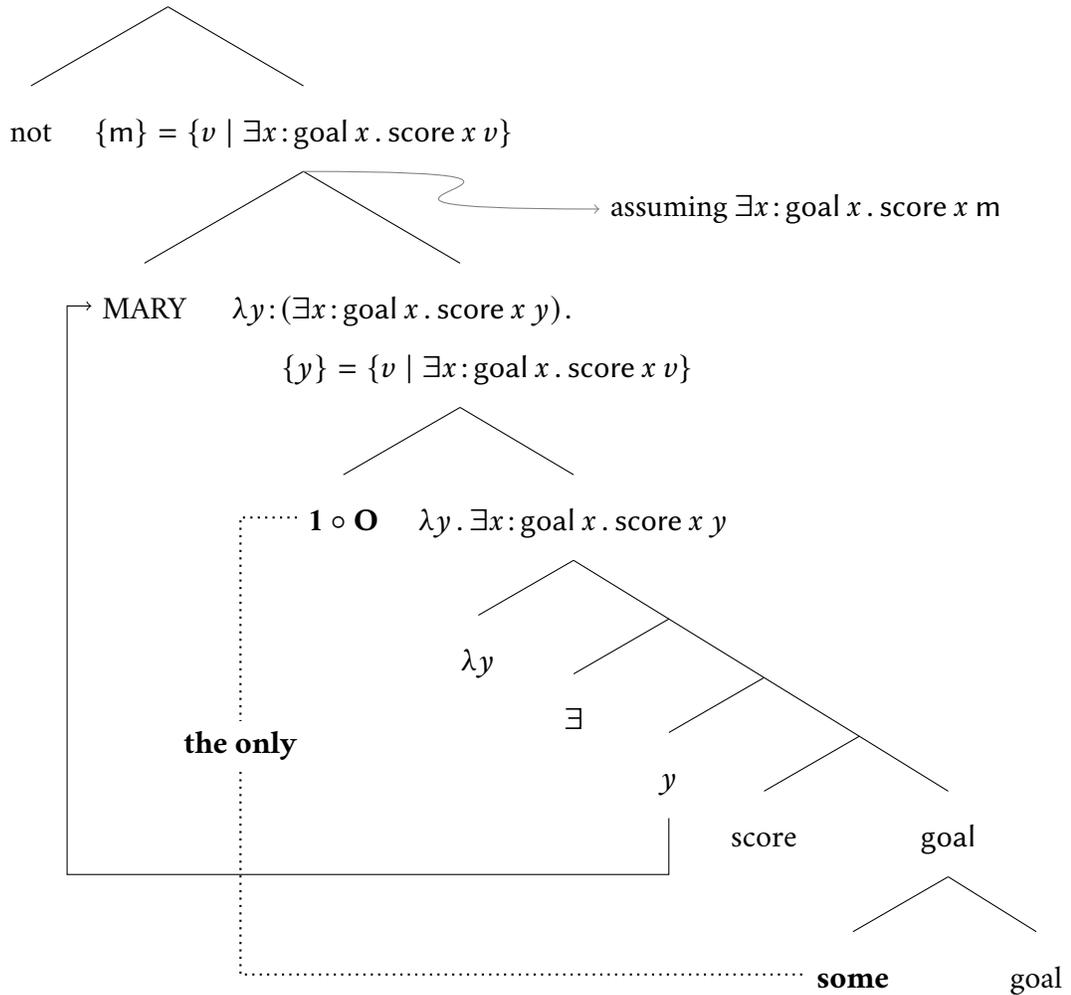
There is plenty of precedent for this intuition. Arguably, both movement approaches (Chomsky 1976, Drubig 1994, Wagner 2007) and structured meaning approaches (Cresswell & von Stechow 1982, Von Stechow 1991, Krifka 1992, 2006) attribute to focus-marking the role of articulating expressions into foreground and background structures, where the background is formed by abstracting over alternatives to the foreground. In the next chapter, Chapter 4, I will present a dynamic split-scope mechanism for focus that parodies the semantics of the definite determiner developed here and in Chapter 2, but for the purposes of describing relative exclusives I will stick to LF diagrams like (21), where focused constituents simply QR to an arbitrary type  $t$  node. In any case, that it should be focus which is responsible for creating a property suitable for modification by 'only' squares with Bhatt's (1999) observation that relative readings of exclusives, like those of superlatives, are calibrated by prosodic stress: 'John gave MARY the only telescope' tells us what Mary and no one else received from John, while 'JOHN gave Mary the only telescope' tells us something about what John and no one else gave Mary.

Returning then to the derivation, evaluation of the exclusive description begins as usual by building a set of potential referents, here goals. These alternatives are composed with the VP and trace of

the subject via the usual alternative semantic mechanisms before existential closure at the TP level. At this point the exclusive and definite are released from their state of suspended quantification. Immediately, the adjective captures the subject's scope — the property of being a goal scorer — to build the more demanding property of *exhausting* the set of goal scorers. It furthermore introduces the presupposition that its argument at least has the preadjacent property of scoring a goal, even if it is not alone in having that property. After this, the definite component of the determiner checks that this new exhaustive property satisfies the cardinality condition, which, by definition, it does. Importantly, the cardinality test here is just as weak as it is in the paradigmatic copular cases of indeterminate readings like (14), which is to say, it does not presuppose that any such singularly lucky striker actually exists. Indeed the final negation of (21) asserts that Mary comes out false when passed into the property of being a single-handed-goal-scorer, thereby guaranteeing (together with the presupposition generated by 'only') that at least one other person scored a goal.

(21) MARY didn't score the only goal

$$\{m\} \neq \{v \mid \exists x: \text{goal } x . \text{score } x v\}$$



Examples with non-subject correlates will compose in exactly the same fashion, as long as the intended correlate is focused. The exclusive DP will generate a temporary cache of potential witnesses satisfying its descriptive content and the constraints imposed by the VP together with its non-focused coarguments. Then the definite-exclusive combo will target the property that focus derives by dislodging the correlate from its scope. Of that scope, 'only' will say that its extension is equal to the singleton set containing the correlate, and 'the' will be trivially satisfied.

### 3.5 Discussion and comparison

This chapter has attempted to synthesize two recent ideas about the nature of exclusives and definites. The first insight, due to Coppock & Beaver (2012b, 2015), is that definite descriptions do not always require the existence of referents. Especially in predicative positions and in downward entailing environments, they show that there are systematic uses of descriptions that require merely conditional uniqueness of potential witnesses: *if there's a referent* then it ought to be clear which entity it is. The second insight is that 'only' takes scope. Sharvit 2015 argues for this on the basis of empirical parallels between exclusives and superlatives, but I take it to be basically self-evident from the data in (6). Given that every baseball game involves at least 54 batters, the adjective in (22) clearly does not exclude the possibility of multiple batters; instead, it excludes the possibility of anyone but Schob having walked a batter. This is exactly what we'd expect if 'only' modifies the VP-level property ' $\lambda x . x$  walked a batter', rather than the NP-level property ' $\lambda x . \text{batter } x$ '.

(22) Schob walked the only batter [cf. (6g)]

The awkwardness for the scopal treatment of 'only' is that the DP remnant that winds up in the exclusive's scope is semantically *indefinite* where the original, pronounced DP is (necessarily) morphologically definite. This tension is resolved by appealing to a procedurally bipartite analysis of definiteness. According to Chapter 2, there is independent reason to think that definite descriptions in one stage introduce a set of alternatives, and in a later stage count those alternatives. If this later stage is delayed or takes scope at a higher point in the compositional structure, it may also suspend the force of various quantificational adjectives, like 'only', which serve as filters or tests on properties. This two-step semantics makes it possible for a definite to (i) behave locally as an alternative-generating indefinite, exactly as in, say, Hamblin semantics, while simultaneously (ii) giving adverbial scope to an exclusive adjective.

The primary conceptual advantage of this approach to relative readings over that of Sharvit 2015 is that it obviates the need for a theory of 'the'-deletion, which in turn relieves the pressure to lexically

identify ‘only’ and ‘est’. The two adjectival modifiers have in common that they create filters over alternatives, which ‘the’ can use to pre-process a set of candidate referents. But under the assumptions of the present analysis, there is no reason to think that ‘only’ is a way of pronouncing the superlative morpheme, or is in any way involved in degree comparison/movement. In fact, using the same split-scope technique for focus semantics that is demoed in Chapter 5, [Bumford 2016 ms](#) provides a single, cross-categorical denotation for focus-sensitive ‘only’, of which (13b) is a special case. From that perspective, the uses of ‘only’ surveyed in this chapter are simply adjectival manifestations of the usual exclusive particle that modifies DPs and VPs (and Ps of every other category). In other words, where for [Sharvit](#) it is something of an accident that the superlative morpheme is sometimes pronounced in the same way as adverbial ‘only’, here adjectival ‘only’ *just is* adverbial ‘only’.<sup>3</sup>

In this respect, the current analysis also extends the reach of [Coppock & Beaver 2015](#), which does not make any attempt to relate adjectival ‘only’ to adverbial or sentential ‘only’. These latter uses are normally taken to depend on a secondary semantic dimension that tracks focus alternatives ([Rooth 1985](#), [Beaver & Clark 2003](#), [Krifka 1992](#)). But the scopal treatment of focus exploited here makes it possible for [Coppock & Beaver’s](#) simple property-modifying ‘only’ to capture the scope of a focused constituent, in which case we get a relative reading of the exclusive. The technical and empirical pay-offs of this approach to focus, especially vis-à-vis quantificational adjectives, are explored at greater length in [Bumford 2016 ms](#).

Another advantage of this fragment is that it is modular. As mentioned in Section 3.3, the split-definiteness hypothesis of Chapter 2 is pitched in the context of dynamic types rather than alternative types. As far as I can tell, ‘only’ does not need to interact with the discourse state in any way, but noth-

<sup>3</sup> [Sharvit \(2015: Section 5\)](#) does argue that ‘est’ and pre-determiner ‘only’ have very similar denotations. Her lexical entries, simplified and reformulated to bring out the parallels, are given in (i), where  $\mathfrak{I}R$  is the image of relation  $R$ . Even so, it seems to me an uncomfortable morphological position to imagine that the phonological word /only/ is a way of realizing both the degree-less (ia) and, *when  $R$  is a noun*, the degree-ful (ib), which is otherwise produced as the suffix /-est/.

(i) a.  $\llbracket \text{only}^{\text{DP}} \rrbracket := \lambda xP: (x \in P \vee P = \emptyset). P \subseteq \{x\}$  [cf. [Ippolito 2008 apud Sharvit 2015: \(61\)](#)]  
 b.  $\llbracket \text{est} \rrbracket := \lambda Rx: (x \in \mathfrak{I}R \vee \mathfrak{I}R = \emptyset). \exists d. R d \subseteq \{x\}$  [cf. [Sharvit 2015: \(72a\)](#)]

ing in the fragment would change if we swapped out the alternative-semantic mode of combination for the dynamic variant assumed in Chapter 2.

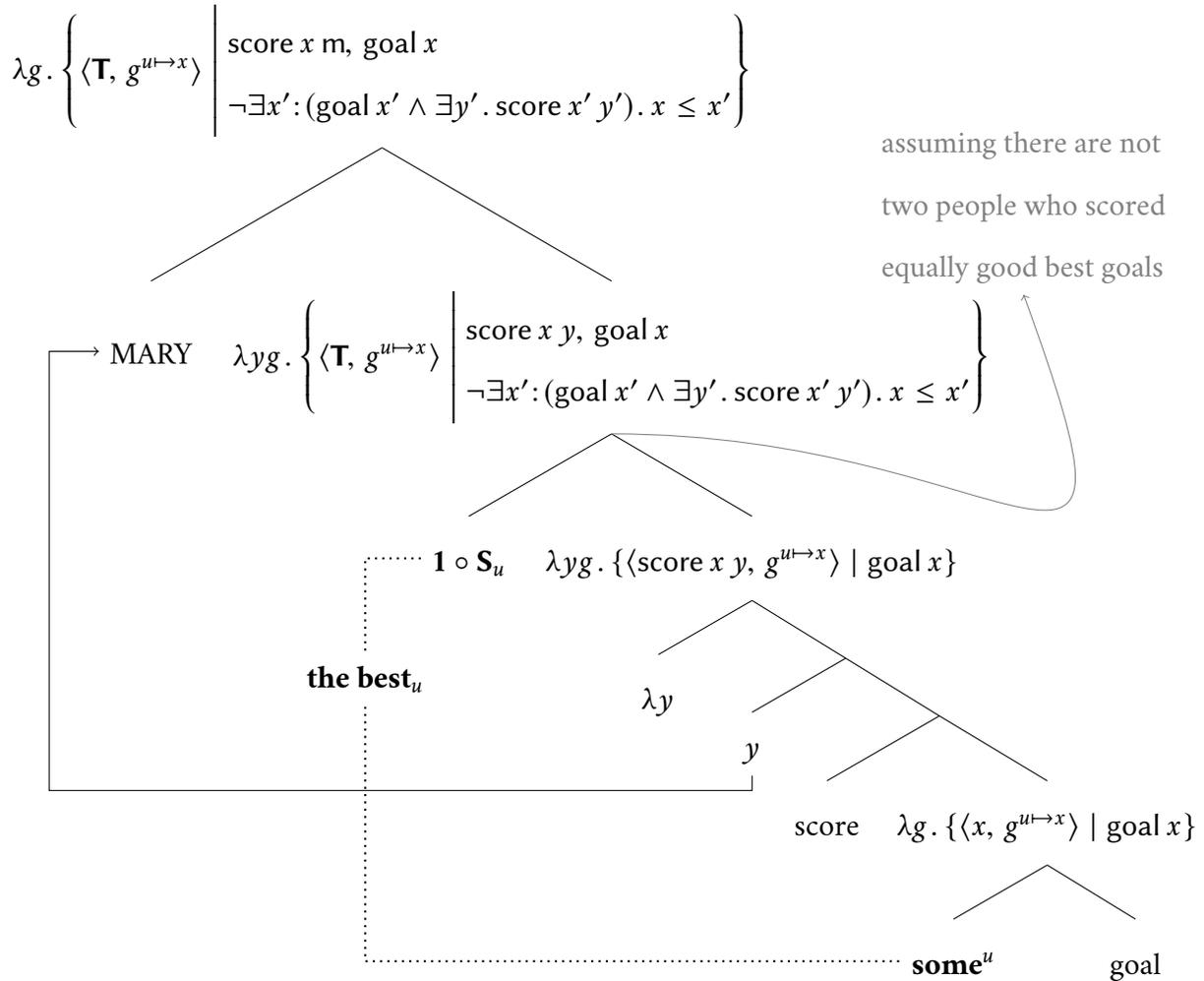
In fact, one point in favor of scaling up to dynamic rather than static alternatives is that it opens the door to a treatment of relative superlatives along exactly the lines that I’ve spelled out here for relative exclusives, recovering the symmetry emphasized by Bhatt (1999), Herdan (2005) and Sharvit (2015). Here is a sketch of how that might go (the full details are presented in Chapter 5). Following Chapter 2, we can assume that at its heart, every superlative adjective is a filter on dynamic outputs. Take the adjective ‘best’, for instance. Provided with some index  $u$  corresponding to the DP it is introduced in, the kernel of the adjective is a dynamic test; it throws out any alternatives that are dominated in how good a referent they assign to  $u$  (23a). Wrapped around this, the general denotation of ‘best’ could be as in (23b), which lifts the filter on outputs  $\mathbf{S}_u$  to a filter on continuations. As with ‘only’, this continuation-modifying entry is flexible enough to work either *in situ* — in which case  $k$  is effectively given by the superlative’s immediate nominal complement — or when delayed by the definite — in which case  $k$  may be the preajcent of a constituent in focus. The corresponding continuized uniqueness test is given in (23c).

- (23) a.  $\mathbf{S}_u := \lambda m g. \{ \langle x, h \rangle \in m g \mid \neg \exists \langle y, h' \rangle \in m g. h u \leq h' u \}$  [cf. Chapter 2: (23b)]
- b.  $\mathbf{best}_u := \lambda k y g. \{ \langle \mathbf{T}, g' \rangle \mid \langle y, g' \rangle \in \mathbf{S}_u(\mathbf{some} k) g \}$
- c.  $\mathbf{1} := \lambda k y g. \begin{cases} k y g & \text{if } |\{v \mid \bigvee \{p \mid \langle p, h \rangle \in k v g\}| \leq 1 \\ \# & \text{otherwise} \end{cases}$

The LF in (24) gives an example of how the relative superlative pieces compose. Focus splits ‘Mary’ from the VP, exposing a property from individuals  $y$  to updates, whose outputs are pairs of truth values and goal-augmented assignments, true if  $y$  scored the goal added to the assignment, false if she didn’t. The superlative takes this dynamic property, collects all of the individuals who don’t completely fail the update (i.e., those that scored at least one goal), and throws out all but those whose paired goal-bearing assignment contains a goal at least as big as that on anyone else’s goal-

bearing assignment; in other words, it keeps only those outputs which correspond to individuals whose goals are untopped in quality by any other outputs. Then the (weak) uniqueness component of the definite ensures that there aren't two such unbested individuals. Interestingly, this presupposition is *not* vacuous, as it is in the case of relative exclusives. In contrast with most other theories of scope-taking superlatives, 'the' is still doing work in this analysis, doing in fact the same work it always does: ensuring there aren't two potential referents for its scope. In this case, that guarantees that there are no ties among goal scorers. If this is true in the context, it returns the output of the superlative unmodified, a property matching best-goal-scorers to updates augmenting an assignment with their best goals. Predicated of Mary, we get the empty set of outputs — dynamic failure — if that best-goal-scorer isn't Mary, or the update returning true together with her top goals if she is.

(24) MARY scored the best goal



Notice that in contrast with Chapter 2, the uniqueness test here is not coindexed with the indefinite component of its DP. It tests that whatever property  $k$  it consumes is uniquely instantiable; that is, that at most one  $y$  will be such that  $k y$  is dynamically true at its input  $g$ . Thus in (24), where the determiner steals the scope of the focus phrase 'MARY',  $1$  tests that the set of individuals who scored best goals is weakly unique, regardless of how many best goals were scored. If the determiner were indexed to the indefinite, as in Chapter 2, it would instead ensure the weak uniqueness of best goals, regardless of how many people they were scored by. I will stick with this modified, value-oriented (rather than assignment-oriented) uniqueness test for the rest of the dissertation, and return to the tradeoffs between the two types of tests in Chapter 5.3.2.

One further nice consequence of moving to this dynamic space is that there is still a connection between a quantificational adjective and its initial DP. In (24) this is maintained through the coindexing of  $S_u$  and the indefinite component of the definite that introduced it, **some**<sup>*u*</sup>. This means that if something interrupts the dynamic flow of information up the tree, then the information the superlative needs in order to properly sort outputs will disappear before it gets the chance. The most dramatic such externally static operator is negation. Sharvit (2015) points out that a sentence like (25a) does not have a reading that would correspond to (25b), in which negation intervenes between the superlative and the indefinite.

(25) a. Mary didn't score the best goal

b. # Mary [ est  $\lambda d \lambda y$  [ not [ *y* scored the *d*-good goal ] ] ]

If that logical form were available, it would guarantee the existence of a degree *d* such that Mary alone failed to score a *d*-good goal, i.e., that Mary's best goal was worse than everyone else's best goal. But the sentence has no such reading. And this is exactly predicted by the dynamics. In any standard dynamic framework, when negation outscopes an indefinite DP, it existentially closes over the alternatives that the DP generates, negates the result, and resets the discourse state in the process. This (appropriately) prevents the indefinite from binding a pronoun outside of the negative clause in which it finds itself: \*'John didn't see any hawk, and it was majestic'. But then in the configuration of (25b), the superlative operator looking for goals by which to compare the scorers will crash when it attempts to inspect the *u*th coordinate of any output assignment, precisely because the intervening negation will have erased any trace of the goals' discourse referents.

Externally static quantifiers have the same effect. The sentence in (26a) has no reading which would correspond to the LF in (26b). Imagine that Mary and her friends are avid birders who are particularly excited by hawks. The LF in (26b) would entail that if we were to rank the group by the *smallest* number of hawks that they saw on any day this week, Mary would come out on top. In other words, Mary saw more hawks on her worst day than anyone else did on their worst day. The absence

of this potential interpretation is again explained by the hypothesis that in order to successfully quantify over the hawk-sums introduced in the direct object, the hawk discourse referents would need to find their way up the tree to the argument of the superlative. The transit however is disrupted by the dynamic universal quantifier which consumes the referent in an effort to prevent typically incoherent cross-clausal binding.

(26) a. Mary saw the most hawks every day this week

b. # Mary [ est  $\lambda d$   $\lambda y$  [ every day  $\lambda z$  [  $y$  saw [the  $d$ -many hawks] (on)  $z$  ] ] ]

In general, the delicate game of catch between the cardinal and indefinite components of the superlative description bears a striking resemblance to the dynamic account of weak island effects in Honcoop (1998). Honcoop analyzes Dutch sentences like (27a) in which a ‘wh’-indefinite, in this case ‘wat een man’, appears syntactically discontinuous. In particular, the indefinite subpart of the constituent, ‘een man’, is pronounced in the argument position of the DP, while the ‘wh’-word is pronounced sentence-initially. He claims that the relationship between the two components is essentially anaphoric, where the lower indefinite generates a discourse referent that the higher operator eventually binds and quantifies over. Reasoning along lines exactly parallel to this just above, Honcoop argues that this explains why the construction is impossible when negation and other dynamically static operators intervene between the two components, as illustrated in (27b).

(27) a. *Wat<sub>i</sub> heeft Jan voor een<sup>i</sup> man gezeien?*

What has John for a man seen?

‘What kind of man did John see?’

b. \**Wat<sub>i</sub> heeft Jan niet voor een<sup>i</sup> man gezeien?*

What has John for not a man seen?

‘What kind of man didn’t John see?’

Yet as Honcoop himself points out, the correlation between interveners in the ‘wat-voor’ construction and externally static dynamic operators is not without exception. In particular, certain modal

and attitude verbs live happily in the gap between the ‘wh’-word and the indefinite it binds. For instance, even though verbs like ‘wil’ (‘want’) generally close off the dynamic potential of indefinites in their scope (\*‘John wants a book, any book, about hawks; it’s long’), they do not disrupt the connection between a ‘wh’-word and an indefinite, as indicated in (28).

- (28) *Wat<sub>i</sub> wil Jan voor een boek?*  
What wants John for a book?  
‘What kind of book does John want?’

These same modal elements are also known to successfully split the scope of superlative (Heim 1999) and exclusive descriptions (Herdan 2005, Sharvit 2015), and counting quantifiers more generally (Cresti 1995, Szabolcsi 2010). And in Chapter 2, I argued that they do not prevent polyadicities between nested definites. Honcoop ultimately proposes an intensionalized binding procedure to carefully thread discourse referents through the relevant modal predicates, and I am hopeful that similar techniques will account for the split-description data at issue in this dissertation, but I leave for future research the possibility of fully integrating the theory here with work on weak islands.

### 3.6 Conclusion

In this article I’ve attempted tease apart two kinds of unusual readings of exclusives in definite descriptions. In one class of readings, the indeterminate readings described by Coppock & Beaver (2012b, 2015), ‘the only NP’ is interpreted as “a thing which is unique in being an NP”. Partly on the basis of these readings, Coppock & Beaver establish that the cardinal component of definiteness is weaker than previously thought: definite determiners are licensed as long as there aren’t two potential witnesses for the descriptive content. In the second class of readings, originally discussed by Bhatt (1999), ‘only’ takes scope out of its containing definite DP, which is interpreted existentially. These readings are licensed by focus on some element external to the exclusive description. The two types of readings often coincide — when the predicate relating the exclusive DP and its correlate is functional and sur-

jective in context — but not always, and I provided natural data that clearly distinguishes the relative paradigm from the indeterminate one, bolstering the judgments of [Bhatt](#), [Herdan](#) and [Sharvit](#).

To quadrate the two visions of exclusive descriptions, I sketched an extension of Chapter 2’s treatment of definiteness in terms of distinct referent-introducing and referent-testing computations that puts exclusives on a par with superlatives, ordinals, and numerals, as suggested by [Bhatt \(1999, 2002\)](#) and worked out in [Sharvit 2015](#). In addition to the two-step definite and the alternative-testing conception of ‘only’, the analysis showed how the cardinal components of a description may exploit compositional properties created by focus-marking, delivering clausal relative readings of quantificational adjectives. The next chapter will delve deeper into the semantics of focus, elaborating on the decompositional semantic symmetries between the focus marker and the definite determiner hinted at in the analysis here.

## Chapter 4

### Strict and sloppy relative readings

#### 4.1 Introduction

Superlative descriptions are typically ambiguous. Imagine that John and several friends take a trip to the library, and each picks out a book. In this context there are two ways to interpret the sentence in (1). On one understanding of the object description, its *absolute reading*, the sentence entails the existence of a single book longer than all the others in the library, and asserts that John picked out that book. This is a reading on which the superlative quantifies over the entire relevant portion of the extension of the nominal ‘book’, selecting the longest among them. Alternatively, on its *relative reading*, (1) may merely entail that John picked out a longer book than any of his friends did, regardless of whether he picked out the very longest book of all, or whether such a book even exists.

(1) John picked out the longest book.

There are, broadly speaking, two classes of theories that attempt to explain how the superlative embedded in the direct object can come to quantify over alternatives to the subject. The first is pragmatic. It identifies the comparison class of the superlative as a context-sensitive parameter of the discourse, akin to vanilla cases of quantificational domain restriction, as when ‘every student’ is understood to quantify only over students in the current relevant class, rather than every student in the world. On theories of this sort, the superlative in (1) covertly quantifies over a restricted set of books, namely those of John and his friends. The other kind of theory is semantic. It identifies the

comparison class as a function of the superlative’s semantic scope, which may differ from its syntactic position. From this perspective, relative readings emerge when a superlative scopes above the verb phrase, where it separates the subject from the predicate, and then directly compares various potential individuals that could saturate the same argument position with respect to their performance on the degree property that it abstracts over. In (1) for example, the superlative would compare John with the rest of John’s friends on the degrees  $d$  to which they can be said to have picked out a  $d$ -long book.

This paper introduces to the debate a novel pattern of binding data, and argues that the paradigm is better explained by the latter, scopal, theories of superlative meaning. In addition, I advocate for and extend the analysis of Chapters 2 and 3 on which quantificational adjectives do not take scope in the traditional sense, but instead are carried along by what are in fact scope-taking determiners. In the rest of this brief introduction, I preview the essential data, the challenges that the data pose for various theoretical strains, and the gist of the solution.

The principle contrast that I will address is illustrated in (2) and (3). Returning to the library scenario, imagine now that John, Mary, Sue, and Fred each pick out a dozen or so books to read. Just to be cute, some of them choose books with titles that include the names ‘John’, ‘Mary’, ‘Sue’, and/or ‘Fred’. In this scenario, (2) may be interpreted as saying one of two things. It either entails, as indicated in (2a), that John picked out fewer books with the word ‘John’ in the title than any of Mary, Sue, or Fred did. Or, as in (2b), it entails that John picked out fewer books with ‘John’ in the title than Mary did with ‘Mary’ in the title, Sue did with ‘Sue’ in the title, or Fred did with ‘Fred’ in the title.

(2) John picked the fewest books with his name in the title

- a.  $\checkmark \forall z \neq j. \max \{n \mid j \text{ picked } n \text{ books with } j\text{'s name}\} < \max \{n \mid z \text{ picked } n \text{ books with } j\text{'s name}\}$
- b.  $\checkmark \forall z \neq j. \max \{n \mid j \text{ picked } n \text{ books with } j\text{'s name}\} < \max \{n \mid z \text{ picked } n \text{ books with } z\text{'s name}\}$

As I’ll show in Section 4.3, the so-called sloppy reading of (2) paraphrased in (2b) presents a conundrum for domain restriction theories of superlatives. Roughly, the trouble for such analyses is

that no matter what set of objects is taken to stand in for the implicit comparison class (regardless of how such a class is identified in practice), the superlative has to quantify over the noun phrase ‘books with his name in the title’. But from the superlative’s point of view, trapped as it is within the grammatical object, the pronoun in that description is ineluctably bound to John. Intersecting this set with the domain restricted comparison class thus yields a set containing only John’s books, which precludes any truth conditions along the lines of (2b). The only move, I argue, is to give up altogether on interpreting the noun phrase, and instead to use it merely as a parameter for the determination of the comparison class. I evaluate the prospects of this idea, and conclude that to the extent that it can be made to work, it is a long way away from a convenient, purely pragmatic theory of domain restriction.

Scope-taking theories of superlatives have no comparable difficulty with the sloppy reading in (2b), or the strict reading above it. On every such theory, the superlative quantifies over a constituent large enough that the pronoun can be bound — strictly or sloppily — within it, which determines the shape of the property against which competitors are compared. However, theories that scope the superlative morpheme *by itself* (e.g., Heim 1999) also predict sloppy readings for superlatives in possessive descriptions with pronominal possessors. The sentence in (3) forms a minimal pair of sorts with that in (2), but it has no analogous sloppy reading. It cannot, that is, mean that John picked fewer books with the same name as him than Mary, Sue, or Fred did of books with the same name as them.

(3) \*John picked his fewest eponymous books

- a.  $\# \forall z \neq j. \max \{n \mid j \text{ picked } n \text{ books with } j\text{'s name}\} < \max \{n \mid z \text{ picked } n \text{ books with } j\text{'s name}\}$
- b.  $\# \forall z \neq j. \max \{n \mid j \text{ picked } n \text{ books with } j\text{'s name}\} < \max \{n \mid z \text{ picked } n \text{ books with } z\text{'s name}\}$

In light of this overgeneration, I propose to adopt and extend a dynamic analysis of superlatives. According to Chapter 2, superlatives do not take scope in the traditional sense, do not leave a degree trace, and do not quantify over an individual-degree relation (or set of focal alternatives containing individual-degree relations). Instead, they denote filters on dynamic outputs, much like the cardinal

postsuppositions in Brasoveanu 2012. They end up quantifying over a relative rather than absolute set of alternatives when the determiner that uses them as an output filter is delayed until further information from the verb phrase has restricted the set of candidate assignments to embed the sentence in a model. In this manner, it is the determiner rather than the adjective that takes scope, carrying the adjective along for this ride. This predicts that it should be impossible for the correlate of a relative superlative to bind a pronoun in that superlative's determiner. To do so, the pronoun would have to remain in the semantic scope of the correlate. But since the pronoun is part and parcel of the determiner-superlative complex, if it remains in the scope of the correlate, then so does the superlative, which rules out any relative reading. This absence is exactly what we see in (3).

In the next section, I step through the strict, sloppy, relative, absolute, definite, and possessive paradigms in detail. The theoretical consequences of these facts are taken up in Section 4.3. Section 4.4 spells out the dynamic analysis hinted at above, and brings it to bear on the data of Section 4.2. Section 4.5 concludes.

## 4.2 Data

### 4.2.1 Strict and sloppy pronouns

In a variety of constructions that emphasize some kind of contrast or semantic parallelism, pronouns can give rise to a well-studied type of ambiguity. The classic case, due to Ross 1967, is verb phrase ellipsis. Ross observed that sentences like (4) are ambiguous between what have come to be called *strict* and *sloppy* interpretations (Ross 1969). On its strict reading, the second clause of (4) contrasts with an interpretation of the first clause on which the pronoun is coreferent with, but not bound by, the subject 'John'. It thus contrasts John and Bill with respect to the property of scratching John's arm, as paraphrased in (4a). The sloppy reading of (4) on the other hand, interprets the pronoun as genuinely bound by its subject, and thus contrasts John and Bill with respect to the property of scratching one's own arm. This gives rise to truth conditions paraphrased in (4b).

- (4) John scratched his arm but Bill did not [cf. Ross 1967: (5.132)]
- a. ✓ John scratched John's arm but Bill didn't scratch John's arm *Strict*
- b. ✓ John scratched John's arm but Bill didn't scratch Bill's arm *Sloppy*

Of special interest to the topic at hand, association with focus also creates opportunities for strict/sloppy ambiguities. Building on Chomsky's (1976) observation that the alternatives evoked by focus prominence depend on whether a pronoun is taken to corefer with the focused constituent or to be bound by it, Rooth (1985) shows that this sensitivity can have truth-conditional ramifications in the presence of a focus-sensitive adverb like 'only'.

- (5) We only expect JOHN to be betrayed by the woman he loves [Rooth 1985: (59a)]
- a. ✓ Only John do we expect to be betrayed by the woman John loves
- b. ✓ Only John  $\lambda x$ . we expect  $x$  to be betrayed by the woman  $x$  loves

For instance, the strict reading of (5) in (5a), on which the pronoun merely refers to John, entails that nobody other than John is expected to be betrayed by John's love. The sloppy reading (5b), on which the pronoun is bound by the focus phrase 'JOHN', entails that nobody else is expected to have the property of being betrayed by one's own love.

Of course, not all bound pronouns in the presence of focus phrases give rise to sloppy readings. The pronoun has to be bound by the element that generates the alternatives. Only in this configuration will the pronoun vary across alternatives, because only when the pronoun is bound to the thing that differs from one alternative to another will the pronoun's meaning depend on which individual is under consideration. To see this, compare (6), which is ambiguous, to (7), which is not. Since the lambda abstracting over the choice of a focal alternative to 'John' doesn't bind the pronoun, the two LFs end up equivalent.

- (6) Mary<sub>8</sub> only introduced JOHN<sup>y</sup> to his<sub>y</sub> current partner
- ✓ Only John was introduced to John's current partner by Mary
  - ✓ Only John  $\lambda y . y$  was introduced to  $y$ 's current partner by Mary
- (7) Mary<sup>x</sup> only introduced JOHN<sup>y</sup> to her<sub>x</sub> current partner
- ✓ Only John was introduced to Mary's current partner by Mary
  - ✓ Only John  $\lambda x . x$  was introduced to Mary's current partner by Mary

We will revisit this fact in Section 4.2.3.2.

## 4.2.2 Definite descriptions with quantificational adjectives

### 4.2.2.1 Absolute and relative definite descriptions

Definite descriptions with quantificational adjectives are typically ambiguous between what are called *absolute* and *relative* readings. On an absolute interpretation of 'the Adj NP', the adjective quantifies over the property denoted by the NP and returns a singleton property whose single member is extracted by the definite. For instance, the description in (8) interpreted absolutely refers to the particular individual who is alone in being an author in the room:  $\iota x . \text{author } x \wedge \text{in } r \ x$ . On a relative interpretation of 'the Adj NP', the adjective compares some element of the sentence to other relevant individuals with respect to some property derived from that element's syntactic context. Returning to (8), the relative reading of the exclusive DP compares Scott to other people with respect to the property of being an author in the room. 'Only' requires that Scott be unique among his competitors in having that property, and the sentence denies that this requirement is satisfied: if it is true on its relative reading, then not only Scott is an author in the room.

- (8) Scott isn't the only author in the room
- ✓ One person in the room is published; Scott isn't that person *Absolute*
  - ✓ It's not the case that Scott alone is published *Relative*

Amount superlative DPs in English only have relative readings (Szabolcsi 1986). The description in (9), for example, can only refer to the girl who got fewer letters than any other girl got. This is a relative reading; it compares potential referents for the relative pronoun (girls) with respect to how many letters they received, and picks out the one that minimizes the function. There is no non-comparative interpretation of ‘the fewest letters’ that could serve as the plural individual denoted by the inner DP, except perhaps the empty sum of letters, if it is sensible to talk of such a thing, but (9) cannot be interpreted as identifying Mary with the girl who got no letters.

- (9) Mary is the girl who got the fewest letters
- a. # Some letter-set is fewer than any other; Mary is the girl who got it
  - b. ✓ Mary is the girl who get fewer letters than any other girl got

The absence of absolute readings in such cases will come in handy when diagnosing the semantic contributions of adjectives and determiners as we go.

There is a large literature on relative superlatives and the environments that condition them. The most important empirical generalization for the argument that I want to make here is that relative superlative interpretations associate with focus (Jackendoff 1972, Szabolcsi 1986, Gawron 1995, Heim 1999, Sharvit & Stateva 2002, Gutiérrez-Rexach 2006, Tomaszewicz 2013). Consider the following examples, adapted from Szabolcsi 1986, who as far as I am aware, was the first to analyze the influence of focus on superlatives, though the observation goes back apparently to Ross (1964).

- (10) When did JOHN get the fewest letters from Peter?
- a. ✓ When did John receive fewer letters from Peter than anybody else did from Peter?
  - b. # When did John receive fewer letters from Peter than he did from anybody else?

(11) When did John get the fewest letters from PETER?

- a. # When did John receive fewer letters from Peter than anybody else did from Peter?
- b. ✓ When did John receive fewer letters from Peter than he did from anybody else?

The question in (10) unambiguously asks the listener to compare John to Peter's other correspondents, and to provide the time at which John was the least attended to of the bunch. In contrast, the question in (11) unambiguously asks about John's other correspondents, and is satisfied only by times in which Peter paid him less attention than he did the others. Note that during the times that positively answer the first question, John may well have not been in communication with anybody but Peter, though it presupposes that Peter must have at that time written letters to several people. On the flipside, during the times that answer the second question, Peter may well have only been writing to John, as long as John received letters from at least a few people.

Relative readings of adjectival ordinals and exclusives are likewise focus-sensitive (Bhatt 1999, Herdan 2005). Here is a contrast adapted from Chapter 3.

(12) John bagged the {first, only} deer in JULY

- a. ✓ July was the {first, only} time John bagged a deer

(13) JOHN bagged the {first, only} deer in July

- a. ✓ In July, John was the {first, only} one to bag a deer

If the quantificational adjective associates with focus on 'July', then (12) entails that John did bag a deer in July, and he did not bag a deer in any month {before, other than} July. If instead the adjective associates with 'John', as in (13), the sentence entails that John bagged a deer in July, and no one else bagged a deer {before him, at all}.

#### 4.2.2.2 Strict and sloppy definite descriptions

As mentioned in Section 4.2.1, focused expressions can bind pronouns sloppily, and in the presence of focus-associating operators, this can have truth conditional consequences (e.g., (5)). This is important

because, as seen in Section 4.2.2.1, relative quantificational adjectives are focus-sensitive. And indeed, Gawron (1995) has pointed out that pronouns anteceded by the correlates of relative superlatives are ambiguous between strict and sloppy interpretations. Thus the sentence in (14) has two readings. Understood strictly, it entails that of all the gifts given to Jean's sister, the most expensive came from Jean herself. Understood sloppily, it entails that of all the gifts given from one sister to another, the most expensive came from Jean.

(14) JEAN gave her sister the most expensive book [Gawron 1995: (8)]

- a. ✓ Jean gave Jean's sister a more expensive book than anyone else gave Jean's sister
- b. ✓ Jean gave Jean's sister a more expensive book than anyone<sup>y</sup> else gave their<sub>y</sub> sister

It is worth pointing out that exclusives and ordinals exhibit the same flexibility.

(15) JEAN gave her sister the {first, only} book

- a. ✓ Jean {before others, alone} gave Jean's sister a book
- b. ✓ Jean {before others, alone}  $\lambda x . x$  gave  $x$ 's sister a book

The most interesting instance of this pattern for present purposes is illustrated by (16), in which the ambiguous pronoun occurs inside the relative DP that associates with the focus phrase that antecedes it. Just as in the ditransitive case from Gawron, (16) carries two readings, depending on whether the pronoun is bound by, or merely corefers with, the subject. In the first case (16a), the sentence entails that the number of voters from John's district that John met with is smaller than the number of voters from John's district that anyone else met with. In the latter case (16b), the sentence entails that if you count up for each politician how many voters that politician met with from their own district, you'll find the lowest number next to John's name.



On the other side of the coin, even relative superlative descriptions containing bound pronouns can fail to generate sloppy readings, if the pronoun is bound by something other than the superlative's correlate.

(19) John gave MARY the most expensive of his books

- a. ✓ John gave Mary a book of his that was more expensive than any book of his that he gave to anyone else

For example, the sentence in (19) has a relative reading (19a), which compares Mary to other people that John gave his own books to. Of these people, it asserts that nobody was given a more precious item than Mary, but does not necessarily require John to have done anything with his absolute most expensive book. This is a relative reading, but not a sloppy relative reading, since the value of the pronoun does not vary depending on which competitor of Mary is under consideration; it is always the price of *John's* books that are being measured.

#### 4.2.3 Possessive descriptions with quantificational adjectives

##### 4.2.3.1 Relative and absolute possessive descriptions

In contrast with the definite descriptions just reviewed in Section 4.2.2.1, adjectives in DPs with prenominal possessors strongly resist relative readings (Schwarz 2005: p. 200, Bos 2009: Section 4.1, Teodorescu 2007, Chacón & Wellwood 2012). I give examples with superlatives first, since these are the most well known.

(20) Which student read Shakespeare's longest play? [cf. Schwarz 2005: (39)]

- a. ✓ Which student read Hamlet?
- b. # Which student read a Shakespeare play longer than any read by any other student?

(21) JOHN read Wilde's {first, only} novel

- a. ✓ John read *Dorian Gray*
- b. # John {before others, alone} read a Wilde novel

Exclusives and ordinals are likewise necessarily absolute in possessive DPs. The sentences in (21) have only the absolute readings paraphrased in (21a). Given that Wilde's first and only novel was *The Picture of Dorian Gray*, the sentences in (21) can only be interpreted as asserting that John read this book. They have no reading on which they would compare John with other potential readers with respect to the property of reading Wilde novels, as indicated by the judgment in (21b).

What has not been noticed before is that this prohibition is quite systematically relaxed when the prenominal possessor is *bound* by something in the sentence. All of the attested sentences in (22) have prominent relative readings. For instance, (22a) asserts that Khan has played fewer Tests in Australia than he has in all other countries. The example in (22e), discovered by Coppock & Beaver, denies that only by way of taxes do immigrants make contributions. And (22g) is about a plan to let David Freese know that the last time he will throw a ball from third base is in his past, even though he will get to throw more balls from right field in the future. The examples in (22d) and (22f) show that even indexical first- and second-person pronouns can license relative readings from the specifiers of possessive DPs, if bound.

- (22) a. ʔ Australia is where Khan has played his fewest Tests
- b. ʔ [KISS] sold their fewest records when they took the makeup off!
  - c. ʔ The Pacers made their fewest 3-pointers of the season (two, in 14 attempts)
  - d. ʔ The Standard Deduction is best for you. Here's why ... It gets you your biggest deduction
  - e. ʔ Immigrants don't make their only contribution through taxes [Coppock & Beaver 2015]
  - f. ʔ I just kissed my first boy
  - g. ʔ It was Rick Hahn's plan all along [...] to tell [David Freese] that he's thrown his last ball from third base and offer him a contract to play right field for the Chicago White Sox

### 4.2.3.2 Strict and sloppy possessive descriptions

Despite the bound pronouns, all of the sentences in (22) are necessarily strict. This is because the antecedent to the possessor is not the correlate of the superlative. They are possessive analogs of the situation in (19). In fact, quantificational adjectives in anaphoric possessive DPs *cannot* associate with the antecedents of their possessors. This means that possessive descriptions are necessarily interpreted absolutely in sentences where nothing except the possessor's binder could possibly serve as the correlate of the adjective. The example in (23) illustrates this. The pronominal possessor is bound by the subject, 'Mary', which in this case is also the only potential correlate of the superlative 'longest'. Even with prosodic focus on the subject, the possessive DP has neither a strict nor a sloppy relative reading. The strict relative reading, sketched in (23b) would entail that of all Mary's cited works, she cited the longest herself. The sloppy relative reading, sketched in (23c), would compare Mary to other relevant individuals with respect to the property of self-citing. It would entail that of all the papers cited by their own authors, the longest was cited (and written) by Mary. Again, these are not possible interpretations of (23).

(23) MARY<sup>u</sup> has cited her<sub>u</sub> longest paper

- a. ✓ Mary has cited  $p$ , where  $p$  is the longest paper Mary has written
  - b.  $\# \forall z \neq m. D z m < D m m$
  - c.  $\# \forall z \neq m. D z z < D m m$
- } where  $D \equiv \lambda x \lambda y. \max \{d \mid x \text{ cited a } d\text{-long paper } y \text{ wrote}\}$

The pattern is perhaps even more stark with amount superlatives, which require relative readings. So if the only potential correlate for the amount superlative also happens to bind the superlative DP's possessor, then the sentence ought to become ungrammatical. This is shown in (24).

(24) \*MARY<sup>u</sup> has cited her<sub>u</sub> most papers

- a.  $\# \forall z \neq m. D z m > D m m$
  - b.  $\# \forall z \neq m. D z z > D m m$
- } where  $D \equiv \lambda x \lambda y. \max \{n \mid x \text{ cited } n \text{ of } y\text{'s papers}\}$

The adjective ‘fewest’ requires a correlate and a concomitant property against which to measure various competitors to the correlate. The only available constituent for this is the subject ‘Mary’. But since ‘Mary’ also binds the superlative’s possessor, such association is apparently ruled out. And thus there isn’t any available interpretation for the sentence, rendering it unutterable.

As is now familiar, the same patterns emerge with exclusives and ordinals in place of superlatives. Compare (25), a variant on the attested relative reading reported in Chapter 3, with the sentence in (26).

(25) John sold his {first, only} book on TUESDAY

- a. ✓ Tuesday is among the times that John sold  $p$ , where  $p$  is John’s {first, only} book
- b. ✓ The {first, only} time that John sold one of John’s books was on Tuesday

(26) JOHN sold his {first, only} book on Tuesday

- a. ✓ John is among those who  $\lambda x . x$  sold  $p_{j/x}$ , where  $p_z$  is  $z$ ’s {first, only} book
- b. # John {before others, alone} sold one of John’s books on Tuesday
- c. # John {before others, alone}  $\lambda x . x$  sold one of  $x$ ’s books on Tuesday

The sentences in (25) have both absolute and relative readings, depending on whether the adjectives quantify over books, or over sellings thereof. Of course both readings are strict, as in each case, the focus phrase, the adjective’s correlate, does not bind the possessive pronoun. In contrast, the sentences in (26) have no relative readings whatsoever. They entail that John has an initial/unique book,  $p$ , which he sold on Tuesday (again, which global alternatives are evoked does depend on whether the pronoun is strictly or sloppily bound, but this is beside the point). The sentences cannot be understood as comparing John to other potential book vendors. That is, the ordinal variant cannot be used to assert that on Tuesday, John sold a book before anyone else. And neither can the exclusive variant be used to assert that on Tuesday, John was the only one to sell any books at all.

#### 4.2.4 Data summary

The examples in (27)–(30) provide something like a set of minimal pairs illustrating the key generalizations discussed in this section. To my knowledge, only the pattern illustrated in (28) has been discussed before, primarily in assorted footnotes. First, a classic strict/sloppy ambiguity arises from any definite description in which a quantificational adjective associates with a focus phrase that also binds a pronoun in the adjective’s DP, as in (27). Second, as seen in (28), relative readings are generally blocked by possessive DPs with free possessors, including referential expressions. Third, even possessive DPs with bound possessors will block relative readings if the binder is bound by the would-be correlate of the relative adjective (29). However, fourth, when the possessor is bound to some non-correlate element of the sentence, relative readings are again possible, as in (30).

(27) MARY<sup>u</sup> has cited the most of her<sub>u</sub> students

- |   |   |  |
|---|---|--|
| a. $\checkmark \forall z \neq m. D z m < D m m$ | } | where $D \equiv \lambda x \lambda y. \max \{n \mid x \text{ cited } n \text{ of } y\text{'s students}\}$ |
| b. $\checkmark \forall z \neq m. D z z < D m m$ |   |  |

(28) \*MARY<sup>u</sup> has cited his<sub>v</sub> most students

- a.  $\# \forall z \neq m. D z g_v < D m g_v$ , where  $D \equiv \lambda x \lambda y. \max \{n \mid x \text{ cited } n \text{ of } y\text{'s students}\}$

(29) \*MARY<sup>u</sup> has cited her<sub>u</sub> most students

- |   |   |  |
|---|---|--|
| a. $\# \forall z \neq m. D z m < D m m$ | } | where $D \equiv \lambda x \lambda y. \max \{n \mid x \text{ cited } n \text{ of } y\text{'s students}\}$ |
| b. $\# \forall z \neq m. D z z < D m m$ |   |  |

(30) GLOSSA is where Mary<sup>u</sup> has cited her<sub>u</sub> most students

- a.  $\checkmark \forall z \neq g. D z m < D g m$ , where  $D \equiv \lambda x \lambda y. \max \{n \mid \text{Mary cited } n \text{ of } y\text{'s students in } x\}$

I take it that the big open questions are the following.

- Why do most possessive DPs block relative readings?

- Why is this constraint relaxed when the possessor is bound by something other than the superlative's correlate?
- And most mysteriously, given that a bound possessor does not generally enforce absolute readings the way that a free or referential possessor does, what prevents a quantificational adjective from associating with the pronoun's antecedent?

In Section 4.4, I will offer speculative thoughts on the first two questions and a definitive answer to the third. As sketched in the introduction, that answer is that doing so would create a scope paradox; the possessive-superlative quantificational complex cannot both quantify over, and be bound into by, the alternatives that focus generates.

### 4.3 Challenges posed to traditional theories

#### 4.3.1 Superlatives, scope, context, and focus

##### 4.3.1.1 Scope and domain restriction

There are two major classes of relative superlative analyses. The first, due to ideas in Szabolcsi 1986 and Heim 1985, 1999, attributes the absolute/relative ambiguity of superlatives to the variable scope of the superlative morpheme itself. This is easiest illustrated by example.

(31) JOHN heard the best drummer [cf. Heim 1985: (9)]

- a. John heard [ the est  $\lambda d$   $d$ -good drummer ]  
↑
- a
- b. John est  $\lambda d$  heard [ the  $d$ -good drummer ]  
↑

In the absolute LF, (31a), the superlative morpheme scopes over the NP that contains it. From this position, it quantifies over the relation  $\lambda d \lambda x . x$  is a  $d$ -good drummer, and returns the property of individuals that maximize this relation; i.e., the property of being an individual whose quality as a

drummer exceeds that of all others. The definite then, as usual, extracts the single individual from this set, yielding a denotation of type  $e$ .

In the relative LF, (31b), the superlative scopes over the VP that contains it. As a result, the relation that it seeks to maximize is not that between individuals and their drumming ability, but that between individuals and the abilities of drummers *that they've heard*. The argument maximum of this relation, then, is the set of individuals who have heard a drummer better than any drummer heard by anyone else. Note that in this configuration, in order to get the truth conditions of relative readings right, the superlative DP must be interpreted *indefinitely* (see Coppock & Beaver 2014 for recent discussion of this, though it was already thoroughly explored in Szabolcsi 1986).

Following the literature, I will call approaches in the vein just described *scopal* theories, since the scope of the superlative determines the possible meanings for the sentence. The major alternative approaches to relative readings, which I will call *restrictionist* or *in situ* theories, contend that properly speaking, sentences with superlatives aren't ambiguous at all, but merely underspecified. Relative readings emerge from a particular choice of comparison class to instantiate the implicit domain restriction variable of the superlative morpheme. Returning to the drumming example, in default cases, the domain over which the superlative quantifies might be the set of all relevant drummers, maybe all the drummers that were playing at a venue downtown last night, or perhaps all the drummers that were just mentioned in a prior sentence. This leads to what would conventionally be called absolute truth conditions. But it is also possible for the domain that the superlative quantifies over to contain just those individuals that were heard by some relevant alternative to John.<sup>1</sup> The sentence in (32) would then assert that out of all the drummers heard by any of John's competitors, the best one was heard by John, which is approximately what the relative truth conditions demand, setting aside discrepancies in the case of ties (see, e.g., Heim 1999, Farkas & Kiss 2000, and Sharvit & Stateva 2002 for conflicting judgments in such cases).

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<sup>1</sup> I use the metalanguage  $\sim$  symbol as a shorthand for the relation that holds between individuals in the same comparison class. This is an abuse of the object language predicate  $\sim$  introduced by Rooth (1985) to capture focus alternatives, as in (34) below.

(32) John heard [ the  $est_C$   $\lambda d$   $d$ -good drummer ]  


a.  $C = \{x \mid x \text{ is relevant}\}$

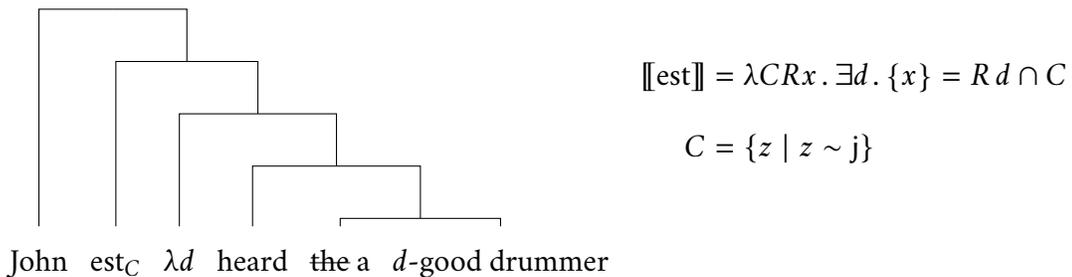
b.  $C = \{x \mid \exists z \sim j. \text{heard } x z\}$

Just for completeness, because absolute readings will not play much of a role in the discussion to follow, let me put these first two schematic analyses of relative readings back to back in a form that makes it easy to compare them. I also introduce the mnemonic convention of using squared trees for LFs of relative readings in which the superlative takes DP-external scope, and triangular trees for LFs in which it remains inside the DP.

(33) JOHN heard the  $best_C$  drummer      Relative reading analyses; no explicit focus-dependence

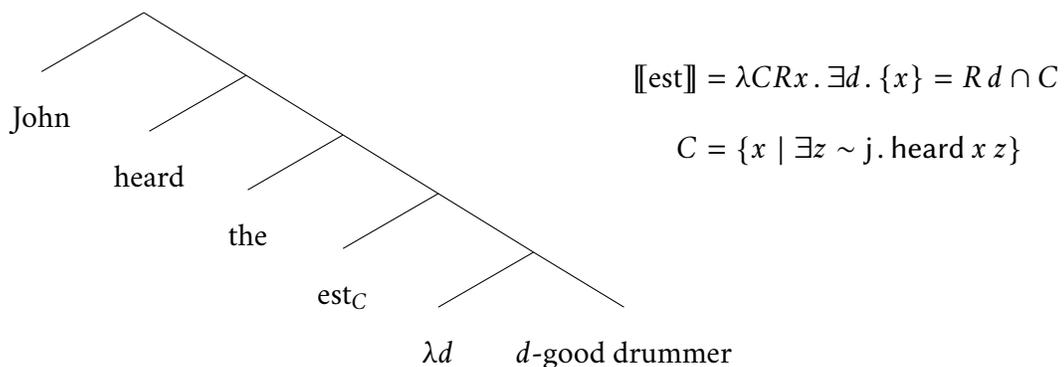
a. Scoped superlative, indefinite ‘the’, pragmatic resolution of comparison class

(Heim 1985, Szabolcsi 1986, Bhatt 1999, Hackl 2009, Gajewski 2010, Sharvit 2015)



b. DP-internal superlative, definite ‘the’, pragmatic resolution of comparison class

(Farkas & Kiss 2000, Gutiérrez-Rexach 2006, Teodorescu 2009, Coppock & Beaver 2014)



### 4.3.1.2 Scope and domain restriction as a function of focus

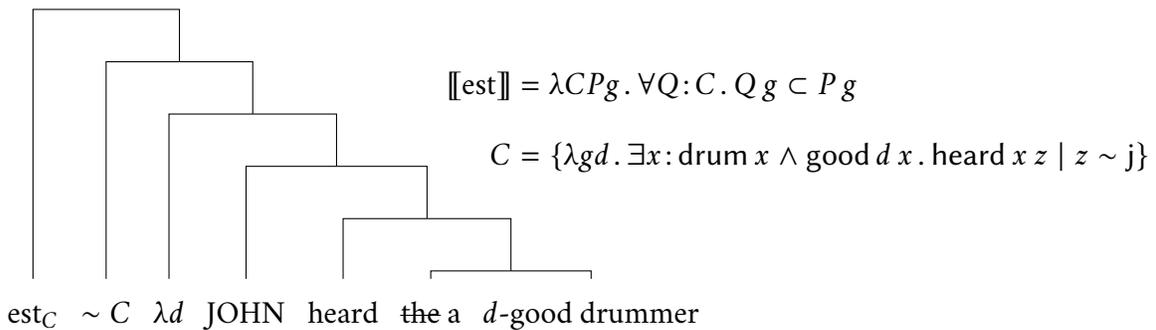
Neither of these theories directly represents the focus-sensitivity of superlatives, discussed in 4.2.2.1, but it is easy enough to accommodate it. Heim 1999 in fact spelled out proposals to do so for both theories (ultimately arguing in favor of the scopal treatment). The trick in both cases is to unify the superlative's contextual domain restriction with the focus alternatives introduced by some continuation in the sentence. I will step through the competing LFs she proposed in turn, but let me first point out something that was, I take it, obvious to Heim. If a superlative's implicit domain  $C$  is to be coincident with the focus value of some constituent  $\Sigma$ , then the superlative (probably) had better not be contained in  $\Sigma$ :  $*[\dots [ [\Sigma \dots \text{est}_C \dots ] \sim C ] \dots ]$ . The problem with this configuration is that by the usual principles of Roothian focus interpretation,  $C$  ought to be a subset of the focus alternatives of  $\Sigma$ . But those alternatives *contain*  $C$ ! If for instance, the sentence is the one in (32), then  $\sim$  will guarantee that  $C \subseteq \{x \text{ heard the best}_C \text{ drummer} \mid x \sim j\}$ . That is,  $C$  will be a set of propositions, each one entailing that some alternative to John heard the best drummer relative to that very set of propositions. While it is conceivable that there could be an appropriate kind of fixed-point denotation for 'est' here, it seems best to avoid the whole ACDish mess.

Consider the scopal approach first, as in (34a). The focus alternatives are introduced by the subject, and the smallest constituent at which there could be focus-induced variation is therefore at the level of the entire sentence. From that position, it may take the focus alternatives of its continuation as its restrictor, and the ordinary value of that continuation as its nuclear scope. What it says of those two pieces is that every degree property generated by varying the focus results in a strict subset of the degrees obtained by leaving the focus as is.

(34) JOHN heard the best<sub>C</sub> drummer      Relative reading analyses; explicit association with focus

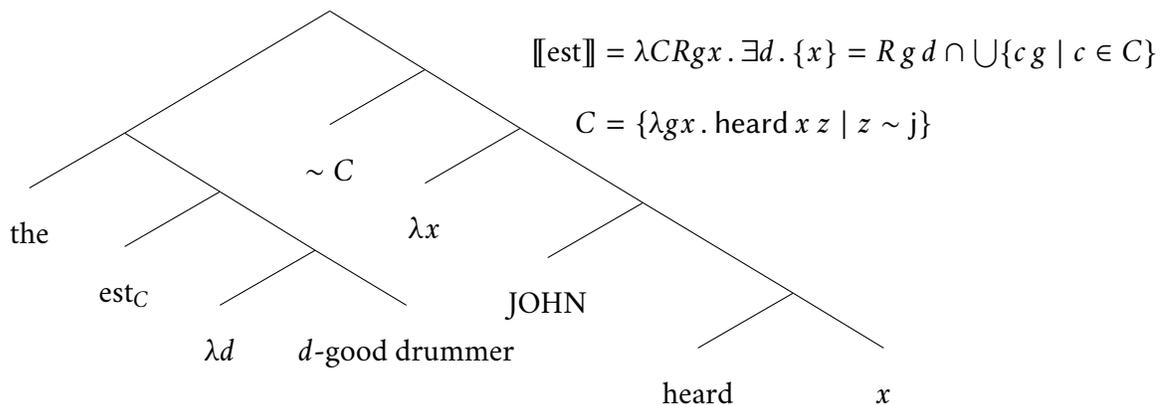
a. Scoped superlative, indefinite ‘the’, comparison class determined by focus

(Heim 1999, Schwarz 2005, Krasikova 2012, Romero 2013, Howard 2014)



b. DP-internal superlative, definite ‘the’, comparison class determined by focus

(Heim 1999, Sharvit & Stateva 2002, Beaver & Clark 2009, Tomaszewicz 2015)



If the superlative’s scope is instead limited to the NP that contains it, as in (34b), then the only way to get its domain argument out of the scope of the  $\sim$  operator is to scope the entire superlative DP. This done, the restrictor of the superlative is identified with the focus alternatives of the continuation of its definite host. So  $C$  contains for each alternative to John, the property of being something that that individual heard. The superlative then taking this set of properties as its domain, and the degree relation denoted by its NP as scope, returns the property that  $x$  has if out of all the things in any of the sets in  $C$ ,  $x$  maximizes the degree relation. In this case, that amounts to saying that  $x$  is someone

who was heard, and who scores better on the  $d$ -good drummer scale than any of the other people that were heard. Finally, the definite determiner says of the unique individual with that property that in fact John heard them.

Before I comment on the pressures that strict and sloppy readings place on these analyses, let me briefly say something about the semantic types here. The standard reported calculations for these focus-induced context sets do not make any reference to assignment functions. For instance, Heim’s (1999) presentation of the analysis in (34b) is essentially the following:

$$(35) \llbracket \text{est} \rrbracket = \lambda C R x . \exists d . \{x\} = R d \cap \bigcup C \quad [\text{cf. Heim 1999: (10), (16)}]$$

$$C = \{\lambda x . \text{heard } x z \mid z \sim j\}$$

This suggests that denotations of expressions are evaluated at assignments, and produce either model-theoretic objects, as ordinary semantic denotations, or sets of these, as focus semantic denotations. But that is not how Rooth’s (1985) theory of focus interpretation — adopted by nearly everyone working in this area — actually works, nor could it be. In particular, there is no good way to define the focus alternatives of a lambda abstract in terms of a function from assignments into sets (Shan 2004). I mention this not as a substantial criticism of how the literature has approached issues of superlatives and focus-sensitivity, since it is fairly clear how to rethread the assignment sensitivity through the various analytical proposals (Rooth 1985, Poesio 1996, Romero & Novel 2013). But it is important to be careful about such things when binding issues are in play.

### 4.3.2 The wages of binding into superlative definite descriptions

In this section, I point out various difficulties for the theories just sketched that are posed by the data from strict and sloppy superlative definite descriptions introduced in Section 4.2.2.2.

#### 4.3.2.1 Scopal relativists and {strict, sloppy} NPs

Theories that read the comparison class *C* off the scope of the superlative morpheme itself have no trouble deriving sloppy readings. For the purposes of illustration, consider a board game with the ambiguous rule in (36a).<sup>2</sup>

- (36) a. Whoever collects the most tokens of her color wins!  
b. MARY collected the most tokens of her color

And in light of this rule, consider the reading of (36b) on which it declares Mary the winner. If the original rule is understood strictly, then it ensures victory for any player *y* who maximizes the relation  $\lambda x \lambda n . x$  collected *n*-many tokens of *y*'s color. For instance, if Mary's color is red, then (36b) ought to entail that Mary collected more red tokens than anyone else. Note that this interpretation makes for a quite friendly game, since everyone could in principle be a winner simultaneously. That is, if Mary's color is red, John's blue, and Fred's green, then it is imaginable that Mary ends up with more red tokens than the others, John with more blue tokens, and Fred with more green tokens. In this case, they have *all* maximized their respective relations. That's fine. That is one kind of game that (36a) could describe.

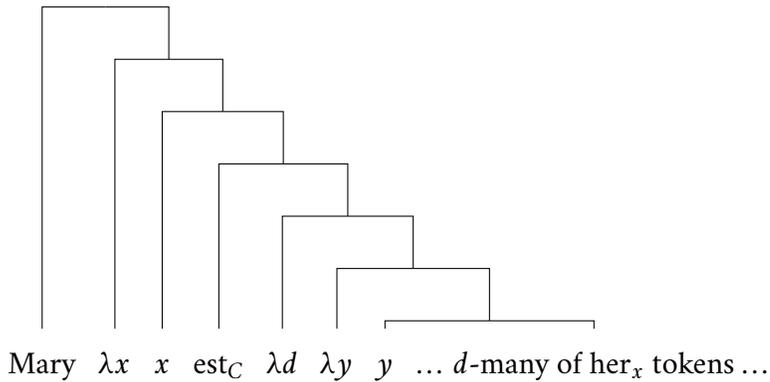
The simplest scopal LF generating this reading would look exactly like (34a), with the additional assumption that the index on 'her' refers to Mary. But this would not quite suffice to derive the strict relative reading of the original rule in (36a), since the possessive pronoun is *bound* by the 'wh'-word, and thus can't accidentally corefer with whoever the free relative containing it picks out (if it is even sensible to suppose that there is such an individual).

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<sup>2</sup> This example is inspired by the attested ambiguous instructions for the game *Color Pop*. I believe the sentences in (36) are ambiguous in just the same way as those in (i), but it will simplify matters to use the positive 'most' rather than its antonym and the transitive 'collect' rather than the existential 'have ... on the board'.

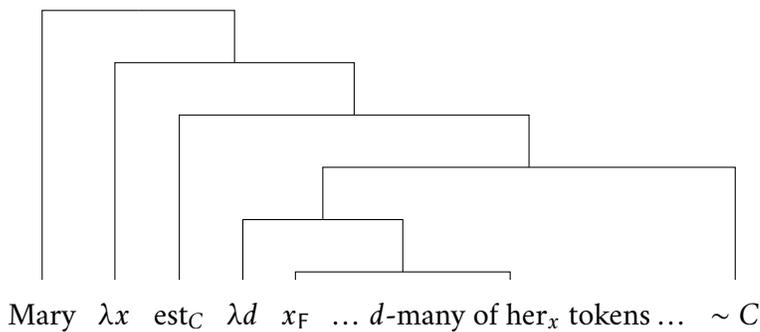
(i) <sup>?</sup>At this point, [...] Whoever has the fewest tokens of her color on the board wins! If two or more players are tied, they compare the tokens they collected during the game; whoever collected fewer of his or her color wins.

(37) a. Strict, parasitic scope



The derivation in (37a) gets around this by having Mary (or the relative pronoun of (36a)) essentially abstract over *two* variables, one of which binds the pronoun, the other of which provides the superlative’s correlate. This is probably in conflict with the principle of Scope Economy that Tomaszewicz (2015) claims is essential for preventing certain unavailable relative readings. In this particular example, the first short raising, out of the subject position, isn’t strictly necessary, since the VP is already of the right type for the superlative to abstract over. But both raisings would be required if the focus correlate of the superlative were in any position other than the subject, so I show the general derivation here.

(37) b. Strict, focus-associating scope



It is a little easier to see how ‘Mary’ ought to strictly bind the pronoun in the case of the focus-associating scopal superlative. In (37b), the subject again scopes out, binding the variable associated

with the pronoun. The superlative then, instead of associating with the raised subject, associates with the subject's trace, which itself takes over the role of introducing alternatives.

Turning now to the sloppy reading of (36), we need to generate an LF in which the pronoun co-varies with the alternatives that the superlative quantifies over. In this configuration, the target sentence (36b) ought to guarantee that Mary maximizes the relation  $\lambda x \lambda n. x$  collected  $n$ -many tokens of  $x$ 's color. Before, under the strict interpretation of the rule, the object of the game was to collect more tokens of your color than other people do *of your color*. As mentioned above, this is not necessarily a competitive game. Everybody can win, for instance, if everybody agrees to collect only tokens of their own color. The sloppy interpretation of the rule does not allow for situations like this. Only one person  $x$  can logically play more of their <sub>$x$</sub>  tokens than anyone else  $y$  plays of *their* <sub>$y$</sub>  tokens. This game is cutthroat.

It is easy to see that sloppy readings on the scopal theory are effortless. They happen whenever a pronoun is bound by the variable that the superlative associates with. In the parasitic variant of the theory, this is the lambda abstract that the superlative's correlate creates by raising, the same abstract that the superlative tucks in on top of, as in (38a). In the focal variant of the theory (38b), the pronoun will be sloppy whenever it is bound by the element in focus.

(38) a. Sloppy, parasitic scope

Mary est  $\lambda d$  [  $\lambda x$   $x$  ...  $d$ -many of her <sub>$x$</sub>  tokens ... ]  
 $\uparrow$ \_\_\_\_\_

b. Sloppy, focus-associating scope

est [ [  $\lambda d$  Mary<sub>F</sub>  $\lambda x$   $x$  ...  $d$ -many of her <sub>$x$</sub>  tokens ... ] ~ C ]  
 $\uparrow$ \_\_\_\_\_

Things will not be so simple for the *in situ* theories discussed in the next section.

#### 4.3.2.2 Restrictionist relativists and {strict, sloppy} NPs

As a reminder, there are two kinds of restrictionist theories, the purely pragmatic and the focus-sensitive. Both agree that the scope of the superlative morpheme is DP-bounded, and assume that the comparison class contains much more information than what is merely relevant. By design, the purely pragmatic strategy offers little theoretical guidance for how the comparison class is determined by the content of the sentence, assuming the process is part of the much larger phenomenon of contextual domain restriction. Focus-sensitive restrictionist theories attribute relative readings to a particular choice of comparison class, as determined by the focus semantics of the superlative DP's continuation.

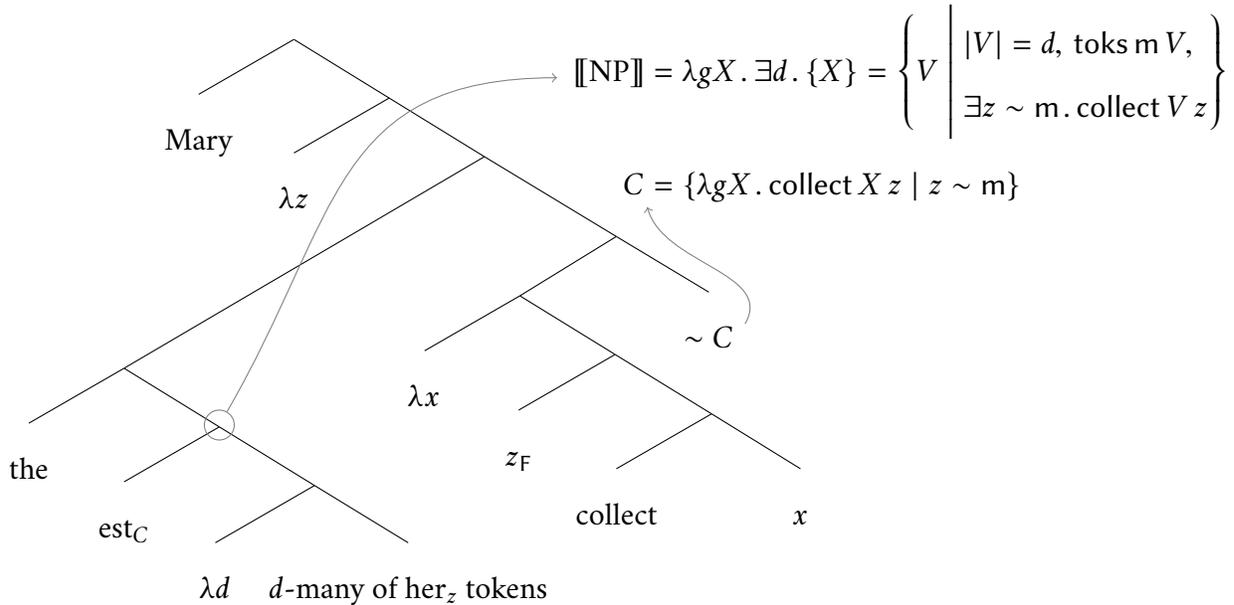
Returning to the running example (36), let's start again with its strict interpretation. Neither the purely pragmatic nor the focus-sensitive restrictionist approaches has any trouble here. The same QR that facilitated the strict reading for the scopal approaches will suffice to generate a strict reading for the *in situ* ones. For the pragmaticist, some independent mechanism leads to a choice of  $C = \{V \mid \exists z \sim m. \text{collect } V z\}$ , the set of token-sums each of which was collected by one of the players in the game. The sentence then asserts that that largest such token-sum that is also in Mary's color was in fact collected by Mary herself (39). The focus-theorist generates  $C$  instead by focus-marking the trace of the subject, as in (39b), which generates the alternatives which ultimately lead to the comparison class above. The rest is the same.

(39) a. Strict, pragmatic *in situ*

Mary  $\lambda z$  [  $z$  collect [ the  $est_C$   $\lambda d$   $d$ -many of her $_z$  tokens ] ]

$$C = \{V \mid \exists z \sim m. \text{collect } V z\}$$

b. Strict, focus-associating *in situ*



The problem for the *in situ* theorist is sloppy readings. Consider again the pragmatic approach, where there are no formal constraints on the comparison class. On the strict reading, the superlative needed to compare for each player the number of Mary-colored tokens that that player had collected. On the sloppy reading, however, the superlative needs to compare for each player the number of tokens in that player's color that *that player* has collected; that is, it needs to get ahold of all and only the sums for which the color matches the collector. But recall the denotation of the superlative:

$$[[est]] = \lambda CRx . \exists d . \{x\} = R d \cap C$$

This definition guarantees that all of the potential witnesses for the description  $x$  that the superlative considers have the property of being  $R$  to some degree  $d$ . But  $R$  here is the NP that the superlative scopes over, the set of token-sums in *Mary's* color. That means no matter what set of objects the

pragmatic module chooses for  $C$ , the only sums that will be compared are Mary-colored sums. This altogether rules out the opportunity for sloppy comparisons, on which Mary’s collection of her own color is compared with Bill’s collection of *his* own color.

(40) Sloppy, pragmatic *in situ*

Mary  $\lambda u$  [  $u$  collect [ the  $\text{est}_{C_Y^u}$   $\lambda d$   $d$ -many [~~tokens of her<sub>u</sub> color~~] <sub>$\bar{Y}$  ] ]</sub>

$\curvearrowright C_Y^u = \{V \mid \exists z \sim m. \forall g^{u \mapsto z} V, \text{coll } V z\}$

The only way a pragmatic theory could possibly derive this sloppy reading is if the nominal component of the superlative’s complement is simply uninterpreted in the scope of the superlative. That is, if the comparison class  $C$  were as described in (40) — the set of token sums whose colors match the players that collected them — and the NP ‘tokens of her color’ not interpreted at all, then the sentence would be true exactly when the sloppy reading is true: iff Mary collected the largest sum in  $C$ .<sup>3</sup>

Yet  $C$  is clearly influenced by the meaning of the superlative’s complement, to say the least. This much can hardly be considered a matter of pragmatics, since, e.g., every imaginable reading of (36) involves comparing players’ tokens based on their colors. But just to drive the point home, consider the sentence in (41).

(41) If John gets the most rebounds or steals, he’ll be the game’s MVP

- a. ✓ John will be the MVP, if either (i) he gets more rebounds than anyone else, or (ii) he gets more steals than anyone else

One reading of (41) entails that there are two ways for John to attain MVP status. One is to out-rebound everyone else. The other is to out-steal everyone else. On this reading, the disjunctive NP takes wider scope than the superlative that embeds it. It doesn’t matter for the purposes of the argument whether it scopes over or under the conditional. What does matter is that in this example, there is only one superlative morpheme and so only one implicit comparison class. If the NP were interpreted, then that comparison class could just be the set of things that players in the game achieved:

<sup>3</sup> Notice that if the NP is interpreted with this sloppy comparison class, we end up with a tautology: Mary collected the largest of the token-sums that were in her color that she collected. This is not a reading of (36b).

$\{x \mid \exists z \sim j. \text{get } x z\}$ . The superlative would intersect this set with the trace  $p$  of the scoped-out disjunctive property, and then quantify over each player's  $p$ -sums. But if the NP is ignored by the superlative, then the comparison class has to take up the slack. However, again, there's only one comparison class. The best it could do without presupposing which of the two paths to glory John might take is to include the union of the game's rebounds and steals. This doesn't deliver the appropriate truth conditions; it would require that John's rebound (or steal) count exceeds everybody else's *combined* rebound+steal count.

It would seem that the implicit class variable  $C$  needs to be formally skolemized by the denotation of the NP, perhaps in the model of Partee's (1989) implicit argument binding. Although unlike the implicit binding that Partee discusses, the relativization of  $C$  to the NP is obligatory, non-deictic, and cataphoric. This is represented in (40) by the  $\Upsilon$  parameter on  $C$ , coindexed with the uninterpreted NP. Even so, it should be noted that  $C$  will have to be a function of the *intension* of the noun phrase, since it has to *rebind* the variable associated with the sloppy pronoun! And moreover, in order to do this, it'll need one way or another to be told what index it's supposed to rebind. Hence the second index on the implicit comparison class variable in (40).

This then is the cost of the pragmatic approach. However, if one is willing to imagine that the noun phrase that complements the superlative adjective is interpreted only insofar as it is used by the reasoner to build the comparison class that restricts 'est', but crucially not in the calculation of the actual assertion, then the sloppy data are, I think, within reach.<sup>4</sup>

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<sup>4</sup> Ambitious readers may in addition wish to construct examples like (i) below, in which the disjunction takes wide scope, but contains sloppily bound pronouns. These will require: (a) that the trace of the scoped disjunct be uninterpreted; (b) that the comparison class be parameterized to the variable that the disjunction abstracts over; and (c) full Sternefeldian (2001) binding reconstruction of the disjuncts into the comparison class. In other words, this purely pragmatic approach appears to be powered by some extremely sophisticated semantic machinery.

- (i) In every election, in order to win you need to convince the most voters in your base or voters in your rival's base
  - a. ✓ In every election, one of these two things has to happen for you to win (which one has to happen may depend on the election): either you convince more voters in your base than anyone else does in their base; or you convince more voters in your rival's base than anyone else does with voters in their rival's base.

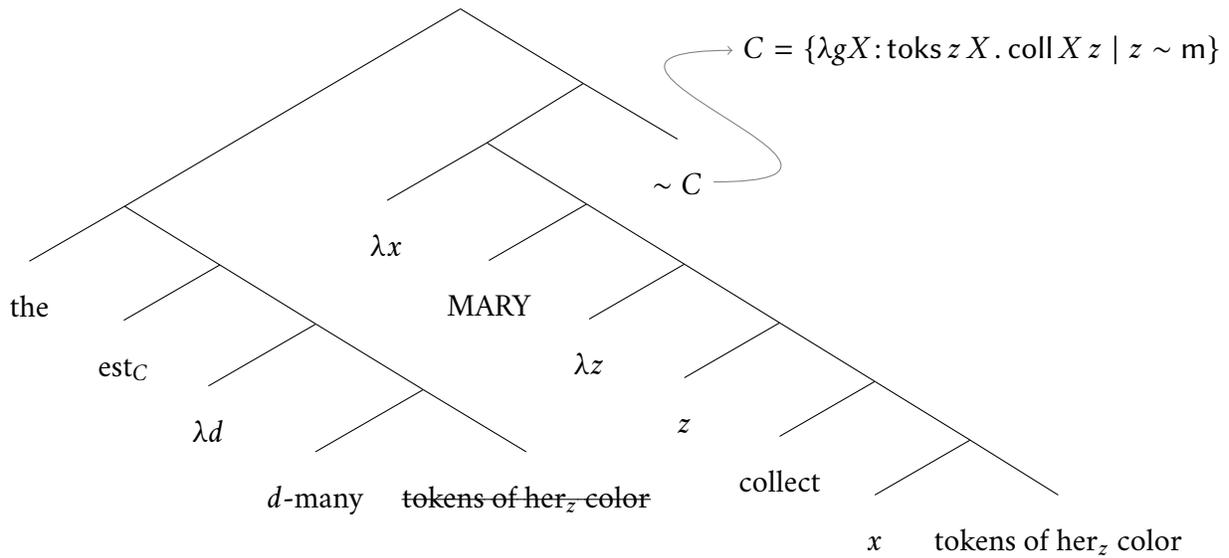
What about restrictionist theories that rely on association with focus? I contend that the picture looks even bleaker, but again, there may be bullets to bite. As a reminder, the LF below presents the schematic shape for a focus-sensitive derivation that leaves the superlative inside the DP.

$$[ \text{the } \text{est}_C \lambda d \text{ } d\text{-many of her}_z \text{ tokens} ] [ \sim C [ \lambda x \text{ MARY collect } x ] ]$$

The problem here is that the constraints of sloppiness and of relativity place deeply conflicting pressures on the pronoun and the superlative morpheme. In order for the pronoun to be interpreted sloppily — i.e., to co-vary with the focus alternatives — it needs to be bound by the element in focus. In this case, that’s the subject ‘Mary’. In order for the superlative to quantify over focus alternatives, it has to outscope them, which means QRing the superlative DP above the element in focus. In this case, that’s the subject ‘Mary’. These two things cannot happen simultaneously. If relativity requires the entire superlative DP to clear out of the scope of the squiggle operator, then nothing in the superlative DP will ever be sloppy, contrary to empirical fact.

The obvious thing to try here is to invoke some kind of reconstructive process for the nominal complement of the superlative adjective. This, in fact, will sort of work! Take the LF in (42), for instance, along with the following “trace conversion rule” for any node  $\gamma$  dominating a trace  $t$  and a copy  $\beta$  (Fox 2003):  $\llbracket [\gamma t \beta] \rrbracket = \lambda g. \iota y. y = \llbracket t \rrbracket g \wedge \llbracket \beta \rrbracket g x$ . Here’s how (42) plays out. The nuclear scope of the QRed superlative description denotes the intensional property of sums  $X$  such that Mary collected the sum  $Y$  that is equal to  $X$  and is a sum of tokens in Mary’s color. In other words, it is the partial function that takes token-sums of Mary’s color to true iff Mary collected them. The focus value of this property abstracts over alternatives to Mary, which crucially also abstracts over the token color that restricts the domain of the function. So the comparison class  $C$  ends up as the set containing for each player in the game those token-sums of *their* color that they collected. The superlative selects the largest of these, and the superlative description says of this largest sum that indeed it was Mary who collected it.

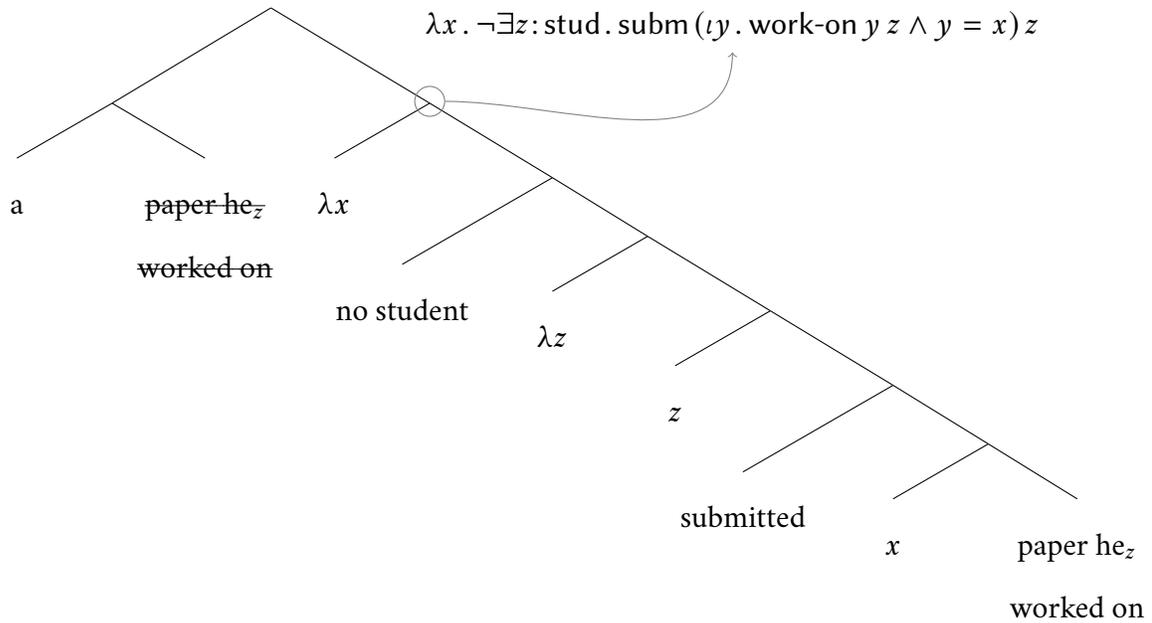
(42) Sloppy, focus-associating *in situ*



Unfortunately this sort of reconstruction looks a little suspicious, since (i) it very nearly replicates the scopal analysis it is meant to be an alternative to, and (ii) it doesn't seem to happen anywhere else. In fact, the LF in (42) looks to be in violation of general *roofing* constraints on scope-taking (Schwarz 2001, Heim 2011, Brasoveanu & Farkas 2011), which ensure that quantificational determiners always scope at the same height as their restrictors. The analogous derivation of (43) leads to the truth conditions in (43a), which are plainly inappropriate; they are neither entailed by nor entail the only actual reading of (43).

(43) No student submitted a paper he worked on

a. # There is a paper that every student worked on but no student submitted



Additionally, allowing the nominal content to reconstruct in this way without the superlative would undermine a generalization due to [Pancheva & Tomaszewicz \(2012\)](#). They report that cross-linguistically, superlatives in morphologically definite descriptions do not associate with focused phrases internal to their own DPs. Thus while the sentence in (44) has a familiar relative reading comparing London to other cities with respect to the age of students that John met there, the sentence in (45) completely lacks an analogous reading comparing London to other cities with respect to the age of students there that John met.

(44) John met the youngest students in LONDON [Pancheva & Tomaszewicz 2012: (12)]

a. ✓ John met in London some students who were younger than any students that he met in any other city

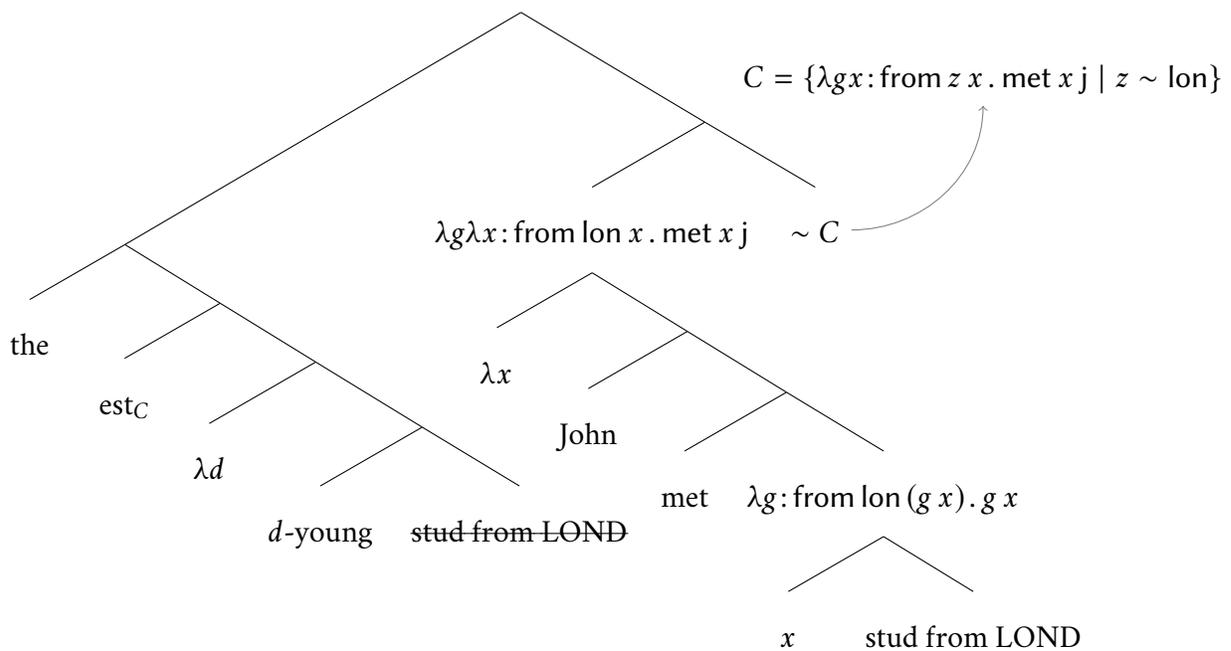
(45) John met the youngest students from LONDON [Pancheva & Tomaszewicz 2012: (10)]

- a. # John met some London students who were younger than any students from any other city that he met

The absence of such readings in languages like English compel Pancheva & Tomaszewicz and later Tomaszewicz (2015) to adopt precisely the context-sensitive *in situ* version at issue here. The reason that if the superlative is trapped within its own DP, then only the superlative *description* can associate with focus (partly for the reasons we've seen regarding the self-containment of *C*). So if the focus is itself contained within the superlative DP, then no relative readings are possible. However, if reconstruction of the nominal content into the nuclear scope of the superlative DP were possible, it would reintroduce opportunities for relativity.

(46) John met the youngest student from LONDON

- a. #  $\lambda g: \text{from lon } \varsigma . \text{met } \varsigma j$ ,  
 where  $\varsigma = \iota x . \exists d . \{x\} = \{v \mid \exists z \sim \text{lon} . \text{young } d v, \text{from } z v, \text{met } v j\}$



The derivation in (46a), mirroring the reconstructive case of (42) yields the unavailable reading that the *in situ* analysis was intended to avoid. In the scope of the squiggle, the superlative DP's abstract denotes the set of partial functions from Londoners to true iff John met them. Its characteristic set — the set of individuals that lead the function to truth — is the set of students from London that John met. The comparison class *C* then abstracts over the choice of London, and taking its intensional union delivers the set of students (from anywhere) that John met. The entire sentence is true iff the youngest of these students that John met is a student from London that John met.<sup>5</sup>

To be clear, the analysis that I will offer in Section 4.4 does not derive the contrast that Pancheva & Tomaszewicz (2012) observe, and the point that scopal theories overgenerate relative readings in the presence of NP-internal focus is well-taken. All I mean to say in this segment is that any restrictionist account capable of deriving sloppy readings, say along the lines of (42), will *also* overgenerate relative readings for NP-internal focus.

### 4.3.3 The wages of binding into superlative possessors

With these issues from definite descriptions in mind, I move on to the difficulties posed by the data from possessive descriptions introduced in Section 4.2.3.2.

#### 4.3.3.1 Possessive descriptions don't have relative readings

Recall from Section 4.2.3.2 that descriptions with referential pronominal possessors do not have relative readings.

(47) JOHN ate the tastiest cookies of Sue's [cf. Chacón & Wellwood 2012: (10)]

- a. John ate cookies of Sue's that were tastier than any cookies of Sue's eaten by anybody else

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<sup>5</sup> Technically, the sentence will result in presupposition failure if the youngest of the students John met is not from London, which is a departure from the truth conditions that the scopal theory would assign. In any case, the sentence certainly has no reading on which it *presupposes* that of all the students John met, the youngest is from London.

(48) JOHN ate Sue's tastiest cookies

[cf. Chacón & Wellwood 2012: (12)]

- a. #John ate cookies of Sue's that were tastier than any cookies of Sue's eaten by anybody else

It is not obvious how a restrictionist theory might explain the absence of relative readings in possessive descriptions like (48a). There is nothing particularly strange or difficult about implicit domain restriction with possessives, nothing in fact clearly different about it than what happens with definites. In fact, possessive determiners ought plausibly to *facilitate* contextual restriction to the frame of comparison, since the possession relation itself has to be resolved pragmatically. For example, in (48), the description does not specify what Sue's relationship is to the cookies at hand. She might have baked them; she might have brought them; she might have tasked someone with finding out where they came from. Or she might stand in the following relation to them:  $\lambda x \lambda y . \Pi x y \wedge \exists z . \text{ate } x z$ , where  $\Pi$  is any of the above. With this choice, the sentence in (48) would entail that John ate the tastiest ( $\lambda x . x$  is a cookie of Sue's that somebody ate), which is approximately the requirement of the relative reading. To be fair, I don't know how to rule this out, since I don't have any constraints to offer on what can or cannot validly instantiate the possession relation, but I take it that the difficulty of interpreting (48) this way tells us something about how unreliable purely pragmatic contextual domain restriction is as a means of generating systematic relative readings.

Focus-sensitive *in situ* theories seem to me even worse off. There isn't any difference in the focus structures of (47) and (48). In both cases the focus alternatives of the continuation for the superlative description are  $C = \{\lambda g x . \text{ate } x z \mid z \sim j\}$ . If this is used as a comparison class for the superlative in (48), then the possessive sentence will entail that John ate the tastiest Sue-related cookie that some alternative to John ate. In other words, it will generate exactly what it generates in the case of (47), steamrolling the contrast.

As for scope-taking theories, Chacón & Wellwood (2012) and Shen (2014) independently argue that if relative readings are derived from covert movement of the superlative morpheme, then the absence of such readings in these possessive descriptions follows from standard assumptions about DP structures and phases. Specifically, they claim that because DPs are phases, covert movement of the

superlative morpheme must proceed by way of the D specifier. This movement, however, is blocked in the case of (48) by the pronominal possessor occupying the position. Not wishing to weigh in on phase theory or the fine structure of the nominal left periphery, I take it that the most descriptive statement of this hypothesis is that possessive determiners with filled specifiers create scope islands. Of course both authors provide independent evidence for this assumption, while situating the proposal within broader theories of islandhood, and the reader is referred to those works and the references therein. What matters for the present purposes is that there is a structural difference between possessive and definite descriptions, and that this difference correlates with various constraints on extraction and scope-taking (Schwarz 2005: fn. 8 offers a similar line of thought).

The challenge that has not yet been appreciated though is that some possessive superlative descriptions *do* seem to allow for relative readings, namely, those with bound pronominal possessors. For a running example, consider the sentence in (22), based on the attested example in (22a), but with ‘fewest’ swapped out for ‘most’, again simply to avoid issues with counting down (Sharvit & Stateva 2002).<sup>6</sup>

(49) Australia is where Khan has played his most Tests [cf. (22a)]

As discussed in Section 4.2.3.2, the most natural interpretation of this sentence has all the trappings of a relative reading. It identifies Australia as the place  $p$  such that Khan has played more Tests at  $p$  than he has at any place other than  $p$ . If the superlative morpheme could scope out of the DP, then either variant of the scope-taking theory would derive this reading. The LF in (50) illustrates the potential parasitic scope derivation. I am assuming for simplicity that the possessive determiner spells out a definite operator and a relational modification to the nominal content, with the following logical

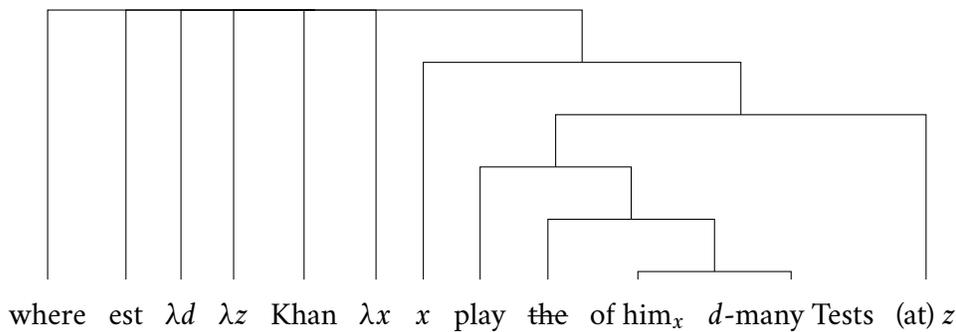
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<sup>6</sup> Here are a few natural examples to assuage readers worried that ‘most’ might be different from ‘fewest’.

- (i) a. <sup>?</sup>Whether you prefer the older FM or not, [there is] no denying that they sold their most albums worldwide with Nicks and Buckingham.
- b. <sup>?</sup>On a night when he walked his most batters (4) and threw just 61 of his season-high 105 pitches for strikes
- c. <sup>?</sup>This is when people make their most mistakes.
- d. <sup>?</sup>Jay Z’s double-CD *The Blueprint 2* contains his most words, with 10,179

structure:  $\llbracket z\text{'s NP} \rrbracket = \llbracket \text{the} \llbracket \text{of } z \rrbracket \text{ NP} \rrbracket$ . There are nontrivial issues lurking here in the syntax and semantics of possessives, but this decompositional assumption at least allows the superlative to scope over the possession relation (the “of” part) in the standard absolute cases:  $\llbracket \text{Sue's tastiest cookie} \rrbracket = \llbracket \text{the est } \lambda d \llbracket \llbracket \text{of Sue} \rrbracket \llbracket d\text{-tasty cookie} \rrbracket \rrbracket$ . I am also assuming that whatever uniqueness is contributed by the possessive determiner would be ignored when the superlative takes scope, exactly as in the case of definite descriptions.

(50) Strict relative reading from a possessive DP, parasitic scope



Why, though, would extra-possessive scope be available to the superlative only when the possessor is bound? Short answer: I don't know. Long answer: It is another manifestation of what [Grano & Lasnik \(2016\)](#) call the *bound pronoun effect*. [Grano & Lasnik](#) report on an assortment of constructions that have been claimed in the literature to show bound subjects relaxing island constraints. This list includes ‘too’/‘enough’ movement, gapping ([Nishigauchi 1998](#), [Merchant 2001](#): Ch. 4, fn. 4), comparative deletion, ACD ([Syrett & Lidz 2011](#): p. 330), quantifier scope ([Kayne 1998](#): fn. 111), multiple-‘wh’ questions ([Nishigauchi 1998](#)), pseudogapping, reciprocal binding, multiple sluicing ([Nishigauchi 1998](#), [Barros & Frank 2017](#), [Merchant 2001](#): Ch. 4, fn. 4), pair-list readings ([Sloan 1991](#)), extraposition, and ‘tough’-movement. The examples in (51) and (52) illustrate some of the contrasts that they find.

- (51) a. \*This magazine is too low-brow [for John to claim that Bill reads]  
 b. \*John claims that Mark likes apples and [Bill <claims that Mark likes> oranges]  
 c. \*More people claim that Bill like apples [than <claim that Bill like> oranges]  
 d. \*[At least one professor claims that Bill reads every journal]  
 e. \*John claims that Mark reads everything [Bill does <claim that Mark reads>]  
 f. \*Tell me [who claims that John reads which journal]
- (52) a. ?This magazine is too low-brow [for John<sup>1</sup> to claim that he<sub>1</sub> reads]  
 b. ?John<sup>1</sup> claims that he<sub>1</sub> likes apples and [Bill<sup>2</sup> <claims that he<sub>2</sub> likes> oranges]  
 c. ?More<sup>1</sup> people claim that they<sub>1</sub> like apples [than <claim that they<sub>1</sub> like> oranges]  
 d. ?[At least one<sup>1</sup> professor claims that he<sub>1</sub> reads every journal]  
 e. ?John<sup>1</sup> claims that he<sub>1</sub> reads everything [Bill<sup>2</sup> does <claim that he<sub>2</sub> reads>]  
 f. ?Tell me [who<sup>1</sup> claims that he<sub>1</sub> reads which journal]

In every case here, an ungrammatical sentence containing extraction or inverse scope out of a finite clause island is improved by replacing a referring expression with a bound pronoun in the subject position of the island. I do not have anything insightful to say about the source of this effect or the proper analysis thereof (though of course see [Grano & Lasnik 2016](#), and also [Barros & Frank 2017](#), for ideas). Nevertheless, one promising analytical possibility is that what we're seeing with superlatives is the first evidence of the bound pronoun effect in sub-clausal constituents. DPs, like tensed finite CPs, are commonly regarded as islands for both scope and extraction. The specifiers of possessive phrases are also generally thought to play precisely parallel roles to the subjects of tensed clauses. So it seems reasonable to surmise that the bound pronoun in the subject position of the possessive phrase might neutralize the island constraints that the determiner layer usually imposes for the same reason (whatever it is) that the sentences in (52) are better than those in (51).

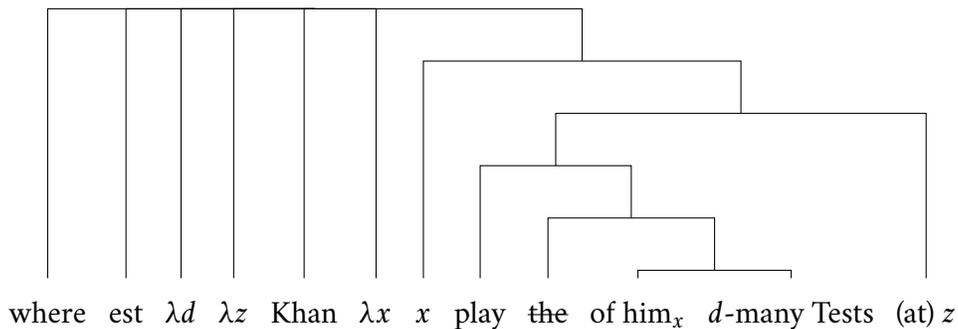
Note that if this is right, it provides another feather in the cap of the scopal treatments of relative readings. Just as there isn't any obvious explanation for the difference between definites and

possessives with respect to the possibilities of contextual domain restriction, there isn't any obvious explanation for the difference between full lexical possessors and bound ones. Domain restriction just doesn't generally care about such things.

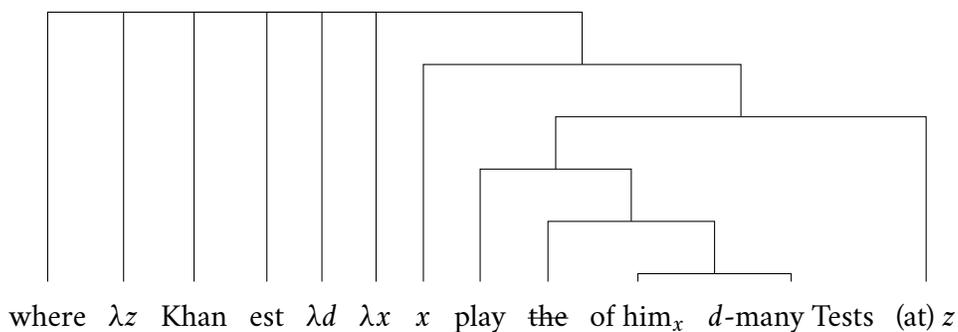
However, if bound possessors open up movement opportunities to superlatives, then scopal theories face a new challenge. Why can't the correlate of the superlative bind the possessor that specifies its description? Returning to the cricket example above, the question is: given that the relative reading paraphrased in (53a) is derivable, what prevents the sloppy relative reading paraphrased in (53b)?

(53) Australia is where Khan has played his fewest Tests

a. ✓ Khan has played fewer Tests in Australia than he has anywhere else



b. # Khan has played fewer Tests in Australia than anyone else has in Australia



In the former structure the relative pronoun proxies for a focus phrase, and the superlative steals its scope. This has the effect of comparing the referent of the free relative (i.e., Australia) to other relevant places with respect to the number of Tests that Khan has played there. In the latter structure,

the embedded subject hosts the superlative morpheme, which uses its scope to compare Khan to other people who have played in the referent of the description (again, Australia).

It's worth observing that the illegitimacy of (53b) can't have anything to do with the competition between the subject and the 'wh'-word for the right to control the superlative. As expected by now, exchanging the possessive for a definite suffices to bring back the relative reading, even when the subject is embedded in a relative clause. The examples in (54) and (55) provide a minimal pair. Especially with focus on 'Khan', (54) can be interpreted as asking for a list of places  $z$  where Khan has played fewer Tests there than any of his competitors. Yet even with the same focus on 'Khan', this interpretation is completely absent from (55).

(54) Tell me all the places where KHAN has played the fewest of his Tests

a. ✓ where  $\lambda z$  Khan est  $\lambda d$   $\lambda x$  [  $x$  play [ the  $d$ -few of his Tests ] ]

(55) Tell me all the places where KHAN has played his fewest Tests

a. # where  $\lambda z$  Khan est  $\lambda d$   $\lambda x$  [  $x$  play [ the [ of him ]  $d$ -few Tests ] ]

Finally, as a reminder, the pragmatic approach does not predict any contrast between (54) and (55), insofar as it cannot generate a sloppy reading in either case. This is obviously bad, since (54) does have a sloppy reading, equivalent to the meaning of the LF in (54a). However, restrictionist theories do predict the contrast in (53); precisely because they cannot naturally generate sloppy readings, they predict that when a bound possessive superlative is felicitous (which, again, they cannot in and of themselves explain) it must be interpreted strictly. Thus an *in situ* account will only generate a reading corresponding to (53a), as appropriate.

#### 4.3.4 Summary of challenges

Here are the conclusions that I draw from the discussion in Section 4.3. Restrictionist approaches to relative readings have a lot of trouble with sloppy pronouns in definite descriptions. In contrast,

theories that generate relative readings by covertly moving the superlative morpheme derive both strict and sloppy readings without any ado (though strict readings require sufficiently unrestricted scope-taking of constant elements).

Without further assumptions, both approaches overgenerate relative readings in possessive descriptions. However, under the reasonable hypothesis that such descriptions present barriers to scope-taking, scopal approaches can be reigned in. It is not clear what analogous assumption would prevent contextual domain restriction from applying in these cases.

Under the additional, independently motivated hypothesis that bound pronouns in subject positions neutralize island constraints (Grano & Lasnik 2016), scopal approaches can also explain why relative readings of possessive descriptions are possible when the possessor is a bound pronoun, but not when the possessor is a lexical item. Again, it is not clear what pragmatic difference between these classes of possessives would account for their different capacity to be contextually restricted by coindexation with focus or otherwise.

Finally, theories that derive relative readings from the scope of the superlative morpheme itself cannot straightforwardly account for the absence of sloppy possessive descriptions, given the availability of non-focus-correlated relative readings from underneath a bound possessor. Focus-sensitive *in situ* theories *can* account for this, as a result of the same mechanisms that (inappropriately) prevent sloppy readings within definite descriptions.

#### 4.4 Analysis

The theoretical lessons I take from these conclusions are (i) that the nominal complement of a superlative in a definite description ought to have a semantic effect on the comparison class that the superlative quantifies over, and *no other semantic effect*. This is exactly what the scopal superlative theories deliver; when the superlative morpheme takes scope over (or just under) a DP-external correlate, the content of the nominal is included, along with the continuation of the correlate, in the denotation of the property that the superlative uses to compare alternatives. Since the superlative

dominates the tree, that nominal is not otherwise interpreted, so there is no strict binding leakage, as in the pragmatic theories. And (ii) the determiner content should not have any corresponding semantic effect on the comparison class. That is, when the superlative takes scope from a possessive description, it ought not to treat the possessor as part of the content that builds up the measuring property, and thus not as something that can be sloppily bound by other elements in the sentence.

In other words, the binding facts from definite descriptions strongly suggest that the scopal analyses are correct in deriving the superlative's comparison class from its scope, and in scoping the superlative *without* the nominal content of its description. However, the binding facts from possessive descriptions suggest that while the NP-level content ought to remain *in situ* when the superlative moves into the clause, the determiner-level content ought to move with it. In other words, the determiner (and its arguments) ought to be evaluated exactly when the superlative is evaluated.

#### 4.4.1 Determining adjectival scope

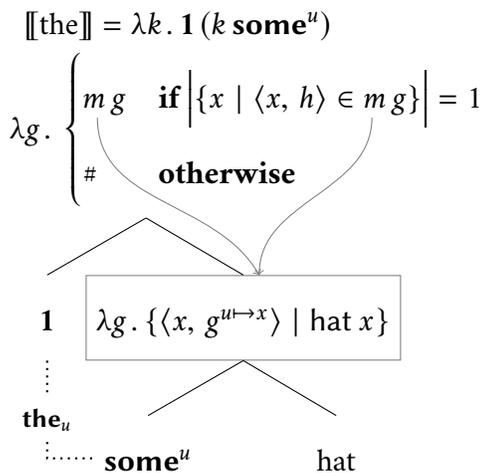
Questions of the exact constituency and syntax of possessives are beyond the scope of this thesis, but to demonstrate the sort of analysis that might consistently account for the definite and possessive facts simultaneously, I will extend Chapters 2 and 3. There it was argued that for reasons completely independent of quantificational adjectives, it is useful to think of the definite determiner as decomposed into semantically modular referent-introducing and referent-counting components. For instance, according to Chapter 2,  $\llbracket$ the hat $\rrbracket$  will denote two distinct operations, one that allocates a discourse referent constrained by the content of the nominal 'hat', and another that searches across all possible assignments of that referent to objects in the world to test that there is no uncertainty about which entity the description might refer to.

Formally, the decomposition is represented as a kind of split-scope effect, in which the non-deterministic referent generating component takes lower scope than the cardinality testing component. This effectively conceives of the definite article as a higher-order dynamic generalized quantifier, as in Charlow's (2017a) analysis of the cumulative readings of modified numerals. The principle motiva-

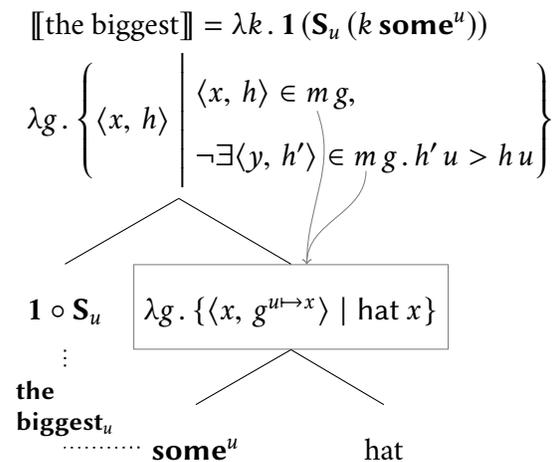
tion for decomposing definiteness in this way comes from cases where another operator intervenes between the introduction of the referent and the counting of its possible witnesses. If that operator has dynamic effects on the set of assignments that successfully embed the utterance in the model, then it can influence what the cardinality operator of the definite quantifies over, amounting to a kind of compositional domain restriction of the definite. In such instances, the scopes of two dynamic sub-computations of the article are split by the third operator.

As seen in Chapter 2, the same intervention processes that split definites will generate relative readings of superlatives. Looking at the representations in (56) and (57), both the uniqueness test of the definite and the superlative adjective act as filters on dynamic outputs. So any effectful operation that intervenes between the generation of the potential witnesses and the subsequent counting of them will also intervene between their generation and subsequent degree-property comparison.

(56) a. the hat



b. the biggest hat



Chapter 3 argues that one of the operations that can intervene between the existential and quantificational components of a description is the introduction of focus alternatives. Thus the sentence in (57) is ambiguous. If the definite and superlative operations of the object description are evaluated immediately after the referent is introduced, then the sentence entails the existence of single goal better than all the others, and asserts that Mary is among those who scored it. If however, those op-

erations are delayed until such time as the focus alternatives have added new constraints to the set of embedding assignment functions, then the superlative quantifies only over goals *that were scored by an alternative to Mary*. The sentence then asserts merely that *of these* goals, it was Mary in fact who scored the best.

(57) MARY scored the best goal

Notice that as in Chapter 3, and in contrast to Chapter 2, the uniqueness test associated with the definite is not indexed to the indefinite. At the same time, to drive home the parallels between definites and focus, I have reverted to Chapter 2's representation of cardinality tests as filters on updates, rather than filters on dynamic properties. That is,  $\mathbf{1}$  and  $\mathbf{S}_u$  are functions that map updates to updates, of type  $(\sigma \rightarrow \{\alpha * \sigma\}) \rightarrow \sigma \rightarrow \{\alpha * \sigma\}$ , not functions that map properties to properties, of type  $(e \rightarrow \sigma \rightarrow \{\alpha * \sigma\}) \rightarrow e \rightarrow \sigma \rightarrow \{\alpha * \sigma\}$ . The reason that these operations were typed as functions on properties in Chapter 3 was that there, a focus phrase's continuation was used as a proxy for the alternative-evoking component of its meaning. This continuation was then therefore the input to the superlative and definiteness tests, and so those were lifted accordingly. Here however, thanks to the dynamic decomposition of focus presented in the next section, the simpler representation of cardinal modifiers as filters on updates will suffice. The two approaches will be synthesized in Chapter 5.

Regardless of how these filters are defined, what is important for the present set of facts is that this technique separates the contribution of the quantificational adjective from that of the nominal it modifies, but lumps it together with the force of the determiner. The adjective, despite its quantificational semantics, does not take scope on its own. It can't. Denotationally, it acts as a filter over dynamic outputs, which simply isn't the sort of type that would allow it to leave a trace that would compose with the rest of the DP. It is stuck where it is, restricting the NP, *unless* the determiner itself picks it up and suppresses it. This is possible because the superlative has precisely the same type as the uniqueness test of the determiner itself, and thus can compose with that test to form a pipeline of filters that post-process dynamic updates.

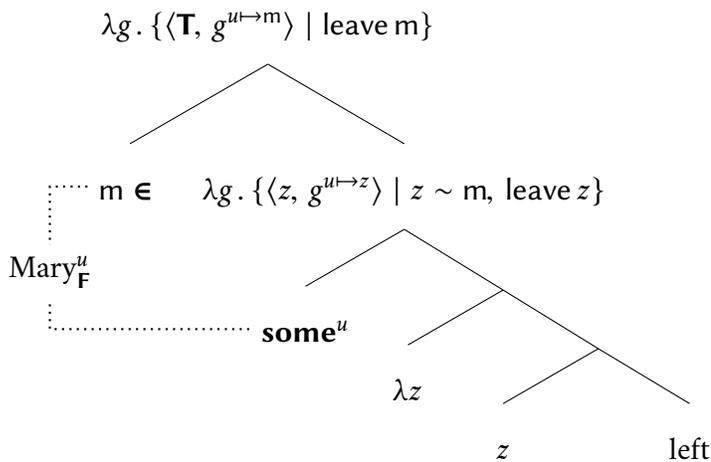
#### 4.4.2 Dynamic split-scope focus

As a first step in situating the split-scope superlative approach to the data in Section 4.2, I develop a dynamic decompositional version of focus that generalizes the effect it has in Chapter 3. In that chapter, simple QR of the focused phrase created a semantic division between the denotation of the focus and the denotation of its remnant in the sentence that approximated the division in definites between the alternative-generating indefinite component and the alternative-filtering cardinal component. In this section, the parallel is formalized. The semantics for focus-marking is given in (58), and its effect illustrated by the LF in (58b).<sup>7</sup>

$$(58) \text{ a. } \llbracket x_F^u \rrbracket := \lambda k. \llbracket x \rrbracket \in k (\lambda P. \mathbf{some}^u (\lambda z: z \sim \llbracket x \rrbracket. P z)),$$

$$\mathbf{where } x \in m \equiv \lambda g. \{ \langle \mathbf{T}, h \rangle \mid \langle x, h \rangle \in m g \}$$

b. MARY left



In the first phase of the focus calculation, alternatives to Mary are considered with respect to whether or not they left. The update at this node in the computation includes one output for each of the alternatives that did in fact leave. In the second phase, those outputs that are not about Mary are

<sup>7</sup> It is not obvious how this particular implementation of focus decomposition could be intensionalized. Ideally, it would not be the truth value  $\mathbf{T}$  that replaces any alternative recognizing Mary as a leaver, but rather the proposition that Mary left. But the only information available to the second step of the focus computation is a set of individuals, the actual leavers, not the property which they are asserted to have partaken in. The official fragment in Chapter 5 will take more care to maintain the semantic separation between the focus value and focus background, and will therefore have no such trouble generalizing.

discarded. If Mary is among the leavers — i.e., if she did leave — then any output generated while she was the alternative under consideration will remain, together with the truth value celebrating her departure. If she is not, then there will be no outputs, a guarantee of downstream falsity in dynamic semantics.

The denotation at the root of the tree is minimally different from what it would have been without any focus marking at all (in the case that Mary stayed, the unfocused expression would include a single output with the value **F**, rather than no outputs at all; the two updates amount to the same truth conditions).<sup>8</sup> It is the difference between asking whether Mary left, and asking whether Mary is among those who left, calculated in two steps. The more involved calculations of the latter derivation can explain the pragmatic markedness of focusing the subject vis-à-vis an intonationally neutral utterance, but without any truth conditional difference, there isn't any justification for the decomposition. That justification comes from derivations in which an operator steals the alternatives introduced by the focus, and of course here the operator that I will concentrate on is the superlative.

### 4.4.3 Superlatives and possessives as filters

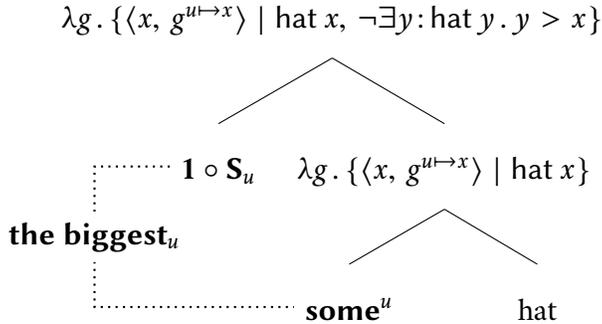
The next decision to make is on denotations for superlatives and possessives. I will follow Chapter 2 in analyzing superlatives as filters on outputs. The denotation in (59a), for example, reads in an update, and throws out any alternatives whose  $u$ th coordinate is dominated in size by the  $u$ th coordinate of any other alternatives. In other words, it selects the biggest witnesses for the description out of the entities that are still live candidates to serve as referents. If the superlative is evaluated when no other information constrains the set of output assignments except for that contained in the nominal, then the superlative description will produce a standard absolute reading of the phrase, as sketched in (59b).

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<sup>8</sup> I am being a bit two-faced about how we should think of  $\lambda g. \{ \}$  in dynamic semantics. In Chapter 2, this degenerate update is understood to represent failure in the presuppositional sense of failing to encode a meaningful update. Here however it represents mere falsity, i.e., the failure to find a successful embedding into the model. If we were committed to the former interpretation, this semantics would technically predict that (58b). Again, the fragment in Chapter 5 will not make this prediction.

$$(59) \text{ a. } \llbracket \text{biggest}_u \rrbracket := \lambda m g. \left\{ \langle a, h \rangle \left| \begin{array}{l} \langle a, h \rangle \in m g, \\ \neg \exists \langle \beta, h' \rangle \in m g. h' u > h u \end{array} \right. \right\}$$

b. the biggest hat



If, on the other hand, the definite-superlative complex takes scope over some larger constituent, it will be possible for the superlative to end up quantifying not over all hats whatsoever, but only those that meet some further set of constraints imposed by the surrounding sentence. That said, it is important to point out that in almost all cases, the scope of the superlative will not have any truth-conditional effect. This is because the superlative quantifies over *side effects* of the computation; it looks at all of the *outputs* across all of the alternatives in play and if need be, throws some of them away. In this monadic dynamic semantics, most operations do not reduce or even change the set of alternatives under consideration. They merely alter the value component of the update.

It is in fact only when scoping out of the restrictor of another indefinite that a superlative's quantificational domain will be affected. The paradigm case of this is when a superlative description is embedded in another description, as in (60). The indefinite component of the outer definite itself discards any alternatives in which a potential hat referent isn't inhabited by any rabbits (because the only outputs it *can* generate are those that have rabbits in them, together with the hats that they're in, respectively). Chapter 2 discusses such examples at length.

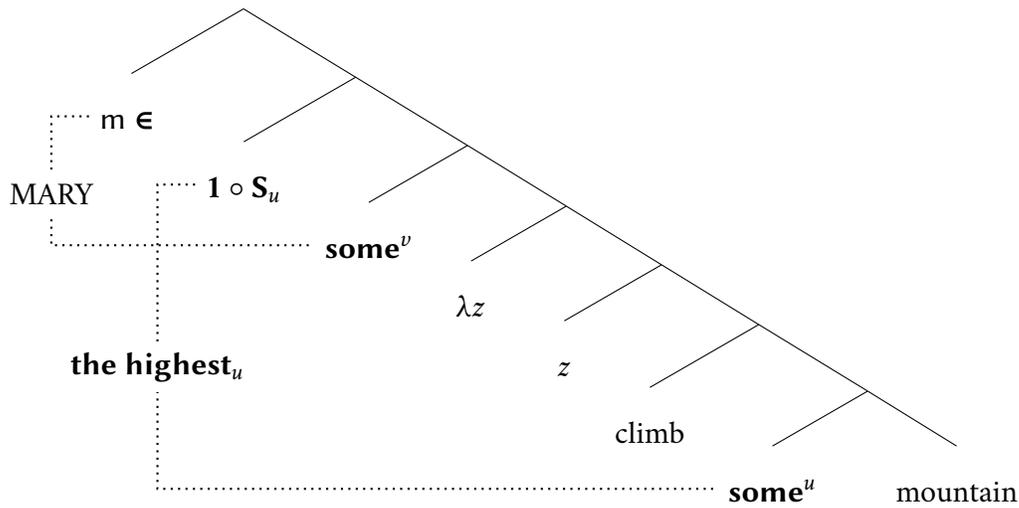
(60) the rabbit in the biggest hat

a. ✓ the rabbit in a bigger hat than any other rabbit is in

Crucially for present purposes, focus marking also generates structures in which a superlative may find itself in the restrictor of an indefinite, namely, the indefinite component of the focus. In this case, if the superlative takes scope above the focus alternatives, it will only consider the values that managed to survive the focus-marker's own test.

Take (61), for example. Assuming that the determiner takes scope, and takes the superlative with it, the object will locally introduce a discourse referent mapped nondeterministically to a mountain. The verb and trace of the focused subject will convert those alternative referents into alternative truth values, one for each mountain, true if  $z$  climbed the mountain in question. Then, in the first pass of the focus computation, each of these mountain-driven alternatives will be supplemented with an alternative to Mary who did in fact climb that mountain. As a result, any initially hypothesized mountains that turn out not to have been climbed by anyone will be discarded from the set of output assignments. At this point, the superlative quantifies over the remaining outputs, filtering out those that do not choose the highest of all the still live candidate mountains. The definite then ensures uniqueness of the *value* at each alternative, which at this point amounts to checking that only a single person climbed any of the highest climbed mountains. Finally, the second pass of the focus computation queries the update, and returns  $\mathbf{T}$  if Mary is among those most successful climbers (together with outputs mapping  $u$  to Mary's highest mountains), or the empty set otherwise.

(61) MARY climbed the highest mountain



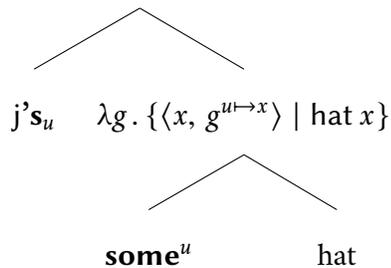
Taking inspiration from this, let the denotation of the possessive determiner be as in (62a). Given a possessor  $z$ , the determiner returns a higher-order dynamic quantifier, just like the definite article. But rather than running a uniqueness test on the candidate witnesses for the description, the possessive suffix runs a filter over outputs, exactly like a superlative. It discards any alternatives that do not map  $u$ , the index associated with its description, to an entity related to the possessor. Following Barker (1995), I use  $\Pi$  to represent the underspecified, contextually variable possession relation.

(62) a.  $\llbracket z's \rrbracket = \lambda k. \llbracket z \rrbracket's_u (k \text{ some}^u)$

b.  $\cdot's_u = \lambda zmg. \{ \langle \alpha, h \rangle \mid \langle \alpha, h \rangle \in mg, \Pi(hu)z \}$

c. John's hat

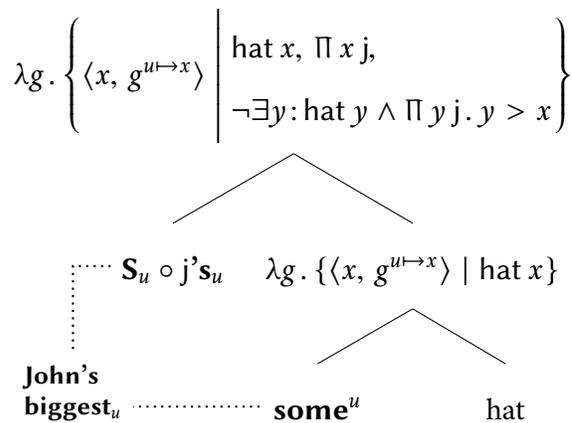
$\lambda g. \{ \langle x, g^{u \mapsto x} \rangle \mid \text{hat } x, \Pi x j \}$



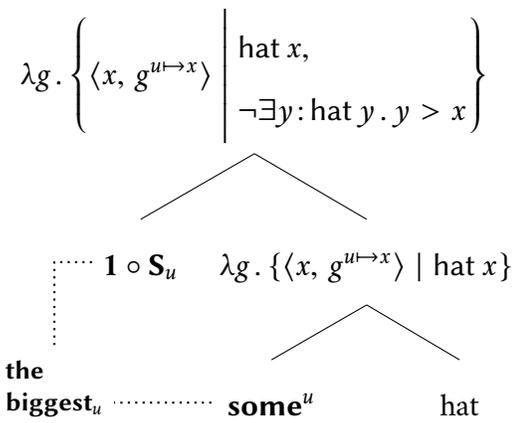
Thus the derivation in (62c) proceeds in two stages. In the first stage, as always, a set of potential referents is assembled, each stored in an alternative, located at a particular address  $u$  on the assignment. At this stage, the alternatives are constrained only by the descriptive content of the nominal, so in the case of (62c), only by the requirement that  $u$  be mapped to a hat. In the second stage, the possessive component of the higher-order determiner filters out any outputs that do not map  $u$  to something of *John's*. At the end of the steps then, what remains are all of the ways of assigning  $u$  to one of John's hats.<sup>9</sup>

Finally, I assume that as with the definite article, the possessive determiner may form a constituent with any superlative or appropriately typed quantificational adjective it abuts, in which case it will deploy that adjective as an additional test over outputs. Compare the derivations in (63a,b).

(63) a. John's biggest hat



b. the biggest hat



The one kink here is that the possessive filter strongly prefers to scope beneath its quantificational adjective, while of course the unicity test of the definite article does not kick in until after the adjective

<sup>9</sup> Per Coppock & Beaver (2015) and many before them, there is no semantic requirement for unicity associated with the possessive determiner, but the modularity of the dynamic tests associated with these higher-order operators makes it especially easy to add it. We just pass the outputs through the **1** test after filtering them through the possessive (and perhaps a superlative):

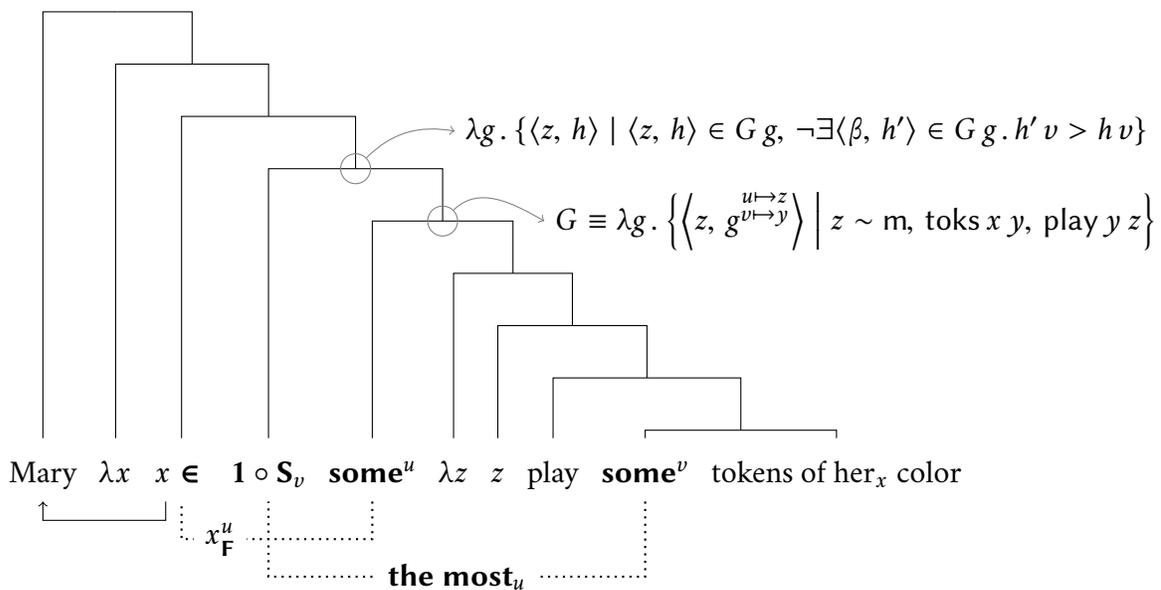
(i)  $\llbracket z's \rrbracket = \lambda k. \mathbf{1}(\llbracket z \rrbracket^s \mathbf{s}_u (k \text{ some}^u))$

has taken its toll on alternatives. Hence the  $S_u \circ j's_u$  ordering of filter composition in (63a) and  $1 \circ S_u$  order in (63b).

#### 4.4.4 Deriving strict and sloppy relative readings

With these pieces in place, strict and sloppy readings emerge essentially exactly as they do in traditional scope-taking analyses. Recall that on its strict reading, (64) entails that of all the people who played tokens of Mary's color, Mary played the most. The subject raises away from the focus position to bind the pronoun. And the superlative uses the subject's trace as a correlate to generate a comparison class. It compares those individuals with respect to its delimited continuation.

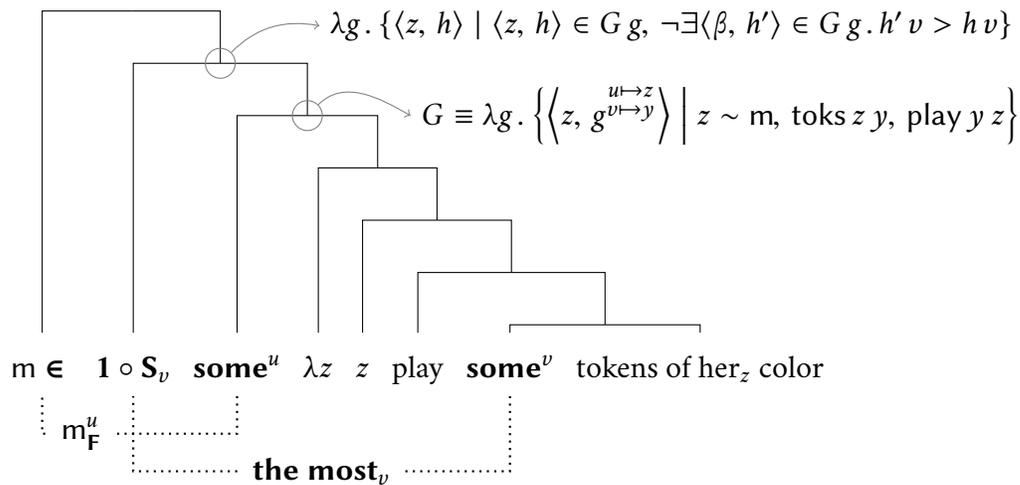
(64) MARY played the most tokens of her color *Strict*



On its sloppy reading, (65) entails that Mary played more of her own colored tokens than anybody else played of their own colored tokens. In other words, it compares players with respect to their record with their personal tokens rather than their record with Mary's tokens. This reading is derived by binding the pronoun to the variable controlled by the focus operator's indefinite component.

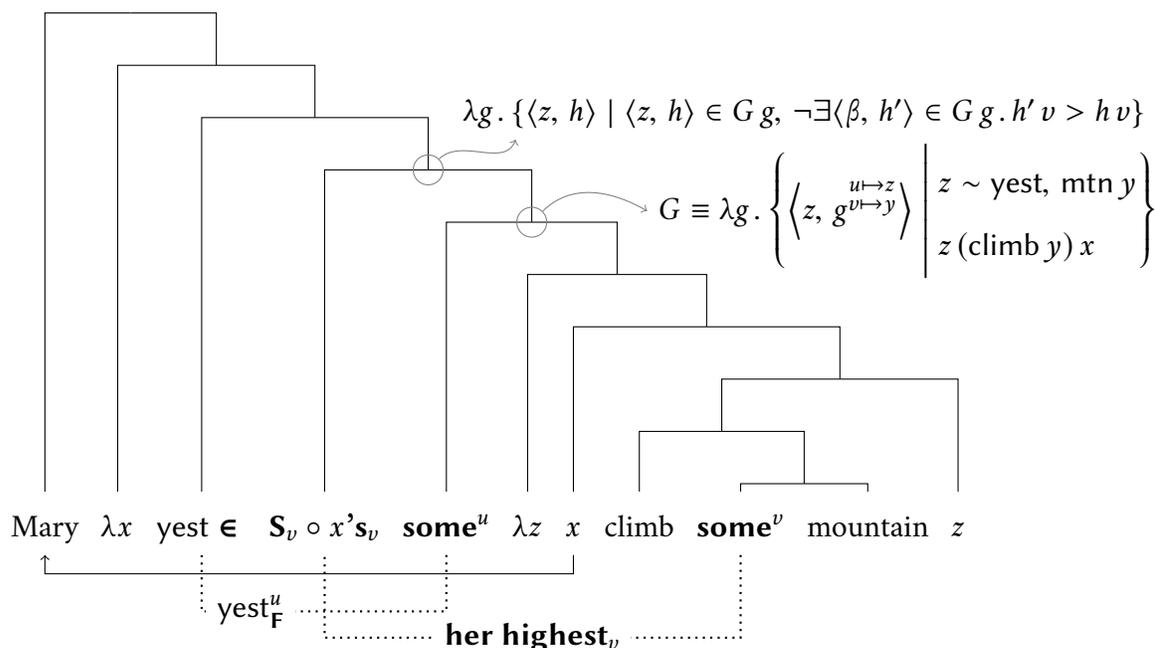
(65) MARY played the most tokens of her color

Sloppy



And just like other Heimian treatments of superlatives, relative readings are derivable whenever the DP does not present a barrier to movement. For instance, to the extent that a bound pronoun in the subject position will relax the usual islandhood of the DP, relative readings are predicted. In (66), the focused adverb ‘YESTERDAY’ generates a set of alternative times  $z$  by which to evaluate the property of Mary’s climbing some mountain at time  $z$ . The possessive and superlative raise to steal those alternatives derived by abstracting over the adverbial, and compare them with respect to the sizes of mountains that Mary climbed (if any) at those times. The possessive throws away any outputs with mountains not contextually related to Mary, and the superlative further throws away any outputs with Mary-climbed mountains that are not as high as some Mary-climbed mountains in other remaining alternatives.

(66) Mary climbed her highest mountain YESTERDAY



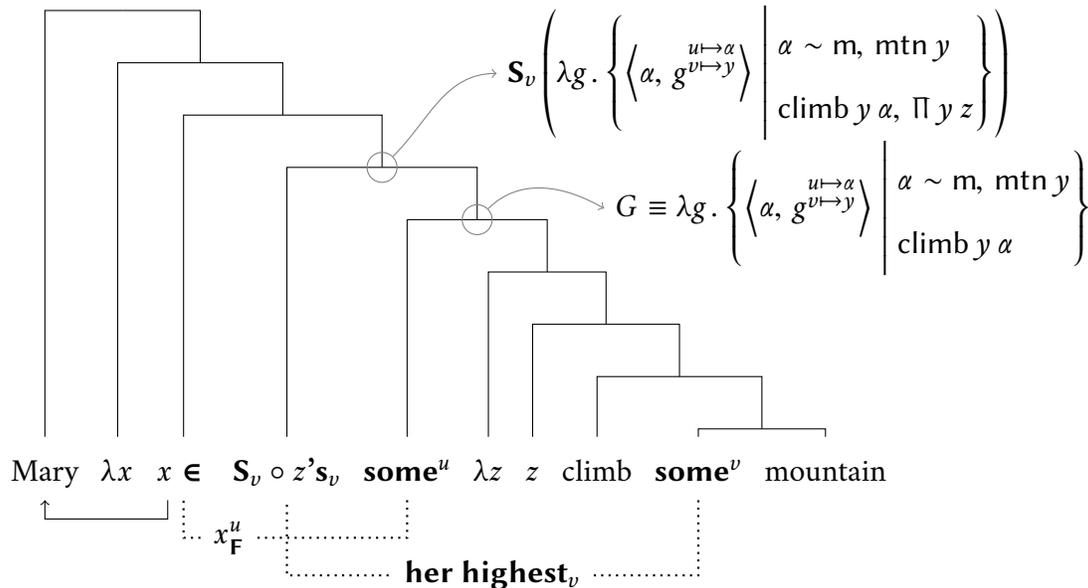
In the final phase of the focus computation, the remaining alternatives — those with mountains on them that  $x$  climbed at time  $z$  such that at no time other than  $z$  did  $x$  climb as high a mountain — are inspected to determine whether yesterday made the cut. Finally  $x$  is instantiated to Mary in all of the alternatives, as both the subject of the climbing and the “possessor” of the mountains.

#### 4.4.5 The absence of sloppiness in possessives

Lastly, in contrast to standard scope-taking theories of superlatives, the analysis here predicts that superlatives do not take scope alone. They do not take scope at all, in fact. They are *taken* by a delayed determiner, which is happy to add them to its list of “postsuppositional” requirements for a set of outputs. This predicts that when the scope-taking determiner contains a bound pronoun, then it will be impossible for the following two things to happen at once: (i) the superlative is interpreted relatively, that is, as quantifying over alternatives that have been restricted by focus; and (ii) the pronoun is interpreted sloppily, that is, as varying with the alternatives introduced by focus. The reason is that

these two things place contradictory demands on the scope of the determiner-superlative complex. Take the sentence in (67) as an example.

(67) MARY climbed her highest mountain



The derivation in (67) does *not* correspond to a sloppy reading of the sentence. That reading, which does not exist, would entail that Mary climbed a higher mountain of hers than anybody else did a mountain of theirs. Because the pronoun (and thus the set of mountains) would have to vary with focus alternatives, it has to be indexed to the variable that the focus indefinite introduces. But in order for the superlative to quantify over exactly those alternatives — in order to compare other climbers to one another — it has to outscope the very focus indefinite that the pronoun at its hip is indexed to. The result is a free reading of the pronoun, and thus a lexical possessive interpretation of the superlative DP. To be sure, there is nothing in the fragment presented here that rules out such a reading, but it runs afoul of the general prohibition against scope-taking out of fully referential possessive DPs. Remember, it is only because the pronoun is supposed to be bound in the first place that any relative reading is permissible at all. So scoping the superlative in such a way that it unbinds the pronoun presumably violates the otherwise robust terms and conditions of possessive islandhood.

More generally, attributing the superlative’s relative scope-taking ability to the independent scope-taking ability of the determiner — and, crucially, depriving it of the ability to take scope otherwise — thus predicts exactly what we saw in Section 4.2: there are no sloppy readings of superlative possessors. This, however, does not threaten the perfectly legitimate sloppy readings of definite descriptions, illustrated in (65), or of strict relative readings when the antecedent of the possessor is not the correlate.

#### 4.5 Conclusion

To wrap things up, let me return to the minimal quadruple of data points that launched this investigation. The primary things that I take (68)–(71) to illustrate are (i) bound pronouns in relative definite descriptions can in general be interpreted strictly or sloppily; (ii) the only possessive descriptions that license relative interpretations of quantificational adjectives are those with bound pronominal possessors; and (iii) nevertheless, relative adjectives never associate with the antecedent of their possessor, i.e., there are no sloppy readings of bound possessive superlatives, even though there are relative ones.

(68) MARY<sup>u</sup> has cited the most of her<sub>u</sub> students

- |   |   |  |
|---|---|--|
| a. $\checkmark \forall z \neq m. D z m < D m m$ | } | where $D \equiv \lambda x \lambda y. \max \{n \mid x \text{ cited } n \text{ of } y\text{'s students}\}$ |
| b. $\checkmark \forall z \neq m. D z z < D m m$ |   |  |

(69) \*MARY<sup>u</sup> has cited his<sub>v</sub> most students

- a.  $\# \forall z \neq m. D z g_v < D m g_v$ , where  $D \equiv \lambda x \lambda y. \max \{n \mid x \text{ cited } n \text{ of } y\text{'s students}\}$

(70) \*MARY<sup>u</sup> has cited her<sub>u</sub> most students

- |   |   |  |
|---|---|--|
| a. $\# \forall z \neq m. D z m < D m m$ | } | where $D \equiv \lambda x \lambda y. \max \{n \mid x \text{ cited } n \text{ of } y\text{'s students}\}$ |
| b. $\# \forall z \neq m. D z z < D m m$ |   |  |

(71) GLOSSA is where Mary<sup>u</sup> has cited her<sub>u</sub> most students

a.  $\checkmark \forall z \neq g. D z m < D g m$ , where  $D \equiv \lambda x \lambda y. \max \{n \mid M \text{ cited } n \text{ of } y\text{'s students in } x\}$

The contribution of this article has been twofold. First, concerning existing analyses of relative readings, the short story is that pragmatic theories of superlatives cannot readily account for the sloppy reading of (68), or the lack of a relative reading in (69), and to the extent that they can, they cannot distinguish between (68) and (70); scopal theories on the other hand generate the right readings for (68), but overgenerate in the case of (69) and (70). The latter can plausibly accommodate independently motivated island patterns to explain these latter two facts, but only at the expense of giving up (71).

In a little more detail, I have argued that contextualist and pragmatic accounts of relative readings face a great deal of difficulty in deriving sloppy readings of definite descriptions, like (68b), where scopal treatments take them in stride. Both kinds of theories overgenerate relative readings in possessive descriptions without some further stipulation. For scope-taking treatments, the obvious stipulation is that possessive DPs are scope islands. It is not clear what the corresponding stipulation for pragmatic theories ought to be. Furthermore, given independent observations about the influence of subject pronouns on scope islands, scope-taking treatments can explain the re-emergence of relative readings in (71), despite the possessive structure. Again, what the pragmatic difference could be between (69) and (71) is not clear. Yet, even if bound pronouns neutralize the possessive scope island, any theory that attributes the comparison class of the superlative to the scope of the superlative morpheme by itself will overgenerate relative readings in (70).

Second, to address this last overgeneration issue with scope-taking theories, I offered an extension of the split-scope analysis of descriptions proposed in Chapters 2 and 3 that treats possessive determiners in the same mold as definites and focus-marking. In particular, the hypothesis that quantificational adjectives acquire relative scope by piggybacking on the delayed evaluation of a determiner immediately predicts the absence of sloppy relative readings in possessive DPs, while maintaining a familiar scopal account of strict and sloppy effects in definite descriptions.

## Chapter 5

### Putting the pieces together

#### 5.1 The Kleene store monad for focus-marking

Let  $\overset{n}{\mathbb{F}}\varphi\alpha$  abbreviate the following data type:  $\overset{n}{\mathbb{F}}\varphi\alpha := \langle \vec{\varphi}^n, \vec{\varphi}^n \rightarrow \alpha \rangle$ . At an index  $n$ ,  $\overset{n}{\mathbb{F}}\varphi\alpha$  pairs a vector of  $n$  objects of type  $\varphi$  with a function from  $n$  objects to a result of type  $\alpha$ . Given this, a constituent of type  $\alpha$  containing  $n$  focused phrases of type  $\varphi$  will have the type  $\overset{n}{\mathbb{F}}\varphi\alpha$ . This is a slight generalization of the representation that, e.g., [Krifka \(1989\)](#) assigns to focus-containing constituents. In the functional programming literature, this type has been referred to as a Kleene store. I don't know what Kleene has to do with it.

Something that I think has never been pointed out, is that in a metatheory with dependent types, this data structure forms a monad. For the definition and proof, let me offer the following notational conventions for manipulating vectors:

$$\begin{array}{l}
 \pi_i \langle z_0, z_1, \dots, z_n \rangle := z_{i-1} \\
 \langle z_0, z_1, \dots, z_n \rangle_{-i} := \langle z_0, z_1, \dots, z_{i-1} \rangle \\
 \langle z_0, z_1, \dots, z_n \rangle_{i-} := \langle z_i, z_{i+1}, \dots, z_n \rangle \\
 \langle u_0, \dots, u_i \rangle \cdot \langle v_0, \dots, v_j \rangle := \langle u_0, \dots, u_i, v_0, \dots, v_j \rangle
 \end{array}
 \qquad
 \begin{array}{l}
 \text{If } f \text{ is a function from } n\text{-tuples, and } i \leq n, \\
 f \odot \vec{x}^i := \begin{cases} f & \text{if } i = 0 \\ \lambda \vec{z}^{n-i}. f(\vec{x}^i \cdot \vec{z}^{n-i}) & \text{otherwise} \end{cases}
 \end{array}$$

With this in place, here are operations that define a monad over Kleene stores:

$$\begin{array}{l}
 \text{H} :: \forall \alpha. \alpha \rightarrow \overset{0}{\mathbb{F}}\varphi\alpha \\
 (\star) :: \forall \alpha, \beta. \overset{i}{\mathbb{F}}\varphi\alpha \rightarrow \left( \alpha \rightarrow \overset{j}{\mathbb{F}}\varphi\beta \right) \rightarrow \overset{i+j}{\mathbb{F}}\varphi\beta \\
 \text{H}x := \langle \vec{\emptyset}^0, x \rangle \\
 \langle \vec{x}^i, f \rangle \star k := \langle \vec{x}^i + \pi_1(k(f \odot \vec{x}^i)), \lambda \vec{z}^{i+j}. \pi_2(k(f \odot \vec{z}_i^i)) \odot \vec{z}_i^{-j} \rangle
 \end{array}$$

Proof that  $\langle \mathbb{F}^n \varphi, H, \star \rangle$  is a monad

Left Identity:

$$Hx \star k$$

$$= \langle \vec{\emptyset}^0, x \rangle \star k$$

$$= \left\langle \begin{array}{l} \vec{\emptyset}^0 + \pi_1(k(x \odot \vec{\emptyset}^0)), \\ \lambda \vec{z}^{0+j} \cdot \pi_2(k(x \odot \vec{z}^{-0})) \odot \vec{z}_0^{-j} \end{array} \right\rangle$$

$$= \langle \pi_1(k(x \odot \vec{\emptyset}^0)), \lambda \vec{z}^j \cdot \pi_2(k(x \odot \vec{\emptyset}^0)) \odot \vec{z}^j \rangle$$

$$= \langle \pi_1(kx), \lambda \vec{z}^j \cdot \pi_2(kx) \odot \vec{z}^j \rangle$$

$$= \langle \pi_1(kx), \pi_2(kx) \rangle$$

$$= kx$$

Right Identity:

$$\langle \vec{x}^i, f \rangle \star H$$

$$= \langle \vec{x}^i + \pi_1(H(f \odot \vec{x}^i)), \lambda \vec{z}^{i+0} \cdot \pi_2(H(f \odot \vec{z}_i^{-i})) \odot \vec{z}_i^{-0} \rangle$$

$$= \left\langle \begin{array}{l} \vec{x}^i + \pi_1(\langle \vec{\emptyset}^0, f \odot \vec{x}^i \rangle), \\ \lambda \vec{z}^i \cdot \pi_2(\langle \vec{\emptyset}^0, f \odot \vec{z}_i^{-i} \rangle \odot \vec{z}_i^{-0}) \end{array} \right\rangle$$

$$= \langle \vec{x}^i + \vec{\emptyset}^0, \lambda \vec{z}^i \cdot f \odot \vec{z}_i^{-i} \odot \vec{z}_i^{-0} \rangle$$

$$= \langle \vec{x}^i, \lambda \vec{z}^i \cdot f \odot \vec{z}^i \odot \vec{\emptyset}^0 \rangle$$

$$= \langle \vec{x}^i, \lambda \vec{z}^i \cdot f \odot \vec{z}^i \rangle$$

$$= \langle \vec{x}^i, f \rangle$$

Associativity:

$$(\langle \vec{x}^i, f \rangle \star \gamma) \star c$$

$$= \left\langle \begin{array}{l} \vec{x}^i + \pi_1(\gamma(f \odot \vec{x}^i)), \\ \lambda \vec{y}^{i+j} \cdot \pi_2(\gamma(f \odot \vec{y}_i^{-i})) \odot \vec{y}_i^{-j} \end{array} \right\rangle \star c$$

$$= \left\langle \begin{array}{l} \vec{x}^i + \pi_1(\gamma(f \odot \vec{x}^i)) + \pi_1(c(\pi_2(\gamma(f \odot \vec{x}^i)) \odot (\pi_1(\gamma(f \odot \vec{x}^i))))), \\ \lambda \vec{z}^{i+j+k} \cdot \pi_2\left(c\left(\pi_2(\gamma(f \odot \vec{z}_i^{-i})) \odot \overrightarrow{(z_{-(i+j)})_i^j}\right)\right) \odot \overrightarrow{z_{(i+j)}^{-k}} \end{array} \right\rangle$$

$$\langle \vec{x}^n, f \rangle \star \lambda b \cdot \gamma b \star c$$

$$= \langle \vec{x}^n, f \rangle \star \lambda b \cdot \left\langle \begin{array}{l} \pi_1(\gamma b) + \pi_1(c(\pi_2(\gamma b) \odot (\pi_1(\gamma b)))), \\ \lambda \vec{y}^{j+k} \cdot \pi_2(c(\pi_2(\gamma b) \odot \vec{y}_j^{-j})) \odot \vec{y}_j^{-k} \end{array} \right\rangle$$

$$= \left\langle \begin{array}{l} \vec{x}^i + \pi_1(\gamma(f \odot \vec{x}^i)) + \pi_1(c(\pi_2(\gamma(f \odot \vec{x}^i)) \odot (\pi_1(\gamma(f \odot \vec{x}^i))))), \\ \lambda \vec{z}^{i+j+k} \cdot \pi_2\left(c\left(\pi_2(\gamma(f \odot \vec{z}_i^{-i})) \odot \overrightarrow{(z_{i-})_j^j}\right)\right) \odot \overrightarrow{(z_{i-})_j^{-k}} \end{array} \right\rangle$$

$$\begin{aligned} & \left( \langle z_0, \dots, z_i, \dots, z_{i+j}, \dots, z_{i+j+k-1} \rangle_{-(i+j)} \right)_i \\ &= \langle z_0, \dots, z_{i+j-1} \rangle_i \\ &= \langle z_i, \dots, z_{i+j-1} \rangle \\ &= \langle z_i, \dots, z_{i+j+k-1} \rangle_{-j} \\ &= \left( \langle z_0, \dots, z_i, \dots, z_{i+j}, \dots, z_{i+j+k-1} \rangle_{-j} \right)_{-j} \end{aligned}$$

$$\begin{aligned} & \langle z_0, \dots, z_i, \dots, z_{i+j}, \dots, z_{i+j+k-1} \rangle_{(i+j)-} \\ &= \langle z_{i+j}, \dots, z_{i+j+k-1} \rangle \\ &= \langle z_i, \dots, z_{i+j+k-1} \rangle_{-j} \\ &= \left( \langle z_0, \dots, z_i, \dots, z_{i+j}, \dots, z_{i+j+k-1} \rangle_{-j} \right)_{-j} \end{aligned}$$

## 5.2 Formal analysis

The formal fragment here exploits the continuized mode of composition championed by [Barker & Shan \(2014\)](#). The dynamic semantics is powered by the nondeterministic state monad developed in [Charlow 2014](#).

### 5.2.1 Notation

**Model Assumptions** Models consist of entities, relations, and functions. Model-theoretic stuff is displayed in sans-serif, so, e.g., `likes` is the function that takes two arguments and returns true if the one likes the other.

**Language and Metalanguage** Functions are characterized by lambda terms. Interior lambdas may be elided, so that  $\lambda x_0 \cdots x_n. M$  abbreviates  $\lambda x_0. \cdots \lambda x_n. M$ . Following [Barker & Shan 2014](#), some lambda terms are visualized using “towers”:  $\frac{\cdots [] \cdots}{T} \equiv \lambda k. \cdots (k T) \cdots$

**Bracketing Conventions** Function application is left associative. Parentheses are omitted, except where necessary for grouping. Dots separate variable-binding operators from the expressions they scope over, and have lower precedence than everything except for braces and slashes.

### 5.2.2 Grammar and combinatorics

#### 5.2.2.1 Types

**Type Constructors** Unary types include entities  $e$ , truth values  $t$ , and discourse contexts  $\sigma$  (modeled here as functions from variables to entities). Constructed types take one of the following forms, where  $\alpha$  and  $\beta$  are any two types:

- $\alpha \rightarrow \beta$ , the type of a function from  $\alpha$  to  $\beta$ .
- $\{\alpha\}$ , the type of a set of  $\alpha$  objects.
- $\alpha * \beta$ , the type of an  $\alpha$  object paired with a  $\beta$  object, in that order.

- $\vec{\alpha}^n$ , the type of a  $n$ -length vector of  $\alpha$  objects.

**Type Abbreviations** To keep type descriptions readable, I use the following type synonyms:

- $\mathbb{K}_{\rho} \alpha \equiv \alpha \rightarrow \mathbb{D} \rho$ , the type of continuations of from  $\alpha$  to  $\rho$
- $\mathbb{D} \alpha \equiv \sigma \rightarrow \{\alpha * \sigma\}$ , the type of updates on constituents of type  $\alpha$ .
- $\mathbb{G} \alpha \equiv \mathbb{K} \alpha t \rightarrow \mathbb{D} \alpha$ , the type of a dynamic indefinite determiner over properties of  $\alpha$  things.
- $\overset{n}{\mathbb{F}} \varphi \alpha \equiv \langle \vec{\varphi}^n, \vec{\varphi}^n \rightarrow \alpha \rangle$ , the type of a constituent of type  $\alpha$  carrying  $n$  focused elements of type  $\varphi$ .

**Type Classes** To enforce some discipline in the polymorphism surrounding the uniqueness test of the definite and the quantificational adjectives it takes as arguments, I define the following type classes.

- $\mathcal{T} \equiv \{\mathbb{D} t\} \cup \{\mathbb{K} \alpha \alpha \rightarrow \rho \mid \rho \in \mathcal{T}\}$ , the set of concrete types that can be existentially closed.
- $\mathcal{C} \equiv \{\mathbb{D}\} \cup \{\mathbb{K} \rho \mid \rho \in \mathcal{T}\}$ , the set of type constructors whose instances can be counted.

The notation  $m :: \alpha$  indicates that  $m$  is of type  $\alpha$ .

### 5.2.2.2 Scope

$$m \parallel n := \begin{cases} m n & \text{if } m :: \alpha \rightarrow \beta, n :: \alpha \\ \lambda k. m (\lambda f. n (\lambda x. k (f \parallel x))) & \text{otherwise} \end{cases}$$

$$m \parallel\!\! \parallel n := \begin{cases} n m & \text{if } n :: \alpha \rightarrow \beta, m :: \alpha \\ \lambda k. m (\lambda x. n (\lambda f. k (x \parallel\!\! \parallel f))) & \text{otherwise} \end{cases}$$

$$m \parallel\!\! \parallel n := \begin{cases} \lambda x. m x \wedge n x & \text{if } m :: \alpha \rightarrow \beta, n :: \alpha \rightarrow \beta \\ \lambda k. m (\lambda x. n (\lambda f. k (f \parallel\!\! \parallel x))) & \text{otherwise} \end{cases}$$

### 5.2.2.3 Focus

$$H :: \forall \alpha. \alpha \rightarrow \overset{0}{\mathbb{F}} \varphi \alpha$$

$$H x := \langle \vec{\emptyset}^0, x \rangle$$

$$(\star) :: \forall \alpha, \beta. \overset{i}{\mathbb{F}} \varphi \alpha \rightarrow \left( \alpha \rightarrow \overset{j}{\mathbb{F}} \varphi \beta \right) \rightarrow \overset{i+j}{\mathbb{F}} \varphi \beta$$

$$m \star k := \langle \vec{x}^i + \pi_1(k (f \circ \vec{x}^i)), \lambda \vec{z}^{i+j}. \pi_2(k (f \circ \vec{z}_{-i}^i)) \circ \vec{z}_{-i}^i \rangle$$

$$\text{where } \langle \vec{x}^i, f \rangle = m$$

### 5.2.2.4 Dynamics

$$\eta :: \forall \alpha. \alpha \rightarrow \mathbb{D} \alpha$$

$$\eta x := \lambda g. \{ \langle x, g \rangle \}$$

$$(\star) :: \forall \alpha, \beta. \mathbb{D} \alpha \rightarrow (\alpha \rightarrow \mathbb{D} \beta) \rightarrow \mathbb{D} \beta$$

$$m \star k := \lambda g. \bigcup \{ k x h \mid \langle x, h \rangle \in m g \}$$

$$\cdot^{\triangleright u} :: \mathbb{D} e \rightarrow \mathbb{D} e$$

$$m^{\triangleright u} := \lambda g. \{ \langle x, h^{u \rightarrow x} \rangle \mid \langle x, h \rangle \in m g \}$$

### 5.2.2.5 Evaluation

$$m^{\Downarrow} := \begin{cases} m \eta & \text{if } m :: (\alpha \rightarrow \mathbb{D} \alpha) \rightarrow \beta \\ m H & \text{if } m :: \left( \alpha \rightarrow \overset{n}{\mathbb{F}} \varphi \alpha \right) \rightarrow \beta \\ m (\lambda n. n^{\Downarrow}) & \text{otherwise} \end{cases}$$

$$m^{\Downarrow} := \begin{cases} m \eta & \text{if } m :: (\alpha \rightarrow \mathbb{D} \alpha) \rightarrow \beta \\ m H & \text{if } m :: \left( \alpha \rightarrow \overset{n}{\mathbb{F}} \varphi \alpha \right) \rightarrow \beta \\ \lambda k. m (\lambda n. k n^{\Downarrow}) & \text{otherwise} \end{cases}$$

$$m^{\Downarrow} := \lambda k. (m^{\Downarrow}) \star k$$

### 5.2.3 Fragment

#### 5.2.3.1 Auxiliary definitions

Item	Type	Denotation
$\sqcup_g$	$\forall \alpha: \mathcal{T} \alpha. \alpha \rightarrow t$	$\lambda \psi. \begin{cases} \bigvee \{p \mid \langle p, h \rangle \in \psi g\} & \text{if } \psi :: \mathbb{D} t \\ \sqcup_g \psi^\Downarrow & \text{otherwise} \end{cases}$
$\mathbf{1}$	$\forall \alpha, \mathbb{M}: \mathcal{C} \mathbb{M}. \mathbb{M} \alpha \rightarrow \mathbb{M} \alpha$	$\lambda \psi. \begin{cases} \lambda x g. \begin{cases} \psi x g & \text{if } \left  \{v \mid \sqcup_g(k v)\} \right  \leq 1 \\ \# & \text{otherwise} \end{cases} & \text{if } \psi :: \mathbb{K} \rho \alpha \\ \lambda g. \begin{cases} \psi g & \text{if } \left  \{x \mid \langle x, h \rangle \in \psi g\} \right  \leq 1 \\ \# & \text{otherwise} \end{cases} & \text{if } \psi :: \mathbb{D} \alpha \end{cases}$
$\$u^>$	$\forall \alpha. \mathbb{D} \alpha \rightarrow \mathbb{D} \alpha$	$\lambda m g. \{ \langle \alpha, h \rangle \in m g \mid \neg \exists \langle \beta, h' \rangle. (h u) > (h' u) \}$

#### 5.2.3.2 Lexicon

Item	Type	Denotation
$\mathbf{sm}^u$	$\forall \alpha. \mathbb{G} \alpha$	$\lambda c g. \{ \langle x, h \rangle \mid x \in \mathcal{D}_\alpha, \langle \mathbf{T}, h \rangle \in c x g^{u \mapsto x} \}$
$\mathbf{the}^u$	$\forall \alpha, \beta, \rho, \mathbb{M}: \mathcal{C} \mathbb{M}. (\beta \rightarrow \mathbb{M} \rho) \rightarrow (\mathbb{G} \alpha \rightarrow \beta) \rightarrow \mathbb{M} \rho$	$\lambda Y c. \mathbf{1} (Y (c \mathbf{sm}))$
$\mathbf{est}_u^>$	$\forall \alpha. \mathbb{K} t \alpha \rightarrow \mathbb{K} t \alpha$	$\lambda k x g. \{ \langle \mathbf{T}, h \rangle \mid \langle x, h \rangle \in \$u^> (\mathbf{sm} k) g \}$
$\mathbf{O}$	$\forall \alpha, \beta. \alpha \rightarrow \mathbb{K} \beta \alpha \rightarrow \mathbb{K} t \beta \rightarrow \mathbb{D} t$	$\lambda x k y g. \{ \{x\} = \{v \mid \sqcup_g(k v \star \gamma)\}, g \}$
$\cdot \mathbf{F}$	$\forall \alpha, \varphi. \varphi \rightarrow ((\mathbb{K} o \varphi \rightarrow \mathbb{K} o \varphi) \rightarrow \vec{\varphi}^1 \rightarrow \alpha) \rightarrow \mathbb{F} \varphi \alpha$	$\lambda x c. \langle \vec{x}^1, c (\lambda k y. k y) \rangle$
$\cdot \mathbf{s}_u$	$\forall \alpha, \beta. \beta \rightarrow \mathbb{K} o \alpha \rightarrow \mathbb{K} o \alpha$	$\lambda z k x g. \{ \langle y, h \rangle \mid \langle y, h \rangle \in k x g, \Pi (h u) z \}$
$\mathbf{prn}_u$	$\mathbb{D} e$	$\lambda g. \{ \langle g u, g \rangle \}$

I assume that the  $\Upsilon$  argument of the definite may be ignored, or perhaps saturated by a default identity function, when ‘the’ does not form a constituent with a quantificational adjective, yielding: **the**<sup>u</sup>  $(\lambda m . m) = \lambda \zeta . \mathbf{1} (\zeta \mathbf{sm})$ .

### 5.3 Derivations

#### 5.3.1 Cross-categorial ‘only’

The lexical entry for ‘only’ takes scope twice. After attaching to its first argument  $x$ , its correlate, it takes two higher-order arguments  $k$  and  $\gamma$ . The first of these is the immediate delimited continuation of its sister, the constituent containing the focused phrase it associates with. But in order to do the semantic work that the exclusive needs to do, ‘only’ eventually needs to quantify over a proposition, whether or not its sister is a propositional type. So it continues to swallow structure until it has enough information to see exactly which alternatives to its correlate make the Kleisli composition of its scopes true.

$$\mathbf{O} :: \forall \alpha, \beta . \alpha \rightarrow \mathbb{K} \beta \alpha \rightarrow \mathbb{K} t \beta \rightarrow \mathbb{D} t$$

$$\mathbf{O} := \lambda x k \gamma g . \left\{ \left\{ \{x\} = \left\{ v \mid \prod_g (k v \star \gamma) \right\}, g \right\} \right\}$$

Because the operator takes two higher-order arguments, and the first of these is usually the nuclear scope of another constituent (a focused phrase), it might be fair to characterize ‘only’ as taking recursive parasitic scope, which would put it in the same category of scope-takers as the functional adjective ‘same’ (Solomon 2009). I won’t stop to explore the connection, but I note it as potentially interesting. In this subsection, I demonstrate the flexibility of the recursive-scope approach in deriving sentences containing ‘only’ in a variety of positions and categories.

One stipulation that I would like to flag up front is that in order to unify the usual focus-sensitive uses of ‘only’ with its focus-insensitive adjectival uses, I will assume ‘only’ can pick up its first two arguments either one at a time, or as a pair. That is, I will use the operator  $\mathbf{O}$  in both its curried and uncurried form, as regards its first two arguments. So to some extent I admit, like everyone else, a

small amount of polysemy between the adjectival and other adpositional manifestations, but unlike everyone else, the difference between the two is not semantic. Its semantic arguments always come in the same order, from the same direction, and it always does the same thing with them. It's just that sometimes (when associating with focus), it gets the first two of them at once, and sometimes (when not associating with focus) it gets the first two of them one at a time.

Finally, let me point out that I will sometimes write  $\lambda g. \{\langle \dots \amalg_g \dots, g \rangle\}$  as  $\eta(\dots \amalg \dots)$  when nothing in the ellipses depends on  $g$ .

### 5.3.1.1 Various adpositional uses

The canonical use of 'only' is probably the adverbial use exemplified in below. Some object in the VP, in this case 'Sue' is focus-marked. This creates a bipartite structure splitting the ultimate  $\mathbb{F} \varphi e$  container type from the object's local gap, which feeds composition. The gap and the focus store scope over the rest of the verb phrase, in the usual way, until they meet the exclusive. At this point they are lowered and saturate the first two arguments of 'only'. Thanks to the recursive type, the result of this combination is another scope-taker, which then raises over the entire sentence, passing the subject into the property-type trace before lowering all the way down. When finally evaluated to completion at the clause boundary, the result is an update that returns  $\mathbf{T}$  iff the set containing Sue is equivalent to the set containing everyone that Bill introduced to Mary.

$$\llbracket \text{SUE} \rrbracket : \quad \text{s}_F = \frac{\langle s, [] \rangle}{\lambda y. []}$$

$$\llbracket \text{introduce Bill to SUE} \rrbracket : \quad \left( \frac{[]}{\text{intro}} \parallel \frac{[]}{b} \parallel \frac{\langle s, [] \rangle}{\lambda y. []} \right)^\Downarrow = \langle s, \lambda y. \eta(\text{intro } b \ y) \rangle$$

$\llbracket \text{only introduce Bill to SUE} \rrbracket :$

$$\mathbf{O} \langle s, \lambda y. \eta(\text{intro } b \ y) \rangle = \frac{\eta(\{s\} = \{v \mid [] \eta(\text{intro } b \ v) \star \lambda p. []\})}{p} = \frac{\eta(\{s\} = \{v \mid [] []\})}{\text{intro } b \ v}$$

$\llbracket \text{Mary only introduced Bill to SUE} \rrbracket :$

$$\left( \frac{[]}{m} \parallel \frac{\eta(\{s\} = \{v \mid [] []\})}{\text{intro } b \ v} \right)^\Downarrow = \eta(\{s\} = \{v \mid \text{intro } b \ v \ m\})$$

One very interesting thing about this derivation is that ‘only’ does not *by itself* take scope. It is not a propositional operator as in most other cross-categorial treatments (e.g., [Rooth 1985](#), [Beaver & Clark 2009](#)). Because it cannot take scope until it has collected its correlate, there is no chance of associating with a focus that it does not c-command. This correctly predicts the absence of backwards association with focus, as in (1), and sideward association with focus, as in (2).

- (1) The GREEN marble only fell off the table      (2) Only the green marble fell of the TABLE  
 a.  $\# \{ \text{green} \} = \{ p \mid \text{the } p \text{ marb fell off the table} \}$       a.  $\# \{ \iota \text{ table} \} = \{ v \mid \text{the green marb fell of } v \}$

Other kinds of adjunctions are quite similar to the VP-level derivation above. The double scope-taking means ‘only’ doesn’t need to pay attention to the type of the focal-continuation in its sister. I give two more examples here, just to illustrate the pattern.

$$\llbracket \text{only with SUE} \rrbracket : \mathbf{O} \left( \frac{[]}{\text{with}} \parallel \frac{\langle s, [] \rangle}{\frac{\lambda y \cdot []}{y}} \right)^\Downarrow = \mathbf{O} \langle s, \lambda y \cdot \eta(\text{with } y) \rangle$$

$$= \frac{\eta(\{s\} = \{v \mid \sqcup \eta(\text{with } y) \star \lambda p \cdot []\})}{p} = \frac{\eta(\{s\} = \{v \mid \sqcup []\})}{\text{with } v}$$

$\llbracket \text{Mary played only with SUE} \rrbracket :$

$$\left( \frac{[]}{m} \parallel \frac{[]}{\text{play}} \parallel \frac{\eta(\{s\} = \{v \mid \sqcup []\})}{\text{with } v} \right)^\Downarrow = \eta(\{s\} = \{v \mid \text{with } v \text{ play } m\})$$

$$\llbracket \text{only SUE} \rrbracket : \mathbf{O} \left( \frac{\langle s, [] \rangle}{\frac{\lambda y \cdot []}{y}} \right)^\Downarrow = \mathbf{O} \langle s, \lambda y \cdot \eta y \rangle = \frac{\eta(\{s\} = \{v \mid \sqcup (\eta v) \star \lambda y \cdot []\})}{y} = \frac{\eta(\{s\} = \{v \mid \sqcup []\})}{v}$$

$\llbracket \text{Mary introduced Bill to only SUE} \rrbracket :$

$$\left( \frac{[]}{m} \parallel \frac{\eta(\{s\} = \{v \mid \sqcup []\})}{\text{intro } b v} \right)^\Downarrow = \eta(\{s\} = \{v \mid \text{intro } b v m\})$$

Because ‘only’ is predefined to existentially close over the alternatives it picks up in its scopes, there is no issue combining with dynamically charged material. This is demonstrated below by attaching ‘only’ to an indefinite and then definite DP. At this point, one more stipulation: I assume that there are subject position gaps in the NPs of these constituents (Heim & Kratzer 1998: Ch. 8.5). This is not at all necessary for these DP-external calculations with ‘only’, but will play a role when we come to the higher-order adjectives.

$$\llbracket \text{a BLUE marble} \rrbracket : \left( \frac{\frac{[]}{\mathbf{sm}}}{\frac{[]}{\frac{[]}{\lambda x. []}} \parallel \frac{[]}{x}} \parallel \frac{\langle \text{blu}, [] \rangle}{\frac{[]}{\lambda p. []}} \parallel \frac{[]}{\frac{[]}{p}} \parallel \frac{[]}{\text{mrb}} \right)^{\Downarrow} = \langle \text{blu}, \lambda p. \mathbf{sm}(\lambda x. \eta((p \parallel \text{mrb}) x)) \rangle$$

$\llbracket \text{only a BLUE marble} \rrbracket :$

$$\mathbf{O} \langle \text{blu}, \lambda p. \mathbf{sm}(\lambda x. \eta((p \parallel \text{mrb}) x)) \rangle = \frac{\eta(\{\text{blu}\} = \{p \mid \mathbf{II} \mathbf{sm}(\lambda x. \eta((p \parallel \text{mrb}) x)) \star \lambda x. []\})}{x}$$

$\llbracket \text{John dropped only a BLUE marble} \rrbracket :$

$$\left( \frac{[]}{j} \parallel \frac{[]}{\text{drp}} \parallel \frac{\eta(\{\text{blu}\} = \{p \mid \mathbf{II} \mathbf{sm}(\lambda x. \eta((p \parallel \text{mrb}) x)) \star \lambda x. []\})}{x} \right)^{\Downarrow}$$

$$= \eta(\{\text{blu}\} = \{p \mid \exists x : (p \parallel \text{mrb}) x . \text{drp } x j\})$$

Here the first scope of the exclusive is nontrivially monadic, so binding it into the continuation that ‘only’ creates for it is not as simple as in the previous examples. But still, inside the restriction of the  $\{v \mid \mathbf{II} \dots\}$  set, we see exactly what we would see if ‘only’ had not meddled with things first. The indefinite takes dynamic scope over the rest of the sentence, binding an  $e$ -type trace to saturate the arguments of the predicates. At the end of the computation, when the final continuation is passed in, the alternatives generated by this indefinite are captured and existentially closed over by the exclusive, so as to figure out exactly which colors *make it true* that John dropped a marble of that color.

The corresponding sentence with a definite rather than an indefinite sister to ‘only’ is almost exactly the same, except that things have to scope a little higher in the very beginning to make room for the additional uniqueness test that the definite imposes.

$$\llbracket \text{the BLUE marble} \rrbracket : \left( \frac{\frac{\frac{[]}{\mathbf{1}[]} \quad \frac{[]}{\mathbf{sm}}}{\frac{[]}{x}}}{\frac{[]}{p}} \parallel \frac{\frac{\frac{[]}{\langle \text{blu}, [] \rangle} \quad \frac{[]}{\lambda p \cdot []}}{\frac{[]}{\lambda x \cdot []}}}{\frac{[]}{p}} \parallel \frac{\frac{[]}{\frac{[]}{\text{mrb}}}}{\frac{[]}{\text{mrb}}} \right)^{\Downarrow} = \langle \text{blu}, \lambda p. \mathbf{1}(\mathbf{sm}(\lambda x. \eta((p \parallel \text{mrb}) x))) \rangle$$

$\llbracket \text{only the BLUE marble} \rrbracket :$

$$\mathbf{O} \langle \text{blu}, \lambda p. \mathbf{1}(\mathbf{sm}(\lambda x. \eta((p \parallel \text{mrb}) x))) \rangle = \frac{\eta(\{\text{blu}\} = \{p \mid \mathbf{1}(\mathbf{sm}(\lambda x. \eta((p \parallel \text{mrb}) x))) \star \lambda x. []\})}{x}$$

$\llbracket \text{John dropped only the BLUE marble} \rrbracket :$

$$\left( \frac{\frac{[]}{j} \parallel \frac{[]}{\text{drp}}}{\frac{\eta(\{\text{blu}\} = \{p \mid \mathbf{1}(\mathbf{sm}(\lambda x. \eta((p \parallel \text{mrb}) x))) \star \lambda x. []\})}{x}} \right)^{\Downarrow} = \eta(\{\text{blu}\} = \{p \mid \text{drp}(\iota(p \parallel \text{mrb}))j\})$$

$$\llbracket \text{every BLUE marb} \rrbracket : \left( \frac{\frac{\frac{[]}{\mathbf{ev}} \quad \frac{[]}{\lambda x \cdot []}}{\frac{[]}{x}} \parallel \frac{\frac{\frac{[]}{\langle \text{blu}, [] \rangle} \quad \frac{[]}{\lambda p \cdot []}}{\frac{[]}{\lambda x \cdot []}}}{\frac{[]}{p}} \parallel \frac{\frac{[]}{\frac{[]}{\text{mrb}}}}{\frac{[]}{\text{mrb}}} \right)^{\Downarrow} = \langle \text{blu}, \lambda p. \eta(\mathbf{ev}(\lambda x. \eta((p \parallel \text{mrb}) x))) \rangle$$

$$\llbracket \text{only every BLUE marb} \rrbracket : \mathbf{O} \langle \text{blu}, \lambda p. \eta(\mathbf{ev}(\lambda x. \eta((p \parallel \text{mrb}) x))) \rangle = \frac{\eta(\{\text{blu}\} = \{p \mid \mathbf{1}[\{\}]\})}{\mathbf{ev}(\lambda x. \eta((p \parallel \text{mrb}) x))(\lambda x. [])}$$

$x$

$\llbracket \text{John dropped only every BLUE marble} \rrbracket :$

$$\left( \frac{\frac{\frac{[]}{j} \parallel \frac{[]}{\text{drp}}}{\frac{\eta(\{\text{blu}\} = \{p \mid \mathbf{1}[\{\}]\})}{\mathbf{ev}(\lambda x. \eta((p \parallel \text{mrb}) x))(\lambda x. [])}}}{x}} \right)^{\Downarrow} = \eta(\{\text{blu}\} = \{p \mid \forall x: (p \parallel \text{mrb}) x. \text{drp } x j\})$$

The adquantificational derivation in which ‘only’ attaches to the generalized quantifier ‘every blue marble’ is actually exactly like the simple adverbial and adnominal derivations above. The GQ is stashed away inside a trivial update in the first continuation of ‘only’, and then immediately unpacked in the exclusive’s set restriction. From there, unlike the simple objects and relations of the earlier cases, the quantifier can continue to itself scope over the rest of the sentence.

### 5.3.1.2 Long-distance association with focus

One reason that structured foreground-background representations of focus meanings have been avoided is that they seem to require that the focus phrase be impervious to scope islands. This is because ‘only’ has no trouble associating with foci buried islands deep within its complement. This worry dissolves in the presence of the monadic interface for the Kleene store. As the derivation below shows, we can still effectively extend the focus phrase’s scope all the way to a cross-sentential ‘only’ without violating island constraints if we scope the entire monadic island over the attitude (see Charlow 2014, 2017b for the discovery and explanation of this technique).

$$\llbracket \text{SUE} \rrbracket : s_{\mathbf{F}} = \frac{\langle s, [] \rangle}{\lambda y. []} \quad \llbracket \text{that SUE left} \rrbracket : \frac{[]}{\star} \left\| \left( \frac{\langle s, [] \rangle}{\lambda y. []} \left\| \frac{[]}{\text{left}} \right\| \right)^{\Downarrow} = \frac{\langle s, \lambda y. \eta(\text{left } y) \rangle \star \lambda m. []}{m \star \lambda p. []} \right.$$

$\llbracket \text{thinks that SUE left} \rrbracket :$

$$\left( \frac{[]}{\text{think}} \left\| \frac{\langle s, \lambda y. \eta(\text{left } y) \rangle \star \lambda m. []}{m \star \lambda p. []} \right\| \right)^{\Downarrow\Downarrow} = \langle s, \lambda y. \eta(\text{left } y) \rangle \star \lambda m. \text{H}(m \star \lambda p. \eta(\text{think } p))$$

$$= \langle s, \lambda y. \eta(\text{think } (\text{left } y)) \rangle$$

$$\llbracket \text{only thinks that SUE left} \rrbracket : \mathbf{O} \langle s, \lambda y. \eta(\text{think } (\text{left } y)) \rangle = \frac{\eta(\{s\} = \{v \mid \llbracket [] \rrbracket\})}{\text{think } (\text{left } v)}$$

$$\llbracket \text{Mary only thinks that SUE left} \rrbracket : \left( \frac{[]}{\mathbf{m}} \left\| \frac{\eta(\{s\} = \{v \mid \llbracket [] \rrbracket\})}{\text{think } (\text{left } v)} \right\| \right)^{\Downarrow} = \eta(\{s\} = \{v \mid \text{think } (\text{left } v) \mathbf{m}\})$$

### 5.3.1.3 Adjectival uses of ‘only’

Finally we come to the adjectival uses of ‘only’. The most important thing to note here is that even as an adjective, ‘only’ needs to combine with an entity before it combines with a property (*pace Coppock & Beaver 2015, Sharvit 2015*). This arrangement of arguments is what anchors the operator in the previous DP-external derivations, preventing a variety of illicit associations with focus. Given this, there are three possible means of semantically slotting ‘only’ in with the nominal content. On the one hand, it could take the trace of the determiner or equivalently the subject of the NP as an initial argument. On the other hand, it could sit around in a sweet spot underneath the lambda of the subject gap and wait for a focus structure to drop into its lap as in all the derivations above. The latter, it turns out, is robustly empirically unavailable. It would allow (3) to be interpreted as in (3b), roughly by generating an LF with the structure: the  $\lambda x$  [ [only John]  $\lambda y$  [  $x$  form with  $y$ ’s signature ] ].

- (3) the only form with JOHN’s signature
- a. ✓ the one form that John signed
  - b. # the one form that nobody but John signed

I propose that the simplest hypothesis as to what rules this is out is that adjectival ‘only’ necessarily forms a syntactic constituent with the determiner or NP subject. Note that this is exactly what precludes sentence initial ‘only’ from associating with VP-internal focus; we assume that in (2), for example, the exclusive’s sister is the sentence-level subject. So effectively I am making the assumption that adjectival ‘only’ is *exactly* like sentence-initial ‘only’; just as the latter cannot be construed as adjoined to the entire TP, the former cannot be construed as adjoined to the entire NP. There are at least two good predictions that this constituency makes vis-à-vis superlatives, which I will return to in Section 5.3.2, after I have presented some basic adjectival derivations.

In the first, absolute, derivation below, ‘only’ finds its correlate in the subject position, and from there, takes trivial scope over the noun ‘hat’. Evaluating the NP at this point also trivially closes off the second of the exclusive’s continuations, and yields the property of being an  $x$  which is equal to

the entire extension of the predicate ‘hat’. The indefinite generates the set of such things, which is of course at most a singleton. This is guaranteed to satisfy the uniqueness test of the definite (assuming the test is weak, as in Coppock & Beaver 2015).

..... ADJECTIVAL ‘ONLY’, ABSOLUTE

[[the only hat]] :

$$\left( \frac{\mathbf{1}[\ ]}{\mathbf{sm}} \parallel \left( \left( \frac{[\ ]}{\mathbf{O}} \parallel \frac{\lambda x. [\ ]}{x} \right) \parallel \frac{[\ ]}{\text{hat}} \right) \right) \Downarrow \Downarrow = \left( \frac{\mathbf{1}[\ ]}{\mathbf{sm}} \parallel \left( \frac{\lambda x. [\ ]}{\mathbf{O} x (\lambda z. [\ ])} \parallel \frac{[\ ]}{\text{hat}} \right) \right) \Downarrow \Downarrow = \mathbf{1}(\mathbf{sm}(\lambda x. \eta(\{x\} = \text{hat})))$$

Because the uniqueness test is logically guaranteed to pass, regardless of the model, I disregard it in the absolute and indeterminate derivations below. The only difference between the two of them, as discussed in Chapter 3, is the scope of the exclusive’s indefinite with respect to negation. If the description outscopes negation, then the sentence asserts that some thing which exhausts the set of hats is such that Mary didn’t buy it. If the negation outscopes the description, we get the weaker assertion that Mary didn’t buy anything which exhausts the set of hats, which is compatible with her having bought several hats.

..... ABSOLUTE READING

[[Mary didn’t buy the only hat]] :

$$\lambda g. \prod_g \left( \frac{[\ ]}{\neg} \parallel \left( \frac{[\ ]}{\mathbf{m}} \parallel \frac{[\ ]}{\text{buy}} \parallel \frac{\mathbf{sm}(\lambda x. \eta(\{x\} = \text{hat})) \star \lambda x. [\ ]}{x} \right) \right) \Downarrow = \lambda g. \exists x: \text{hat } x \wedge \{x\} = \text{hat}. \neg \text{buy } x \text{ m}$$

..... INDETERMINATE READING

[[Mary didn’t buy the only hat]] :

$$\lambda g. \neg \prod_g \left( \frac{[\ ]}{\mathbf{m}} \parallel \frac{[\ ]}{\text{buy}} \parallel \frac{\mathbf{sm}(\lambda x. \eta(\{x\} = \text{hat})) \star \lambda x. [\ ]}{x} \right) \Downarrow = \lambda g. \neg \exists x: \text{hat } x \wedge \{x\} = \text{hat}. \text{buy } x \text{ m}$$

Finally we come to a relative reading! This derivation proceeds essentially exactly as in Chapter 3, except that instead of ‘the only’ splitting the gap between the focus and its continuation, the complex will in fact plainly outscope them. That the exclusive should have to outscope the entire Kleene store focus structure, rather than steal the continuation that it creates, is again a consequence of its uniform cross-categorial correlate-first type. The only other difference between this derivation and the simpler one in the main text is that there is no need to invoke external existential closure here, because it is packed into the alternative-capturing denotation of ‘only’. With this in mind, what we see in the derivation is that the focus on ‘Mary’ stashes the denotation of the subject and creates a gap in its place. The definite grabs the adjective and lifts it into its postsuppositional position. Everything else combines applicatively. When finally evaluated, **O** returns the determinate dynamic proposition that is true iff Mary is the only value  $v$  that leads to dynamic truth when passed through the focal continuation, essentially the property of being someone who bought a hat. The unicity test is again trivial.

..... RELATIVE READING

$$\llbracket \text{MARY} \rrbracket : \quad \mathbf{m}_F = \frac{\langle \mathbf{m}, [] \rangle}{\lambda y . []} \quad \llbracket \text{the only hat} \rrbracket : \quad \frac{\mathbf{1}(\mathbf{O} [])}{\mathbf{sm.hat} \star \lambda x . []} \quad [\text{not evaluated}]$$

$y$   $x$

$\llbracket \text{MARY bought the only hat} \rrbracket :$

$$\left( \frac{\frac{[]}{\langle \mathbf{m}, [] \rangle} \parallel \frac{[]}{\lambda y . []}}{\mathbf{1}(\mathbf{O} [])} \parallel \frac{[]}{\mathbf{sm.hat} \star \lambda x . []} \right) \Downarrow = \mathbf{1}(\mathbf{O} \langle \mathbf{m}, \lambda y . \mathbf{sm.hat} \star \lambda x . \eta(\text{buy } x \ y) \rangle)$$

$$= \mathbf{1} \left( \eta \left( \{ \mathbf{m} \} = \{ v \mid \llbracket \mathbf{sm.hat} \star \lambda x . \eta(\text{buy } x \ v) \rrbracket \} \right) \right)$$

$$= \mathbf{1} \left( \eta \left( \{ \mathbf{m} \} = \{ v \mid \exists x : \text{hat } x . \text{buy } x \ v \} \right) \right)$$

... [1 still trivial here because ‘only’ is determinate] ...

### 5.3.2 Superlatives

Turning now to superlatives, the first thing to

point out is that they are filters on Kleisli arrows.  $\mathbf{est}_u^> :: \forall \alpha . \mathbb{K} t \alpha \rightarrow \mathbb{K} t \alpha$

This means that unlike ‘only’, they pick up the  $\mathbf{est}_u^> := \lambda k x g . \{ \langle \mathbf{T}, h \rangle \mid \langle x, h \rangle \in \mathcal{S}_u^> (\mathbf{sm} k) g \}$

continuations that they modify before they pick

up the arguments that constitute their correlates. This means that inside the noun phrase, a superlative adjective doesn’t need to hug the determiner or cliticize onto the subject gap. It can go ahead and pick up the nominal property like a normal higher-order adjective (modulo the dynamic return types). This will become clear in the examples. To save some space, in all of the derivations from here on out, let  $\mathbf{S}_u \equiv \mathbf{est}_u$  bigger.

The absolute derivation is fairly straightforward. I’ve attached the superlative operator outside of the entire subject gap, but it could just as easily go inside it and take trivial scope over the noun, as ‘only’ did on its absolute reading. There is a little bit of awkwardness related to the indexing on the superlative. This is usually given by the index on the determiner that heads the phrase, but in the absolute case, where the superlative will be evaluated before the determiner adds any binding information, it needs to associate with the index of the subject (or the index of its own trace!). I’ve just

left that part out of the explicit derivation, but really there should be something like  $\frac{\lambda z . (\eta z)^{pu} \star \lambda x . []}{x}$

in the position of the subject. Once the NP is lowered, the superlative maps the resulting Kleisli property onto another Kleisli property, the latter dynamically true of an entity if that entity is a hat bigger than any other hat. This is passed into the indefinite, which turns it into a normal set of dynamic alternatives (the set of hats bigger than any other hats), which again passes trivially through the uniqueness test.

$$\llbracket \text{the biggest hat} \rrbracket : \left( \frac{\mathbf{1}[\ ]}{\mathbf{sm}} \parallel \mathbf{S}_u \left( \frac{\lambda x. [\ ]}{x} \parallel \frac{[\ ]}{\text{hat}} \right) \right) \Downarrow \Downarrow = \frac{\mathbf{1}[\ ]}{\mathbf{sm}} \parallel \frac{[\ ]}{\lambda y g. \{ \langle \mathbf{T}, g \rangle \mid \text{hat } y, \neg \exists z : \text{hat } z. z > y \}}$$

$$= \mathbf{1}(\lambda g. \{ \langle y, g \rangle \mid \text{hat } y, \neg \exists z : \text{hat } z. z > y \})$$

Next up, the [Haddock](#) derivation presents the DP-internal variety of a relative superlative reading. This happens, like all relative readings, when the definite lifts the superlative into a position of scope and is delayed until more information is accumulated. So in the first step, ‘the biggest hat’ denotes the partially evaluated higher-order update that nondeterministically adds a hat to the  $u$ th coordinate of the assignment, and then waits, poised to filter the alternatives according to the size of the thing they’re storing in  $u$ . In the meantime, the rest of the embedding NP is combined, up to and including the subject. At this point, the definite-superlative spring is sprung, and the whole NP collapses. The entire NP continuation — the function mapping things  $z$  onto nondeterministic truth values, one for each hat, true if  $z$  is a rabbit in that hat, false otherwise — is then passed through the superlative filter, which returns a new continuation — the function mapping things  $z$  onto the deterministic truth value  $\mathbf{T}$  iff they lead the initial continuation to  $\mathbf{T}$  and furthermore they pair  $\mathbf{T}$  with an output whose  $u$  (i.e., whose hat) is bigger than that of any other  $\mathbf{T}$ -generating output.

Note that while the superlative itself filters alternatives based on the size of the thing they store at  $u$ , the uniqueness test that then feeds on the superlative’s own output checks the *values* stored across alternatives. In this case that guarantees that  $\mathbf{1}$  is actually testing for uniformity of *rabbits* across alternatives, after the superlative has filtered out all of the dominated hats. At the end of the entire calculation then, what we’re actually left with, assuming the tests are passed, is a deterministic update yielding the one rabbit that is in a hat bigger than any hat that any other rabbit is in. But there is no requirement that that rabbit be in just one maximally large hat.

$$\llbracket \text{the biggest hat} \rrbracket : \left( \frac{\mathbf{1}(\mathbf{S}_u [])}{\mathbf{sm}} \parallel \left( \frac{\lambda x. []}{x} \parallel \frac{[]}{\text{hat}} \right) \right)^\Downarrow = \frac{\mathbf{1}(\mathbf{S}_u [])}{\mathbf{sm}(\lambda x. \eta(\text{hat } x))} = \frac{\mathbf{1}(\mathbf{S}_u [])}{\lambda g. \{ \langle x, g^{u \rightarrow x} \rangle \mid \text{hat } x \}}$$

$\llbracket \text{the rabbit in the biggest hat} \rrbracket :$

$$\begin{aligned} & \left( \frac{\mathbf{1} []}{\mathbf{sm}} \parallel \left( \frac{[]}{\lambda z. []} \parallel \frac{[]}{\text{rab}} \parallel \frac{[]}{\text{in}} \parallel \frac{\mathbf{1}(\mathbf{S}_u [])}{\mathbf{sm}.\text{hat}^{pu} \star \lambda x. []} \right) \right)^\Downarrow^\Downarrow \\ &= \left( \frac{\mathbf{1} []}{\mathbf{sm}} \parallel \frac{[]}{\mathbf{1}(\mathbf{S}_u(\lambda z. \mathbf{sm}.\text{hat}^{pu} \star \lambda x. \eta(\text{rab } z \wedge \text{in } x z)))} \right)^\Downarrow \\ &= \left( \frac{\mathbf{1} []}{\mathbf{sm}} \parallel \frac{[]}{\lambda y g. \{ \langle y = z, g^{u \rightarrow x} \rangle \mid \text{hat } x, \text{in } x z \}} \right)^\Downarrow, \text{ where } G = \{ \langle y, x \rangle \mid \text{hat } x, \text{rab } y, \text{in } x y \} \\ & \qquad \qquad \qquad z = \iota z. \exists \xi. \langle z, \xi \rangle \in G \wedge \forall \langle a, b \rangle \in G. a \neq z \Rightarrow b < \xi \\ &= \lambda g. \{ \langle z, g^{u \rightarrow x} \rangle \mid \text{hat } x, \text{in } x z \}, \text{ where } G = \{ \langle y, x \rangle \mid \text{hat } x, \text{rab } y, \text{in } x y \} \\ & \qquad \qquad \qquad z = \iota z. \exists \xi. \langle z, \xi \rangle \in G \wedge \forall \langle a, b \rangle \in G. a \neq z \Rightarrow b < \xi \end{aligned}$$

This is, I think, the right prediction to make for superlatives. In my estimation, the person who climbed the highest mountain might well have climbed several equally large mountains, so long as nobody else climbed any that were larger. But it represents a departure from the position taken in Chapter 2 that plain Haddock cases — e.g., ‘the rabbit in the hat’ — require polyadic unicity — exactly one rabbit-hat pair. If **1** always tests for uniqueness of the property over which it scopes, rather than witnesses for the indefinite from whence it scoped, then we predict that the complex description will presuppose the existence of a unique hatted rabbit, but nothing of its potentially many hats. In this case, in fact, *both* definites end up testing the same thing (though in slightly different ways), viz, namely that the property of being a rabbit in a hat holds of at most one entity.

One benefit of this prediction is that it accounts for the oddity of examples like those in (4). In both of these sentences, the inner definite actually ends up counting the values that satisfy the containing description. The hat wags the rabbit. As a result, the relative reading of ‘rabbit in the (biggest) hat’ will be trivially definite, in the sense of Chapter 3: if there is any such thing, there is at most one. The usual pragmatic pressures to use stronger language whenever possible will lead speakers to reject the variants in (4) in favor of their double-definite [Haddocky](#) variants.

- (4) a. \*John thinks a rabbit in the hat is cute [cf. Chapter 2: (29)]  
b. \*John thinks a rabbit in the biggest hat is cute

Another nice prediction here is that there could not be a [Haddock](#) reading with ‘only’ in place of a superlative. The superlative is crucially stealing the continuation created by the subject gap that the determiner itself would normally grab hold of to quantify over. At the last second it preprocesses that property before the determiner generates a set of alternatives for future composition, throwing out a bunch of candidate assignments. This is all only possible because the superlative is defined in such a way that it is ready and able to descend on any continuation it is able to. The exclusive adjective is not immediately in a position to do this. It is restricted to positions from which it can take an *e*-type argument first before it gets any shot at any continuation. This means that most of the time, it is going to *require* focus-marking somewhere inside its complement, because only focus-marking is going to create a sequence of arguments of the right type. Alternatively, it can survive in a position adjacent to the determiner where *e*-type traces and continuations emerge naturally in close proximity. But it cannot mimic the derivation above because it would not be prepared to do anything with the property created by the missing subject without first having a correlate to check for exhaustivity.

The full sentential relative superlative derivation is very similar to the [Haddock](#) case. Except now instead of exploiting a missing subject argument (or raised determiner, as it may be), the superlative exploits the continuation that the focus-marker creates. So unlike the exclusive relative reading earlier, the relative superlative description really does split the scope of the focus denotation. Once the focus continuation is lowered and passed through the superlative filter, we end up again with the property

of being a  $z$  that climbed a mountain higher than any mountain climbed by anyone else. From that, **1** tests that there is only one such  $z$  that has that property. Notice again, though the superlative is targeting mountains, the definite that gives it scope is targeting climbers. The whole sentence evaluates to the Kleene store that saves John as its point and the property of being the greatest mountain climber as its context.

..... RELATIVE SUPERLATIVE

[[JOHN climbed the biggest mountain]] :

$$\left( \begin{array}{c|c|c} \langle j, [] \rangle & [] & [] \\ \hline [] & [] & \mathbf{1}(\mathbf{S}_u []) \\ \hline \lambda z. [] & [] & \mathbf{sm.mtn}^u \star \lambda x. [] \\ \hline z & \text{climb} & x \end{array} \right)^\Downarrow$$

### 5.3.3 Possessives

Like superlatives, possessives are also modeled as filters on dynamic Kleisli arrows. Given an index  $u$ , the possessive phrase  $z's_u$  reads in a continuation and returns a continuation. The continuation that it returns is like  $k$ , except that for every  $x$  it keeps only those outputs whose  $u$ th coordinate is  $\Pi$  related to  $z$ , where  $\Pi$  is the contextual possession relation. Any entity  $x$  that does not generate any outputs with appropriately  $z$ -related values stored at  $u$  ends up returning the empty set, and so is either completely disregarded if in the restrictor of a dynamic indefinite, or otherwise sets a dynamic course for eventual truth-conditional falsity. We will see both of these outcomes below.

Because a possessive phrase has the same type as a superlative, the basic derivation here looks quite similar to the absolute superlative derivation above. I will assume throughout this chapter that the possessive suffix itself only introduces the possession relation (via the filter that it denotes), and

that some covert analog of the usual definite determiner takes care of the final DP packaging (as in, e.g., Larson & Cho 2003, Partee & Borschev 2003: Ch. 6, and Italian).

..... BASIC POSSESSIVE DESCRIPTION

$$\begin{aligned} \llbracket \text{John's hat} \rrbracket : & \left( \frac{\mathbf{1}[\ ]}{\mathbf{sm}} \parallel \text{j's} \left( \frac{\lambda x. [\ ]}{x} \parallel \frac{[\ ]}{\text{hat}} \right)^{\Downarrow} \right)^{\Downarrow} = \frac{\mathbf{1}[\ ]}{\mathbf{sm}} \parallel \frac{[\ ]}{\lambda y g. \{ \langle \mathbf{T}, g \rangle \mid \text{hat } y, \Pi j y \}} \\ & = \mathbf{1}(\lambda g. \{ \langle y, g \rangle \mid \text{hat } y, \Pi j y \}) \end{aligned}$$

Things get more complicated when possessives are combined with quantificational adjectives. I assume that the possessive and superlative adjective combine to form a composite filter on properties. I don't have a precise theory of how this happens, but however it is that the composite filter comes into existence, it needs to be the case that the superlative filter *follows* the possessive one (Partee & Borschev (2003): fn. 6 makes a similar suggestion about constituency, attributing the idea to Den Dikken). It is just an empirical fact that the natural reading, maybe the only reading, of 'John's biggest hat' refers to an object which is a John-related hat that is bigger than any other John-related hat. This means that the superlative cannot be allowed to discard alternatives before the possessive has already restricted them to things associated with John. If it were, the description would end up referring to a hat that is both not smaller than any other hat and a thing that John has. If it turns out this is a possible interpretation of the phrase, then it is easy enough to generate: just run the filters in the other order. Aside from that, everything proceeds as in the basic possessive example and the absolute definite superlative example.

..... ABSOLUTE POSSESSIVE SUPERLATIVE

$\llbracket \text{John's biggest hat} \rrbracket :$

$$\begin{aligned} \left( \frac{\mathbf{1}[\ ]}{\mathbf{sm}} \parallel \mathbf{S}_u \circ \text{j's} \left( \frac{\lambda x. [\ ]}{x} \parallel \frac{[\ ]}{\text{hat}} \right)^{\Downarrow} \right)^{\Downarrow} & = \frac{\mathbf{1}[\ ]}{\mathbf{sm}} \parallel \frac{[\ ]}{\lambda y g. \{ \langle \mathbf{T}, g \rangle \mid \text{hat } y, \Pi j y, \neg \exists z: \text{hat } z \wedge \Pi j z. z > y \}} \\ & = \mathbf{1}(\lambda g. \{ \langle y, g \rangle \mid \text{hat } y, \Pi j y, \neg \exists z: \text{hat } z \wedge \Pi j z. z > y \}) \end{aligned}$$

Recall from Chapter 4 that there are no relative readings of quantificational adjectives with full lexical possessors, plausibly because such structures are evaluation islands. The only well-typed derivations of these items in this order are equivalent to the absolute ones above. With bound possessors however, relative readings do appear to be possible.

Of necessity, there will be a lot going on in the next several derivations. In each case, I represent the binding of the pronoun as high up in the effect tower as I can, since that binding doesn't play any role in actually deriving the readings of interest, only in licensing them. First take a look at the relative denotation of 'his highest mountain'. The monadic pronoun clears out of the way leaving a pure trace  $\nu$  for the possessive to grab. Minted, this possessive and the superlative fuse as before to form the composite filter that first discards entities that do not end up paired with any assignments whose  $u$ th coordinates are related to  $\nu$ , then further discards entities that do not end up paired with assignments whose  $u$ th coordinates are dominated in size by those of other entities. This composite filter is picked up by the implicit determiner and situated in the postprocessing stack after candidate witnesses have been generated.

The sentence 'John climbed his highest mountain YESTERDAY' then acquires its relative reading in a manner parallel to the derivation of 'JOHN climbed the highest mountain' earlier. Ignoring the top level binding between 'John' and the pronoun, we see that the focus correlate of the superlative opens a new Kleene store and leaves a gap over times. The proposition that  $x$  climbed a mountain <sup>$u$</sup>  at time  $t$  accumulates in the scope of that gap. The possessive-superlative complex steals that continuation and replaces it with the property of being a time  $t$  at which  $x$  climbed a mountain at least as high as any any mountain climbed by  $x$  at any other time  $t'$ . Again, the uniqueness test — if there is any such thing associated with the implicit determiner of the possessive — guarantees that only one such maximal time exists. This new property is then lowered into the store, where it is paired with the particular time yesterday. Finally, this rich structure is lowered into the dynamic circuit that sustains the current between the subject and the pronoun.

$$\llbracket \text{his highest mountain} \rrbracket : \left( \frac{\text{prn}_i \star \lambda v. []}{\mathbf{1} \circ \mathbf{S}_u \circ v' \mathbf{s}_u []} \right) \left( \frac{[]}{\lambda x. []} \right) \left( \frac{[]}{\text{mtn}} \right) \Downarrow = \frac{\text{prn}_i \star \lambda v. []}{\mathbf{1} (\mathbf{S}_u \circ v' \mathbf{s}_u [])} \lambda g. \{ \langle x, g^{u \mapsto x} \rangle \mid \text{mtn } x \}$$

\llbracket \text{John climbed his highest mountain YESTERDAY} \rrbracket :

$$\left( \frac{(\eta j)^{p_i} \star \lambda x. []}{[]} \right) \left( \frac{[]}{\text{climb}} \right) \left( \frac{\text{prn}_i \star \lambda v. []}{\mathbf{1} (\mathbf{S}_u \circ v' \mathbf{s}_u [])} \right) \left( \frac{[]}{t} \right) \Downarrow$$

The relative reading of the exclusive in possessive DP with a bound possessor is similar. The only difference is that the exclusive filter, rather than immediately following the possessive filter, is actually given scope over the possessive filter (and uniqueness test of the possessive determiner). This is the difference between  $\mathbf{1} (\mathbf{O} \circ v' \mathbf{s}_u [])$  and  $\frac{\mathbf{O} []}{\mathbf{1} (v' \mathbf{s}_u [])}$ . Again, I don't know exactly how the pieces of the very left periphery — the covert determiner, the possessive, and the exclusive particle — conspire to generate this structure (for instance, it's a little on the noncompositional side, if we assume that the exclusive and possessive form a constituent, as was the case with the superlative). But once the higher-order quantifier is assembled, the rest of the derivation is almost exactly as in the superlative case. In the scope of the focused adverbial, a property from times to nondeterministic truth values is created, one for each mountain that  $x$  (John) may or may not have climbed. The possessive throws out any times in which John is not appropriately related to the mountain, and the uniqueness test, if it exists in possessive constructions, guarantees that only one time  $t$  is such that  $x$  climbed a relevantly related mountain at  $t$ . Note that this already does half the work of the exclusive! Finally this

exclusive property is paired with yesterday, and the entire focus store is passed to **O**. So when finally completely evaluated, the entire dynamic update returns true iff that one time at which John climbed a relevant mountain was yesterday.

..... RELATIVE POSSESSIVE EXCLUSIVE

$$\llbracket \text{his only mountain} \rrbracket : \left( \frac{\text{prn}_i \star \lambda v. []}{\mathbf{O} []} \right) \parallel \left( \frac{[]}{\lambda x. []} \right) \parallel \left( \frac{[]}{\text{mtn}} \right) \Downarrow = \frac{\text{prn}_i \star \lambda v. []}{\mathbf{O} []} \parallel \frac{\mathbf{1} (v' s_u [])}{\text{sm}^u} \parallel \lambda g. \{ \langle x, g^{u \rightarrow x} \rangle \mid \text{mtn } x \}$$

\llbracket \text{John climbed his only mountain YESTERDAY} \rrbracket :

$$\left( \frac{(\eta j)^{pi} \star \lambda x. []}{[]} \right) \parallel \left( \frac{[]}{\text{climb}} \right) \parallel \left( \frac{\text{prn}_i \star \lambda v. []}{\mathbf{O}} \right) \parallel \left( \frac{[]}{\langle \text{yest}, [] \rangle} \right) \Downarrow$$

$$\left( \frac{[]}{x} \right) \parallel \left( \frac{[]}{y} \right) \parallel \left( \frac{\mathbf{1} (v' s_u [])}{\text{sm.mtn}^{pu} \star \lambda y. []} \right) \parallel \left( \frac{\lambda t. []}{t} \right)$$

To wrap things up, here's a possible derivation for a basic, absolute expression of exclusive possession. This turns out to be quite complex, as a result of the type of the exclusive and possessive not quite lining up. I assume as before that the exclusive precedes the subject gap, and that the possessive occurs where it is pronounced, to the left of the exclusive. Superlatives and possessives have the same  $\mathbb{K} o \alpha \rightarrow \mathbb{K} o \alpha$  type, which means they can simply be composed (in either order) without any trouble. But the type for **O** is quite different, and fitting this together with the possessive in such a way that it doesn't quantify over alternatives until after the possessive filter takes its toll requires a lot of scope-taking. We need the latter because, as with superlatives, it seems nearly required that 'John's only hat' be interpreted as the thing that exhausts the set of hats *that belong to John*, not the thing that both belongs to John and exhausts the set of hats.

Because this derivation is far from intuitive, I've included all of the type-shifting operations explicitly. After combining with the subject, 'only' takes scope and its trace is pushed onto the stack. Independently, the possessive filter is *evaluated* point blank. This results in the property that reads in an individual  $x$  and either returns a trivial update containing  $x$  if the  $u$ th thing on the incoming information state is related to John, or the degenerate update containing no outputs. From there, the dynamic trace of the exclusive is sequenced immediately into this possessive property. This has the effect that the trace itself is the  $u$ th thing on the stack coming into the possessive, which means that the trace itself is either filtered out or not depending on whether it is appropriately related to John. If it is, it is kept; if it isn't, the update is empty. All of this is finally lowered into the first of the exclusive's scopes. That, all together, is the denotation of 'John's only'. This complex is then combined with the nominal, which becomes the second scope of 'only', which is then complete, and denotes the update that is true only of entities  $x$  that exhaust the set of things that are both of John and a hat. This giant property is then fed to the determiner, which constructs the trivial set of things that have this property. This, as usual, passes through the uniqueness test by sheer force of logical necessity.

Of course there are a great many other less complicated ways that these denotations might combine that respect the same linear order and constituency. All of them result in the possessive outscoping the exclusive, yielding a reading for the description that refers to a thing which is both John's and the only hat. Assuming this is a possible though unnatural interpretation of the phrase, then there is no semantic threat posed by the combinatorial ambiguity, though how it is that the rather involved derivation shown below comes to be by far the most natural reading of the sentence is a mystery.

[[John's only]] :

$$\begin{aligned}
 & \left( \left( \frac{[]}{j's_u} \Downarrow \left\| \left( \left( \frac{[]}{\mathbf{O}} \left\| \frac{\lambda x. []}{x} \right\| \frac{[]}{\triangleright u} \left\| \frac{[]}{\star} \right\| \right) \right\| \frac{[]}{\star} \right) \right) \right) \Downarrow = \left( \left( \frac{[]}{j's_u} \Downarrow \left\| \frac{\lambda x. []}{\mathbf{O} x (\lambda z. [])} \right\| \frac{[]}{(\eta z)^{\triangleright u} \star} \right) \right) \Downarrow \\
 & = \left( \frac{\lambda x. []}{\mathbf{O} x (\lambda z. [])} \right) \Downarrow = \frac{\lambda x. []}{\lambda g. \eta (\{x\} = \{v \mid \coprod_g ((\eta v)^{\triangleright u} \star j's_u^{\Downarrow} \star \lambda y. [])\}) g} \\
 & \left( \frac{(\eta z)^{\triangleright u} \star j's_u^{\Downarrow} \star \lambda y. []}{y} \right) \Downarrow = \frac{y}{y}
 \end{aligned}$$

[[John's only hat]] :

$$\begin{aligned}
 & \left( \frac{\mathbf{1} []}{\mathbf{sm}} \left\| \left( \frac{\lambda x. []}{\lambda g. \eta (\{x\} = \coprod_g ((\eta v)^{\triangleright u} \star j's_u^{\Downarrow} \star \lambda y. \eta (\hat{y}))\}) g} \right) \right\| \frac{[]}{\hat{}} \right) \Downarrow \\
 & \left( \frac{\mathbf{1} []}{\mathbf{sm}} \left\| \frac{[]}{\lambda x g. \eta (\{x\} = \coprod_g ((\eta v)^{\triangleright u} \star j's_u^{\Downarrow} \star \lambda y. \eta (\hat{y}))\}) g} \right\| \right) \Downarrow \\
 & \left( \frac{\mathbf{1} []}{\mathbf{sm}} \left\| \frac{[]}{\lambda x g. \eta (\{x\} = \{v \mid \coprod_g (\lambda h. \{\langle \hat{v}, h^{u \rightarrow v} \rangle \mid \Pi v j\})\}) g} \right\| \right) \Downarrow \\
 & \left( \frac{\mathbf{1} []}{\mathbf{sm}} \left\| \frac{[]}{\lambda x. \eta (\{x\} = \{v \mid \hat{v}, \Pi v j\})} \right\| \right) \Downarrow
 \end{aligned}$$

$$\mathbf{1} (\lambda g. \{\langle x, g^{u \rightarrow x} \rangle \mid \{x\} = \{v \mid \hat{v}, \Pi v j\}\})$$

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