Ellipsis licensing in differential degree complements

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1. Introduction

Here I investigate the licensing of ellipsis in degree complement clauses found inside differential degree quantifiers. I identify an asymmetry in which the degree complement clause where VP ellipsis takes place must contain a QR-ed quantifier outside the ellipsis site, despite the seeming availability of antecedents both with and without the QR-ed quantifier. This phenomenon has not previously been investigated, to the best of my knowledge, likely owing to the relative understudiedness of comparatives with differential phrases that are themselves comparative or equative degree quantifiers.

I explore, and ultimately reject, the possibility that this requirement might be explained via an appeal to incommensurability. There is some initial plausibility to the idea that the degree complement clause without the QR-ed quantifier and the constituent in the scope of the relevant degree head denote measures on different scales. The resulting incommensurability finds a natural expression in the directed scale segment framework of Schwarzschild 2013; I sketch an analysis along those lines in section 3. A fuller view of the data, however, reveals that the putative incommensurability is a problem only under ellipsis. This, in turn, suggests that any explanation for the restriction on ellipsis in differential degree complements must come from a theory of ellipsis licensing, not from a theory of scale structure.

I show in section 5 that the theory of ellipsis licensing proposed by Kennedy (2014)—which he calls the predicates and formulas theory—correctly derives the restriction in question. On this theory, the ellipsis-containing degree complement clause can never stand in the requisite contrast relation to its antecedent without the QR-ed quantifier. The restriction

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1At NELS I attempted to defend a version of the incommensurability hypothesis, a rather elaborate implementation in the directed scale segment framework of Schwarzschild 2013 (under the title “A directed segment approach to complex differentials”). I sketch a shorter version of the idea here partly because I find the demonstration of its untenability instructive, and partly for historical reasons.
is not easily explained under the more commonly assumed predicates theory—indeed, its initial mysteriousness derives largely from the implicit adoption of the predicates theory—and so the data from differentials constitute an additional (and, as far as I am aware, novel) point in favor of the predicates and formulas theory.

2. **An interpretive restriction on differential degree complements with ellipsis**

The phenomenon of interest is an interpretive restriction on degree complement clauses (i.e., comparative or equative clauses) that make up part of a differential phrase and that contain VP ellipsis. This is illustrated with the equative *as* clause in (1).

(1) John read as many more books than Mary as Alice did.
   a. as Alice did <read more books than Mary>
   b. *as Alice did <read books>

The degree relation expressed by equative *as* in (1) can only be understood as a comparison between (i) the amount by which John’s number of books read exceeds Mary’s and (ii) the amount by which Alice’s number of books read exceeds Mary’s, as sketched informally in (1-a). It cannot be understood as a comparison between (i) the amount by which John’s number of books read exceeds Mary’s and (ii) the number of books that Alice read, as in (1-b).

On its face, this is a puzzling restriction. Let us make a few structural assumptions explicit in order to show this. To begin, observe that the degree quantifier headed by equative *as* in (1) binds the position of the differential argument within the degree quantifier headed by comparative more/er. While differentials often take the form of measure phrases or other modifiers, they can equally well take the form of comparative or equative degree quantifiers. Differential phrases are boldfaced in (2); as shown there, I take equative *as* constructions like the one in (1) to constitute a degree quantifier rendered discontinuous on the surface via rightward extraposition.

(2) a. John read three more books than Mary.
   b. John read many more books than Mary.
   c. John read as many more books than Mary as Alice did.

I follow much of the literature in treating comparative more/er as heading a quantificational DegP that takes scope via QR. Let us further assume that -er takes a degree argument representing the differential (alongside the one representing the standard of comparison). We can then treat the equative *as* construction in examples like (1) as another quantificational DegP that is merged in the differential argument position of -er before raising to take scope.2 These assumptions yield the LF for (1) sketched in (3).

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2More precisely, it is the degree argument/parameter of *many*, which I assume is always present in the differential position but goes unpronounced in examples like (2-a).
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(3) [as [as Alice did \(<\rangle\)]_2 [[t_2\text{-many}] -er than Mary]_1 [John read t_1\text{-many books}]

The LF in (3) contains only one possible antecedent for resolving the ellipsis in the as clause, namely the VP read t_1\text{-many books}. There appear to be at least two possibilities, however, for how to construct the remainder of the as clause. The two candidate as-clause LFs are sketched in (4).

(4) a. as wh_4 [[t_4\text{-many}] -er than Mary]_3 [Alice did (<read t_3\text{-many books}>)]
   b. as wh_3 [Alice did (<read t_3\text{-many books}>)]

The as-clause LFs in (4-a) and (4-b) correspond to the informal sketches in (1-a) and (1-b), respectively. The uniformity of the elided syntactic material in the two cases only sharpens the question posed above: why is (4-a) an available LF for the as clause in (1) while (4-b) is not?

In what follows, I consider two possible explanations. The first proceeds from an intuition that the LF in (4-b) is unavailable because it leads to incommensurability in the degree relation expressed by the degree head as: the as clause (which serves as the restriction of the degree head as) and the matrix clause (its nuclear scope) denote measures on different scales, with the result that no direct comparison between them is possible. The second explanation I consider is that there are independent factors regulating the licensing of ellipsis that conspire to exclude the LF in (4-b): in other words, the right theory of ellipsis licensing simply predicts the unavailability of (4-b) as a matter of course, independent of any considerations related to measurement.

I examine the incommensurability hypothesis in section 3; in section 4, we will see reasons to reject it. In section 5, I show that the theory of ellipsis licensing developed by Kennedy (2014) successfully accounts for the restriction.

3. The incommensurability hypothesis

Schwarzschild (2013), building on recent proposals by Schwarz (2010) and Bale (2011), develops a theory of gradability that eschews the use of abstract degrees in favor of sets of possible individuals (an idea that dates at least to Cresswell 1976). Degrees, on this theory, are sets of world–individual pairs (type \(\langle e \times s, t \rangle\)). Measure functions map a world and an individual to a degree (type \(\langle s, \langle e, \langle e \times s, t \rangle \rangle \rangle\)). These can either be lexically specified or derived compositionally in the syntax; the lexical entry for the gradable adjective tall in (5) illustrates:

(5) \[\text{tall} = \lambda w \lambda x \lambda y, w'. x\text{'s height in } w \text{ meets or exceeds } y\text{'s height in } w'.\]

With degrees and measure functions so conceived, Schwarzschild defines directed scale segments as tuples consisting of two degrees, an ordering, and a measure function. Degree morphemes like comparative -er can then be treated as denoting functions that introduce directed scale segments and specify the measure function and the relationship between the
segment’s two degrees (namely whether the degree that marks the start of the segment is ordered above or below the one that marks the end of the segment), as in (6).

\[
[-er] = \lambda A_{\langle x, e, (e \times s, t) \rangle} \lambda \sigma. \neg\neg (\sigma) \land \mu_\sigma = A
\]

In this directed scale segment semantics for comparatives, the than clause or phrase’s value specifies the segment’s start degree, the subject’s value specifies its end degree, and the degree morpheme specifies the relation between the two. The segment’s measure function is either specified by a gradable predicate or derived in the syntax via parasitic scope taking of the degree morpheme (I refer the interested reader to Schwarzschild’s paper for details). For an example like John read more books than Mary, we get the derived measure function in (7-a) and the truth conditions in (7-b): these state that there is a rising segment on the scale \( \mu_{rb} \) (i.e., the scale of number of books read) whose start degree is Mary’s value on the scale and whose end degree is John’s value on the scale.

\[
\text{John read more books than Mary.}
\]

\text{a. } \mu_{rb} = \lambda w \lambda x \lambda (y, w'). x \text{ read at least as many books in } w \text{ as } y \text{ in } w'
\]

\text{b. } \exists \sigma. \neg\neg (\sigma) \land \mu_\sigma = \mu_{rb}(Mary) \land \text{START(}\sigma\text{) = }\mu_{rb}(Mary) \land \text{END(}\sigma\text{) = }\mu_{rb}(John)

As in any semantics for comparison, the values being compared must lie on the same scale; more formally, they must be in the range of the same measure function. With the measure function derivable in the syntax, however, it is relatively easy in Schwarzschild’s system to construct logical forms for clausal comparatives in which the degree complement clause yields a measure function different from the one in the matrix clause. Comparison of degrees in the ranges of different measure functions yields incommensurability and concomitant semantic infelicity.

Returning to our example (1), with the LF shown in (3), we might seek to understand the restriction on the interpretation of the as clause as due to incommensurability. We can construct an LF such that the matrix-clause derived measure function is the one shown in (8-a), while the as-clause LF without the QR-ed quantifier (i.e., the one from (4-b)) yields the measure function shown in (8-b). (The as-clause LF in (4-a), with the QR-ed quantifier outside the ellipsis site, yields the same measure function as the matrix clause on these assumptions.)

\[
\text{a. } \lambda w \lambda x \lambda (y, w'). x \text{ read at least as many more books than Mary in } w \text{ as } y \text{ in } w'
\]

\[
\text{b. } \lambda w \lambda x \lambda (y, w'). x \text{ read at least as many books in } w \text{ as } y \text{ in } w'
\]

If the directed scale segment semantics is the right semantics for comparatives, and if measure functions can be derived in the syntax in the way Schwarzschild suggests, then the unavailability of the as-clause LF in (4-b) might receive a principled explanation along the lines sketched here: the absence of the QR-ed quantifier yields an as-clause measure function different from the matrix-clause measure function, with infelicity the result.
4. The incommensurability hypothesis laid low

If the unavailability of the as-clause reading sketched in (1-b)/(4-b) is due to incommensurability—i.e., due to a low-level clash in the semantics of measurement and comparison—then it should persist in cases where there is no ellipsis in the as clause. In fact, the restriction vanishes in the absence of ellipsis. Setting aside the implications of this fact for the larger directed segment project, it is clear that the incommensurability hypothesis sketched above is not the right explanation for the restriction on differential as-clause interpretation under investigation here.3

Consider the pair of sentences in (9), where (9-a) repeats the example from (1) and (9-b) is a minimal variant in which the differential as clause contains comparative deletion instead of VP ellipsis. Notably, (9-b) is ambiguous, supporting both the reading found in (9-a) and the previously missing reading, which compares (i) the amount by which John’s number of books read exceeds Mary’s to (ii) the number of books that Alice read.4

(9) a. John read as many more books than Mary as Alice did.
   b. John read as many more books than Mary as Alice read.

An as-clause LF for (9-b) that lacks the QR-ed quantifier should yield a measure function every bit as incommensurable with the matrix-clause measure function as its counterpart in (9-a); but in fact there is no infelicity.

We find the same pattern when we compare pseudogapping (standardly taken to involve VP ellipsis) and comparative subdeletion, as in (10). The pseudogapping example in (10-a) lacks the reading where the as clause measures the number of magazines Alice read, but its ellipsis-free subdeletion counterpart in (10-b) is ambiguous.

(10) a. John read as many more books than Mary as Alice did magazines.
    b. John read as many more books than Mary as Alice read magazines.

These examples suggest strongly that the restriction of interest here is an ellipsis phenomenon, not a measurement phenomenon. An explanation must therefore be sought not in a theory of gradability or measurement, but in a theory of ellipsis licensing. It is to one such theory that I now turn.

3I do not mean to suggest that the directed segment semantics is incapable of handling ellipsis-free examples like (9-b). Given suitable syntactic assumptions, one could arrange things such that both the matrix clause and the as clause are associated with a general cardinality measure function. In other words, the directed segment semantics is not doomed to erroneously derive incommensurability in such cases. (And, of course, this only further weakens the incommensurability hypothesis as a potential explanation for the interpretive restriction we find under ellipsis.)

4I am indebted to Mats Rooth for pointing out the contrast shown in (9) during the question period at NELS.
5. A predicates-and-formulas approach

The interpretive restriction on differential degree complements under ellipsis detailed above receives a natural explanation within the theory of ellipsis licensing developed by Kennedy (2014). The theory incorporates the requirements for syntactic identity and semantic contrast proposed by Rooth (1992). The result for the case under investigation here is that the as clause must contain the QR-ed degree quantifier outside the ellipsis site in order to contrast appropriately with its matrix-clause antecedent. This ensures that ellipsis is licensed with the LF in (4-a) but not with the LF in (4-b), thereby deriving the restriction of interest.

I introduce the theory in section 5.1 and then apply it to our differential degree complement data in section 5.2.

5.1 Predicates and formulas for ACD

Kennedy dubs his theory the “predicates and formulas” theory. The name reflects the way in which the arguments of a quantificational determiner are represented at logical form. A determiner’s restriction is represented as a constituent in which an object-language binder is prefixed to an open proposition (a predicate), while its nuclear scope is represented as an open proposition without any object-language binder (a formula). Most theories of the syntax–semantics interface are uniform in their treatment of a determiner’s arguments: Heim & Kratzer (1998), for example, treat both arguments as predicates, while Heim (1997) treats both as formulas. Kennedy’s is, instead, a hybrid theory.

Kennedy (2014, 256) adopts the syntactic and semantic conditions on ellipsis licensing of Rooth 1992; these are detailed in (11) and (12).

(11) a. Syntactic identity: a deleted VP and its antecedent must contain the same lexical material, differing at most in the value of indices on traces and pronouns.
    b. Semantic contrast: a deleted VP must be contained in a constituent that contrasts appropriately with a constituent containing the antecedent VP.

(12) A constituent $\phi$ contrasts appropriately with a constituent $\psi$ iff:
    a. $\phi$ and $\psi$ do not overlap, and
    b. for all assignments $g$, the ordinary semantic value of $\psi$ with respect to $g$ is an element of the focus semantic value of $\phi$ with respect to $g$.

Kennedy develops the predicates and formulas theory with the goal of accounting for the pattern of ellipsis licensing under antecedent-contained deletion (ACD) sketched in (13).

(13) a. Polly visited every city that Erik did.
    b. *Polly visited every city that is located in a state that Erik did.
    c. Every city that Polly visited is located in a state that Erik did.
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In Kennedy’s LFs, binder indices are written as superscripts and bindee indices as subscripts. I refer the interested reader to Kennedy’s paper for details of the semantic interpretation rules for constituents with superscripted binder indices; suffice it to say for present purposes that the semantic effect of composing a constituent bearing superscript \(i\) with an open proposition where \(i\) is free is equivalent to that of composing the open proposition with a prefixed object-language binder bearing index \(i\).\footnote{As Kennedy (2014, 263ff.) discusses, there is a variety of available implementation strategies. What is common to all of them is the idea that a constituent with a superscripted binder index denotes a function from assignment functions to something else. See Kennedy’s discussion and references therein, especially Sternfeld 1998, 2001, Kobele 2006, 2010.}

The LF for the basic ACD case in (13-a) is shown in (14). The syntactic identity requirement is satisfied, since the deleted VP contains the same lexical material as its antecedent (in fact, even the indices on the traces are identical; more on this below). And the semantic contrast condition is satisfied, since we can identify a constituent containing the deleted VP that contrasts appropriately with a constituent containing its antecedent: for example, we can select the constituents dominating the subject, tense, and the VP in each clause, assuming focus on \(Erik\) in the clause where ellipsis occurs.\footnote{We could just as well select the deleted and antecedent VPs themselves in this case.} Though the traces are semantically free within these constituents, the identity of their indices ensures that the ordinary semantic value of the constituent containing the antecedent VP, \(\text{visit}(g(1))(\text{polly})\), is an element of the focus semantic value of the constituent containing the deleted VP, \(\{\text{visit}(g(1))(x) \mid x\ \text{an alternative for } \text{erik}\}\), for every assignment \(g\).

\[(14)\quad [\text{every city } \text{[wh}^1 \text{that Erik did } <[\text{VP visit } t_1]>\text{]}^1 [\text{Polly PAST } [\text{VP visit } t_1]]\]

The LF for the ungrammatical ACD example in (13-b) is shown in (15). In this case, the syntactic identity requirement is satisfied, since the deleted VP and its antecedent differ only in the values of the indices on the traces. But the semantic contrast condition cannot be satisfied. For every constituent \(c\) that contains the antecedent VP and does not overlap with a constituent containing the deleted VP, the trace, \(t_1\), is semantically free in \(c\). This is a consequence of the theoretical design, with the nuclear scope of the determiner (in this case, \(\text{every}\)) represented as a formula at LF. In this case, then, the contraindexing of the traces in the deleted VP (\(t_2\)) and its antecedent (\(t_1\)) prevents the semantic contrast condition from being satisfied, since these are not guaranteed to have the same semantic value under every assignment.

\[(15)\quad [\text{every city } \text{[wh}^1 \text{that } t_1 \text{ is located in a state } \text{[wh}^2 \text{that Erik did } <[\text{VP visit } t_2]>\text{]}^1 [\text{Polly PAST } [\text{VP visit } t_1]]\]

Finally, the LF for the grammatical ACD case in (13-c) is shown in (16). Once again, the syntactic identity requirement is satisfied in virtue of the two VPs’ differing only in the values of the indices on the traces. In this case, however, the contraindexing of the traces does not prevent satisfaction of the semantic contrast condition. This is because the deleted VP and its antecedent are both contained inside relative clauses, and these
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are represented as predicates at LF. The ordinary semantic value of the relative clause containing the antecedent VP, $\lambda x. \text{visit}(x)(\text{polly})$, is an element of the focus semantic value of the relative clause containing the deleted VP, $\{\lambda x. \text{visit}(x)(y) \mid y \text{ an alternative for } \text{erik}\}$. The semantic contrast condition is thus satisfied, and ellipsis is licensed.

(16) \[\text{every city } [wh^1 \text{ that } [\text{Polly } \text{PAST} [\text{VP visit } t_1]]]]^1 \ [t_1 \text{ is located in a state } [wh^2 \text{ that } \text{Erik did } <[\text{VP visit } t_2]>>]\]

The crucial difference between the LFs in (15) and (16), for purposes of ellipsis licensing, concerns the status of the binder constituent whose superscripted index matches the one found on the trace in the antecedent VP (i.e., the index 1 in each case). In (16), this constituent is the relative operator, $wh^1$, which does not overlap with any constituent containing the deleted VP. In (15), by contrast, the relevant constituent is the entire quantificational DP headed by every, which contains the deleted VP, thereby preventing the no-overlap component of the semantic contrast condition from being met. The result is that the contraindexing of the traces in the deleted VP and the antecedent VP makes it impossible to satisfy the semantic contrast condition in (15) but not in (16): the only available constituents containing the antecedent VP in (15) are formulas, but in (16) there is an available constituent that is an appropriately contrasting predicate.

A question then arises in connection with the LF in (14). Just as in (15), the only available constituents containing the antecedent VP are formulas, yet ellipsis is licensed. As discussed above, this is because the traces in the deleted VP and the antecedent VP in (14) bear the same index; indeed, satisfaction of the semantic contrast condition in (14) is dependent on this coindexing. Why are the traces permitted to have identical indices in (14) but not in (15)?

Kennedy (2014, 267) proposes that, as a general matter, all binders must bear different indices, with one principled exception: a relative operator can (and, perhaps, must) bear the same index as the one borne by the DP whose nominal head the relative clause modifies. Kennedy suggests that this index matching is a form of local, syntactically mediated agreement. The proposal successfully predicts the difference between (14) and (15). In (14), the relative operator that binds the trace in the deleted VP modifies the nominal head (city) of the DP that binds the trace in the antecedent VP. The two binders are thus coindexed, with the traces in turn coindexed and the semantic contrast condition satisfied despite the fact that the antecedent is contained in a formula. In (15), by contrast, the relative operator that binds the trace in the deleted VP modifies a nominal head (state) within a more deeply embedded constituent; crucially, it is not the nominal heading the DP that binds the trace in the antecedent VP. The two binders are thus contraindexed, with the traces in the deleted and antecedent VPs likewise contraindexed. Since the antecedent VP in (15) is always contained in a formula, the semantic contrast condition cannot be satisfied.

To summarize the major features of Kennedy’s theory: (i) we assume Rooth’s twin syntactic and semantic conditions on ellipsis licensing; (ii) nuclear scopes are represented as formulas at LF; (iii) restrictions (including, especially, relative clauses) are represented as predicates at LF; and (iv) a relative operator bears the same binder index as the DP
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whose nominal head it modifies. With these assumptions in place, we are ready to return to the data from differential degree complements.

5.2 Predicates and formulas for differential degree complements

Let us begin with the as-clause LF from (4-a), which contains the QR-ed degree quantifier outside the ellipsis site. A predicates-and-formulas style LF for this as clause is shown in (17-a), with the matrix-clause LF shown in (17-b).

(17) a. \[ [\text{as} \ [\text{as} \ [\text{wh}_2 \ [(t_2\text{-many}) -\text{er than Mary}]^3 \ [\text{Alice did } \langle [\text{VP}\ \text{read} \ t_3\text{-many books}] > ]]]]_2 \]

b. \[ [(t_2\text{-many}) -\text{er than Mary}]^1 \ [\text{John } \text{PAST} \ [\text{VP} \ \text{read} \ t_1\text{-many books}]] \]

There are two quantificational DegPs in the matrix clause: the comparative quantifier headed by -er, which bears the binder index 1, and the differential degree quantifier headed by as, which bears the binder index 2 (i.e., the entire constituent represented in (17-a)).

Importantly, I propose that Kennedy’s assumptions about binder indexing should lead us to give the wh-operator in the degree complement clause in (17-a) the same index as the quantificational DegP for which it serves as restriction: namely, the index 2. This is a natural extension of Kennedy’s proposal for individual quantifiers. In this case, instead of modifying the head nominal within a quantificational DP, the constituent that contains the wh-operator serves as the first argument of the Deg head itself. Here too, then, binder matching can be conceived of as a matter of local syntactic agreement.

If this assumption is warranted, then we can explain the licensing of ellipsis with this as-clause LF. The syntactic identity condition is straightforwardly satisfied: the deleted VP in (17-a) and the antecedent VP in (17-b) differ only in the values of the indices on the traces they contain. More interestingly for our purposes, the semantic contrast condition is also satisfied. With the indexing established in (17), the constituent \[ [(t_2\text{-many}) -\text{er than Mary}]^3 \ [\text{Alice did } \langle [\text{VP}\ \text{read} \ t_3\text{-many books}] > ] \], which contains the deleted VP, contrasts appropriately with a constituent containing the antecedent VP, namely the entire constituent shown in (17-b) (assuming focus on the elided-clause subject Alice, as with Erik in Kennedy’s ACD examples). Note in particular that the contraindexing of the traces in the deleted VP (t_3) and the antecedent VP (t_1) does not prevent satisfaction of the semantic contrast condition here, since these traces are bound within the constituents in question. The only free index in each constituent is the index on the trace of the differential degree quantifier. Crucially, in each contrasting constituent, the free trace bears the index 2. This ensures that the ordinary semantic value of the constituent containing the antecedent VP, shown in (18-a), will be an element of the focus semantic value of the non-overlapping constituent containing the deleted VP, shown in (18-b), for every assignment \( \text{g} \).\(^7\) As a result, we correctly predict that ellipsis is licensed with this as-clause LF.

\(^7\)The representations in (18) are placeholders for one’s preferred semantics for comparison; note in particular that the metalanguage expression \texttt{mary} + \texttt{g}(2) in (18) and examples below is meant to represent the degree returned by applying the measure function in question to the individual \texttt{mary} and then adding to that the value that the assignment provides for the trace of the differential. Whatever the particular semantic implementation, (18-a) will come out as an element of (18-b), as required by the semantic contrast condition.
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(18) a. \[-er(mary+g(2))(\lambda d.\text{read}(d\text{-}\text{many}\text{-}\text{books})(john))\]
b. \{\[-er(mary+g(2))(\lambda d.\text{read}(d\text{-}\text{many}\text{-}\text{books})(x)) \mid x \text{ an alternative for alice}\}\]

Things are different with the as-clause LF from (4-b), which lacks the QR-ed degree quantifier outside the ellipsis site. An updated LF for this as clause is shown in (19-a); the matrix-clause LF, which is unchanged from the previous example, is repeated in (19-b).

(19) a. \[\text{as}\text{-}\text{clause}: \text{as} [\text{wh}^2 \text{[Alice did }<\text{VP read }t_2\text{-}\text{many books}>]\text{]]}^2\]
b. \[\text{as} \text{-}\text{clause}: [t_2\text{-}\text{many} \text{-}er \text{than Mary}]^1 \text{[John PAST [VP read }t_1\text{-}\text{many books}]]\]

The crucial difference is in the position of the trace bound by the wh-operator, \(wh^2\): whereas in (17) \(wh^2\) binds an as-clause-internal trace in a position structurally parallel to that of the coindexed matrix-clause trace, in (19) \(wh^2\) binds an as-clause-internal trace in a position structurally parallel to that of the contraindexed matrix-clause trace \(t_1\). The result is that the semantic contrast condition cannot be satisfied in (19). In particular, there is no antecedent-VP-containing constituent in which \(t_1\) is bound that can contrast appropriately with a deleted-VP-containing constituent. Contraindexing of the traces in the deleted VP and the antecedent VP is thus no longer semantically innocent as it was in (17), and we correctly predict that ellipsis is not licensed with this as-clause LF.

Note that both components of the predicates and formulas theory are indispensible here. The assumption that restrictions are represented as predicates—and, in particular, the assumption that there is a principled mechanism for coindexing wh-operators with the index-bearing constituents that contain them—is crucial for satisfying the semantic contrast condition in (17). If the as-clause-internal wh-operator were not coindexed with the quantificational DegP headed by as, then the free traces in differential position in the contrasting constituents would be contraindexed and semantic contrast would fail. On the other hand, if nuclear scopes were represented as predicates, then in (19) there would be an antecedent-VP-containing constituent in which \(t_1\) was bound, namely \([\text{John PAST [VP read }t_1\text{-}\text{many books}]]\). This constituent would contrast appropriately with the deleted-VP-containing constituent \([wh^2 \text{[Alice did }<\text{VP read }t_2\text{-}\text{many books}>]\text{]},\) and we would erroneously predict ellipsis to be licensed.

Much as with the ACD cases that Kennedy discusses, then, it is the hybrid representational nature of the predicates and formulas theory that allows us to derive the observed restriction on ellipsis licensing in differential degree complements.

6. Manipulating the position of focus

Since the semantic contrast condition on ellipsis licensing makes reference to the position of focus, we predict that appropriate focus manipulations might change the possibilities for what can be contained within a differential degree complement in which ellipsis is licensed. I discuss two such cases below: cases in which focus on the object supports pseudogapping and cases in which focus on the comparative degree quantifier headed by -er supports an interpretation in which John’s difference from Mary is compared simply to Alice’s total number of books read, i.e., the reading missing from examples like (1).
Ellipsis licensing in differential degree complements

Pseudogapping has already been sketched above with the example John read as many more books than Mary as Alice did magazines in (10-a). As we observed there, pseudogapping in the differential degree complement restricts the interpretation to one that compares (i) the amount by which John’s number of books read exceeds Mary’s to (ii) the amount by which Alice’s number of magazines read exceeds Mary’s, but never to the number of magazines Alice read. This restriction receives an explanation entirely parallel to the one sketched above for the ordinary VP ellipsis cases. In particular, the QR-ed degree quantifier headed by -er must be present in the as clause outside the ellipsis site in order to satisfy the semantic contrast condition, for exactly the same reasons as with VP ellipsis.

There are two interesting differences between the pseudogapping cases and the ordinary VP ellipsis cases. First, in order for the syntactic identity condition to be satisfied, the object DPs must vacate both the deleted VP and its antecedent. The traces they leave behind may (and, given our theoretical assumptions, perhaps must) be contraindexed. If we assume that this vacating movement adjoins the object DPs to a position immediately above VP, then it does not matter whether we treat the resulting LF representations as predicates or formulas: either way, both the object DP trace and its binder will be present within the constituent containing the deleted VP and the contrasting constituent containing its antecedent, since we need to select an antecedent-VP-containing constituent large enough to contain a binder for the matrix degree trace (as discussed above for (17), where this is the trace $t_1$). Second, in pseudogapping both the subject and the object in the as clause bear focus. The focus semantic value of the deleted-VP-containing constituent will thus contain variables in both positions, as shown in (20-b), in turn supporting their non-identity with their correspondents in the antecedent-VP-containing constituent, whose ordinary semantic value is identical to the one shown above in (18-a), repeated in (20-a).8

\begin{itemize}
  \item[(20)]
  \begin{enumerate}
    \item[-er(mary+g(2))(λd.\, read(d-many-books)(john))]
    \item \{[-er(mary+g(2))(λd.\, read(d-many-N)(x)) | x an alternative for alice, N an alternative for magazines}\}
  \end{enumerate}
\end{itemize}

A more intriguing effect is found in cases where the entire as-clause-internal degree quantifier is in focus. Consider (21), where the phrase in total is a degree quantifier that contrasts with the matrix degree quantifier headed by comparative -er.

(21) John read as many more books than Mary as Alice did in total.

Notably, (21) has the reading that was previously missing: the differential degree head as compares (i) the amount by which John’s number of books read exceeds Mary’s to (ii) the

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8For the sake of simplicity and legibility, the representations in (20) show the semantic values of the object DPs folded back into the positions in which they are interpreted. As mentioned above, we get the same semantic result regardless of whether we take this binding to be read off an LF containing a predicate or one containing a formula. I likewise take a simple, flat view of multiple foci, treating the focus semantic value of the as clause here as a set of propositions in which values for the two constituents in focus may vary independently (and likewise in (23-b) below, mutatis mutandis). I do not believe that anything crucial hinges on the choice of implementation for multiple foci for present purposes.
total number of books Alice read. Why is this reading available under ellipsis here but not in (1), which differs from (21) on the surface only in lacking the degree quantifier in total within the as clause?

The LF for the differential degree quantifier headed by as in (21) is shown in (22-a). The matrix-clause LF is the same as in the examples discussed in the previous section, and is repeated in (22-b).

\[
\begin{align*}
(22) & \quad a. \ [as [as [wh^2 [t_2\text{-in total}]^3 [Alice did <[VP read t_3\text{-many books}]>>]]]^2 \\
 & \quad b. \ [[t_2\text{-many}] \text{-er than Mary}][\text{John PAST } [VP read t_1\text{-many books}]]
\end{align*}
\]

I treat in total as a parameterized degree quantifier here, much like treatments of many after Hackl 2000 (including the treatment used throughout the present paper). This allows us to provide an appropriate semantics along with a syntax that contains the customary wh-operator movement within the degree complement clause. The indexing conventions are as above.

The syntactic identity condition on ellipsis licensing is plainly satisfied in (22), as in the cases discussed earlier. More interestingly, in this case the presence of focus on the degree quantifier in total also leads to satisfaction of the semantic contrast condition. The contrasting constituents are \([[[t_2\text{-in total}]^3 [Alice did <[VP read t_3\text{-many books}]>>]]]\, which contains the deleted VP, and the entire constituent represented in (22-b), which contains the antecedent VP. These constituents contain contraindexed VP-internal degree traces, but in both constituents, the VP-internal degree trace is bound. This means that the ordinary semantic value of the antecedent-VP-containing constituent, repeated in (23-a), is an element of the focus semantic value of the deleted-VP-containing constituent, shown in (23-b). The only additional assumption that is needed here is the quite reasonable assumption that a degree quantifier of the form \(n\text{-many more than Mary}\) is a suitable alternative for \(n\text{-in total}\), for any numeral \(n\).

\[
\begin{align*}
(23) & \quad a. \ -\text{er(mary}+g(2))(\lambda d.\text{read}(d\text{-many-books})(\text{john})) \\
 & \quad b. \ \{Q(\lambda d.\text{read}(d\text{-many-books})(x)) \mid x \text{ an alternative for alice, }Q \text{ an alternative for } g(2)\text{-in-total}\}
\end{align*}
\]

The presence of, and focus on, the degree quantifier in total in (21) thus yields an LF where the semantic contrast condition can be satisfied, and ellipsis licensed, even though differential as is not comparing John and Alice’s differences from Mary in number of books read. The contrast between (1) and (21) only further emphasizes the fact that we need a theory of ellipsis licensing, not a theory of measurement, to explain the restriction found in the former case. Once again, Kennedy’s predicates and formulas theory makes

\^Note in this connection that the coindexation of the free traces \((t_2)\) in the contrasting constituents here is incidental to the satisfaction of the semantic contrast condition, since the one that occurs in the deleted-VP-containing constituent is in focus. In other words, it is plausibly also the case that a degree quantifier of the form \(n\text{-many more than Mary}\) would be a suitable alternative for \(m\text{-in total}\), for any possibly distinct numerals \(n\) and \(m\).
the right predictions about the conditions under which ellipsis is licensed and the resultant range of interpretations supported within differential degree complements under ellipsis.

7. Summary

We began with a mysterious interpretive restriction on differential degree complements under ellipsis and ended with a new source of empirical support for a particular theory of ellipsis licensing: the predicates and formulas theory of Kennedy (2014), with its antecedents in Rooth 1992 and Heim 1997. The hybrid representational nature of the predicates and formulas theory seems to provide just the right framework of syntax–semantics interface assumptions for implementing Rooth’s theory of ellipsis licensing. Kennedy shows that this framework makes the right empirical predictions for an intricate set of ACD data. Here we have seen that his framework is similarly successful, and its assumptions similarly indispensable, for an account of ellipsis in differential degree complements.

References