Attributive uses of many

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Abstract In contrast to its determiner-like use, the attributive use of many has received little attention in the literature. The present paper narrows down the gap. First, just like ordinary superlative/positive adjectives and determiner-like many have received a unified account, a unified analysis is developed for reconstructed superlative/positive adjectives and reconstructed attributive many. In addition to the LFs independently motivated for reconstructed superlatives (Bhatt 2002; Hulsey & Sauerland 2006), an exhaustivity operator will be called for (cf. Chierchia, Fox & Spector (2012)), leading to nested foci. Second, the entire palette of readings attested for determiner-like many –cardinal vs. proportional, host-external vs. host-internal– will be shown to obtain for attributive many as well.

Keywords: many, degree operator, reconstruction, relative clause, cardinal, proportional, comparison class, exhaustivity operator, nested foci

1 Section

Determiner-like uses of many and its antonym few are relatively well studied in the semantics literature, both in terms of ambiguity and context-dependency. With respect to ambiguity, Partee (1989) and a long tradition thereafter treat these items as lexically ambiguous in terms of quantificational import, leading to a cardinal reading with the truth conditions in (1a)-(2a) and to a proportional reading with the truth conditions in (1b)-(2b), where the value of n and p is, as we will see, contextually determined. Using (3) as scenario validating both readings, the cardinal reading is exemplified in (4) and the proportional reading in (5):

(1) Many Ps are Q.
   a. CARDINAL reading:       |P ∩ Q| > n, with n a large natural number.
   b. PROPORTIONAL reading:   |P ∩ Q| : |P| > p, with p a large proportion.

(2) Few Ps are Q.
   a. CARDINAL reading:       |P ∩ Q| < n, with n a small natural number.

* We thank the audiences of SALT 27 and of the Speaker Series at the Department of Linguistics and Philosophy at M.I.T. for helpful comments and pointers. Remaining errors are mine.

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b. PROPORTIONAL reading: \(|P \cap Q| : |P| < p\), with \(p\) a small proportion.

(3) Scenario: All the faculty children were at the 1980 picnic, but there were few faculty children back then. Almost all faculty children had a good time.

(4) There were few faculty children at the 1980 picnic.

(5) Many (of the) faculty children had a good time.

With respect to context dependency, different truth conditions obtain depending of what comparison class is intended in the context, which in turn affects the values of \(n\) and \(p\) (Lappin (1988); Solt (2009); Romero (2015); see also Cohen (2001); Greer (2014)). For example, sentence (6) may be understood as comparing the number of professors that are musicians with the number of professors that have other hobbies or with the number of other high-level professionals that are musicians. The former reading is primed by the continuation (6a), where the alternatives in the comparison class are triggered by an element external to the NP hosting \(many\), namely, by \(musicians\). The latter reading is induced by (6b), where the comparison class is based on alternatives to a element internal to the host NP, namely, \(professors\):

(6) Many professors are musicians, ...

a. ... compared to professors who are \textit{painters, sculptors or singers}.

b. ... compared to \textit{bankers, architects or programmers} that are musicians.

The spectrum of quantificational and comparison class readings of determiner-like \(many\) has been at the centre stage of recent formal analyses in the literature. \(Many\) is decomposed into a stem \(MANY\) and the positive degree operator \(POS\) (Solt (2009); Penka (2011); Romero (2015); cf. Hackl (2000) on \textit{more} as \(MANY+\text{-}er\) and Hackl (2009) on \textit{most} as \(MANY+\text{-}est\)): (7)-(9). The choice between the stems \(MANY\_\text{card}\) and \(MANY\_\text{prop}\) delivers the quantificational import of the sentence. The argument fed into the \(\lambda Q\)-slot of \(POS\) determines what comparison class \(C\) the sentence will be evaluated against (Solt (2009); Romero (2015); a.o.). As we will see, the appeal of this line of analysis is that the formal apparatus called for is independently motivated for ordinary adjectives –e.g. \textit{long}– in superlative and positive form. As a result, \(ADJ+\text{-}est\), \(ADJ+POS\) and \(MANY+POS\) receive a unified analysis (where \(ADJ\) is the stem of an ordinary gradable adjective).

(7) \([MANY\_\text{card}]=\lambda d,A.x.e.|x|\geq d\)

\(=\lambda d,A.P_{<d,t>}x.e.\ P(x)\ \wedge\ |x|\geq d\)

(8) \([MANY\_\text{prop}]=\lambda d,A.x.e.\ P_{<d,t>}x.e.\ P(x)\ \wedge\ |x|:|P_{\text{Atomic}}|\geq d\)

(9) \([POS]=\lambda Q_{<d,t>}x.e.\ P_{<d,t>}x.e.\ L_{<d,t>,\ <dt>}Q\subseteq P\)
In contrast to determiner-like uses, attribute uses of *many* and *few*, exemplified in (10a) and (11a), have received much less attention. With regard to the empirical description, the literature typically only considers the cardinal reading and does not discuss different comparison classes parallel to the ones above. Attempts at a formal analysis have been limited too. Hackl (2000) suggests that simple examples of attributive *many* like (10a) contain a silent amount relative *that there were*, as in (10b), but provides no further analysis. Solt (2015) picks up Hackl’s suggestion and proposes the LF (11b) for example (11a), where *POS* and *MANY* are reconstructed into the silent relative clause and a pro-form *pro<e,t>* occupies the head of the NP. The result is the interpretation paraphrased in (11d) (cf. Shimoyama (1999)):

(10)  

a. The many guests all brought presents. (Hackl 2000: 99)  

b. The many guests *that there were* all brought presents.

(11)  

a. The many/few students who attended enjoyed the lecture. (Solt 2015: 257)  

b. LF: [ [NP The pro<e,t> [CP there were many students who attended ] ] enjoyed the lecture]  

c. $[pro<e,t>]= \lambda x_e. *student(x) \land attend(x)$  

d. ‘Many students attended. The students that attended enjoyed the lecture.’

However, this reconstruction analysis uses radically different LFs from those independently motivated for reconstructed superlatives. Consider sentence (12) with the superlative adjective *longest* as part of the head of the NP. This sentence is known to allow for the two readings (12a)-(12b) –disambiguated by the position of *ever*–, the latter of which involves reconstructing *longest* into the embedded complement CP inside the relative clause (Bhatt 2002; Hulsey & Sauerland 2006). We note that comparable examples are found for *many* and *few*, witness (13)-(14), with *ever* disambiguating the reading in the case of *few*. This parallelism raises the question of whether a unified analysis of reconstructed *ADJ+est* and *MANY+POS* is possible.

(12)  

The longest book that John (ever) said Tolstoy had (ever) written is on the shelf.  

a. High reading: ‘the $x$ that is the longest book about which John said that Tolstoy had written it’  

b. Low reading: ‘the $x$ such that John said that the longest book that Tolstoy had written was $x$’

(13)  

The many women that Mary said John had dated were standing over there.  

a. High reading: ‘the $x$ that is a numerous women sum and about which Mary said that John had dated it’
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b. Low reading: ‘the $x$ such that Mary said [that John had dated the women sum $x$ and that $x$ is many]’

(14) The few women that Mary (ever) said John had (ever) dated were standing over there.

The present paper aims at advancing the empirical description and formal analysis of attributive *many*, maintaining a unified analysis not only for \( \text{ADJ} + \text{est} \), \( \text{ADJ} + \text{POS} \) and determiner-like \( \text{MANY} + \text{POS} \), but also for attributive \( \text{MANY} + \text{POS} \). More concretely, the first and main objective is to develop an analysis of the low reading of *many* in (13) as parallel as possible to the one proposed for *longest* in (12) in the literature. As we will see, in addition to reconstruction into the Relative Clause, an exhaustivity operator associated with the trace will be called for, leading to a structure with nested alternative-marking parallel to nested focus-marking (cf. Wold (1996)). Once this analysis is in place, it can be used for simpler examples like (11a) (and possibly (10a)) if desired. The second, smaller goal of this paper is to attest what readings are available for attributive *many*. We will see that attributive *many* affords the same array of readings as determiner-like *many* does: Attributive *many* can be cardinal or proportional in nature and allows for a host-external and host-internal resolution of the comparison class argument.

The paper is organised as follows. Section 2 introduces the necessary background on \( \text{ADJ} + \text{est} \), \( \text{ADJ} + \text{POS} \) and determiner-like uses of \( \text{MANY} + \text{POS} \). Section 3 is concerned with low readings in Relative Clauses: Subsection 3.1 presents the analysis of the low reading of \( \text{ADJ} + \text{est} \) in the literature and section 3.2 parsimoniously extends this analysis to \( \text{ADJ} + \text{POS} \). Section 4 develops the proposal for the low reading of attributive \( \text{MANY} + \text{POS} \). Section 5 exemplifies the relevant array of readings for attributive *many*. Section 6 concludes.

2 Background

Ordinary (gradable) adjectives may appear in the comparative, superlative and positive form. Here we are interested in the latter two.

We start with ordinary superlative adjectives. They have been decomposed into a *STEM* and the superlative operator *est* defined in (15), where the $\lambda P$-argument corresponds to the comparison term –e.g., the set of degrees that Lucía reaches in tallness in (16)– and the $\lambda Q$-argument corresponds to the comparison class –the set containing, for each girl $x$ in the class, the set of degrees that $x$ reaches in tallness:

(15) \[-\text{est}] = \lambda Q_{<d_t,t>} . \lambda P_{<d_t>} . \forall Q \in Q[Q \neq P \rightarrow Q \subset P]

(16) a. Lucía is tallest (among the girls in her class).

b. $\forall Q \in \{\lambda d.tall(greta, d), \lambda d.tall(sarah, d), \lambda d.tall(lucia, d), \ldots\}$

\[
Q \neq \lambda d.tall(lucia, d) \rightarrow Q \subset \lambda d.tall(lucia, d)
\]
Superlative adjectives are known to allow for an absolute and for a relative reading, as in (17). Here we will be interested in the relative reading. The exact relative reading depends (at least partly) on the focus structure of the sentence, that is, on what element of the sentence functions as the focus associate of est (Szabolcsi 1986; Heim 1999). This is illustrated in (18) with two different focus associates –Mary and John– external to the host NP the longest letter. Focus associates internal to the host NP are possible in some languages too, as shown in (19) for Bulgarian (Pancheva & Tomaszewicz 2012):\footnote{In English, host-internal associates in relative readings of est have been claimed to be available for some speakers and deviant for others (Wilson 2015).}

(17) John climbed the highest mountain.
   a. Absolute: “John climbed a mountain higher than any other mountain”.
   b. Relative: “John climbed a higher mountain than anybody else climbed”.

(18) a. John wrote the longest letter to Mary\footnote{compares recipients of John’s letters}
   b. John\footnote{compares senders of letters to Mary} wrote the longest letter to Mary.

(19) Ivan ima naj-dobri albumi na/to U2\footnote{[Bulgarian]}
Ivan has est-good albums of/by U2
‘Ivan has better albums by U2 than by any other band.’
\footnote{compares authors of albums owned by Ivan}

A sample derivation of the relative reading is sketched in (21). The degree phrase [est C] scopes out of its NP host to gain sentential scope and the comparison class [C] is (partly) retrieved from the focus value of the LF sister of [-est C] via Rooth’s (1992) squiggle operator (20) (Heim 1999):

(20) \([\phi \sim C]\) is defined only if \([C] \subset [\phi]^f\);
    = \([\phi]\) if defined.

(21) Relative reading of (17):
   a. LF: \([-est C]\[1[John_F climbed A t_1-high mountain]] \sim C\]
   b. \([1[John climbed A t_1-high mountain]] =\)
   \(\lambda d. \exists x[\text{climb}(john, x) \land \text{mount}(x) \land \text{high}(x, d)]\)
   c. \([C] \subset \{\lambda d'. \exists x[\text{climb}(john, x) \land \text{mount}(x) \land \text{high}(x, d')], \lambda d'. \exists x[\text{climb}(bill, x) \land \text{mount}(x) \land \text{high}(x, d')], \ldots\}\)
   d. \([21a]\) = 1 iff \(\forall Q \in [C] [Q \neq \lambda d. \exists x[\text{climb}(j, x) \land \text{mount}(x) \land \text{high}(x, d)]] \rightarrow\)
   \(Q \subset \lambda d. \exists x[\text{climb}(j, x) \land \text{mount}(x) \land \text{high}(x, d)]]\)
We turn to ordinary adjectives in the positive form. In a parallel fashion to superlative adjectives, positive adjectives have been decomposed into a STEM and the positive operator POS in (22) (Heim 2006; von Stechow 2009: a.o.). For POS, function $L$ takes a set of sets of degrees on a given scale (the comparison class, e.g., the set containing, for each 8-year old $x$, the set of degrees that $x$ reaches in tallness) and returns the so-called neutral segment on that scale (i.e., the interval of degrees that make an 8-year old neither tall nor short plus the next degree higher and next degree lower than that interval). A simple example is offered in (23):

$$\[\text{POS}\] = \lambda Q_{<dt,t>} . \lambda P_{<dt,t>} . L_{<dt,t>,<dt,t>} (Q) \subseteq P \quad (=9)$$

(23) a. Lucía is tall (for an 8-year old / compared to other 8-year olds).
   b. \(L(\{\lambda d.\text{tall}(\text{valentin},d), \lambda d.\text{tall}(\text{jonah},d), \lambda d.\text{tall}(\text{lucia},d), \ldots\}) \subseteq \lambda d.\text{tall}($lucia,d)\)

The absolute/relative ambiguity has been detected for adjectives in the positive form too, as in (24) (Schwarz 2010). Again, we will concentrate on the relative reading. The exact relative reading depends, as before, on what element POS associates with, marked here with the subscript ALT to indicate that it is the source of the alternatives. Relative readings are illustrated in (25) for two different host-external associates (Schwarz 2010) and in (26)-(27) for a host-internal associate (Romero 2015):

(24) Mia has an expensive hat.
   a. Absolute: ‘Mia has a hat that is expensive for a hat’
   b. Relative: ‘Mia has a hat that is expensive for somebody like Mia to have (e.g., for a 3-year old)’.

(25) a. Paul$_{ALT}$ gave Mia an expensive hat.
     $\mapsto$ a hat that is expensive for somebody like Paul (e.g. unemployed people) to give
   b. Paul gave Mia$_{ALT}$ an expensive hat.
     $\mapsto$ a hat that is expensive for somebody like Mia (e.g. a 3-year old) to get

2 If two 8-year olds are equally tall, we need to represent the corresponding set of degrees twice. This can be secured by making function $L$ take a multi-set of degree sets (where the same degree set can figure more than once) (Blizard 1989). For the mathematical operations (mean, standard deviation, etc.) that $L$ applies to this multi-set to obtain the neutral segment, see Solt (2009).

3 We leave open whether POS’s associate functions as focus (cf. Herburger (1997) for many) or as topic (cf. Cohen (2001) for many). Furthermore, regardless of what information structure function the associate of POS has, this function may not always be marked phonologically (Cohen 2001; Beaver & Clark 2008). We will use the squiggle operator to retrieve not only the focus semantic value $[\phi]^f$ but generally the alternative semantic value $[\phi]^{alt}$.
(26) Scenario: Careless of their quality, John buys almost all his clothes at very cheap stores. The only exception are his shirts, for which he wants medium quality and is ready to pay a normal price.

(27) (For how very little John typically spends on pieces of clothing,) John buys [NP expensive shirts_{ALT}].

To derive the relative reading, Schwarz (2010) and Romero (2015) extend Heim’s (1999) analysis of ext to POS. As before, the degree phrase [POS C] scopes out of its host to obtain sentential scope and retrieves the comparison class [C] (partly) from the alternative semantic value of its LF sister. A sample derivation is in (28):

(28) Relative reading of (24):

a. LF: \([\text{POS C}][1\text{ Mia}_{ALT} has a t_1\text{-expensive hat}] \sim C\]

b. \([1\text{ Mia has a t_1\text{-expensive hat}] = λd.∃x[have(mia,x) \land hat(x) \land \text{expensive}(x,d)]\]

c. \([C] \subseteq \{λd'.∃x[have(mia,x) \land hat(x) \land \text{expensive}(x,d')], λd'.∃x[have(noa,x) \land hat(x) \land \text{expensive}(x,d')], \ldots\}\]

d. \([24] = 1 \text{ iff } L([C]) \subseteq λd.∃x[have(mia,x) \land hat(x) \land \text{expensive}(x,d)]\]

We turn to determiner-like uses of many. A parallel analysis has been developed for its absolute reading (Penka 2016) and its relative reading (Solt 2009; Romero 2015). Again, we will concentrate on the relative reading. Since the different possible relative readings will be important when we turn to attribute uses of many, we will examine them in more detail.

We start with the analysis of cardinal many, adapted here from Solt (2009). As in the case of ordinary adjectives, cardinal many is decomposed into an adjectival stem MANY_{card}, defined in (29), and the degree operator POS in (9). POS can have as its associate an element external to the host NP, as illustrated in (30), where the intended associate Lucia is external to the host NP many books. Its abridged derivation is given in (31).

(29) \([\text{MANY}_{card}] = λd.d.λx.\mid x\mid ≥ d\]

(30) (For an 8-year old,) Lucía_{ALT} has read many books.

(31) a. LF: \([\text{POS C}][1\text{ Lucia}_{ALT} has read [NP A t_1\text{-MANY books}]]) \sim C]\]

b. \([C] \subseteq \{λd'.∃x[\text{book}(x) \land \mid x\mid ≥ d' \land \text{read}(lucia,x)], λd'.∃x[\text{book}(x) \land \mid x\mid ≥ d' \land \text{read}(anna,x)], λd'.∃x[\text{book}(x) \land \mid x\mid ≥ d' \land \text{read}(sarah,x)], \ldots\}\]

c. \(L([C]) \subseteq λd.∃x[\text{book}(x) \land \mid x\mid ≥ d \land \text{read}(lucia,x)]\]
Cardinal *many* allows for a host internal associate too.\(^4\) Consider scenario (32) and sentence (33) from Romero (2016). The intended associate of *POS* in (33) -made salient by the *for*-phrase- is *Douglas*, which is internal to the host NP *many books by Douglas*. With this associate in mind, scenario (32) makes the cardinal reading of the sentence true and its proportional reading false. Since the sentence is judged true in this scenario, the host-internal cardinal reading is available. The derivation is sketched in (34):

(32) Scenario: John keeps all the books he reads in his library. John dislikes Scottish authors and has read little from them. More concretely, there are five Scottish authors and, when looking at John’s library, the speaker sees that John has read the following amounts of books by them:

<table>
<thead>
<tr>
<th>Author</th>
<th>Books Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>McFire</td>
<td>1 (out of 2)</td>
</tr>
<tr>
<td>McDawn</td>
<td>1 (out of 3)</td>
</tr>
<tr>
<td>Hings</td>
<td>1 (out of 5)</td>
</tr>
<tr>
<td>Keath</td>
<td>2 (out of 4)</td>
</tr>
<tr>
<td>Douglas</td>
<td>6 (out of 60)</td>
</tr>
</tbody>
</table>

(33) (For how unappealing Scottish authors are to John,) John has read *many books by Douglas*.

(34) a. LF: 
\[
[\text{\textsc{POS}} \text{\textsc{C}}] \quad [1[\text{\textsc{NP}} \land t_1-\text{\textsc{MANY}} \text{\textsc{books by Douglas}_{\textsc{ALT}}}] ] \sim C
\]

b. \([C] \subseteq \{ \lambda d'. \exists x[\#\text{book}(x) \land \text{by}(x,mcfire) \land |x| \geq d' \land \text{read}(john,x)], \\
\lambda d'. \exists x[\#\text{book}(x) \land \text{by}(x,mcfdawn) \land |x| \geq d' \land \text{read}(john,x)], \\
\lambda d'. \exists x[\#\text{book}(x) \land \text{by}(x,hings) \land |x| \geq d' \land \text{read}(john,x)], \\
\lambda d'. \exists x[\#\text{book}(x) \land \text{by}(x,keath) \land |x| \geq d' \land \text{read}(john,x)], \\
\lambda d'. \exists x[\#\text{book}(x) \land \text{by}(x,douglas) \land |x| \geq d' \land \text{read}(john,x)]\} \}
\]

c. \(L([C]) \subseteq \lambda d. \exists x[\#\text{book}(x) \land \text{by}(x,douglas) \land |x| \geq d' \land \text{read}(john,x)]\]

We turn to the analysis of proportional *many* in determiner-like use, adapted here from Romero (2015). Proportional *many* is decomposed into *POS* and the proportional adjectival stem in \(\text{\textsc{MANY}}(35)\). *POS* may associate with an element external to the host NP, as in Partee’s (1989) original proportional example (36) (=\(5\)), which can be easily understood as having *good* as *POS*’s associate in the relevant scenario. We sketch its semantic derivation in (37):

(35) \(\text{\textsc{MANY}}_{\text{\textsc{prop}}} = \lambda d. \lambda. P_{<e,t>} \cdot \lambda x. P(x) \land |x| : |P_{\text{Atomic}}| \geq d\)

(36) Many (of the) faculty children had a \text{\textsc{good}}\_{\text{\textsc{ALT}}} time.

(37) a. LF: \([\text{\textsc{POS}} \text{\textsc{C}}] \quad [1[[\text{\textsc{NP}} \land t_1-\text{\textsc{MANY}} \text{\textsc{faculty children}}] \text{\textsc{had a good}}_{\text{\textsc{ALT}}} \text{\textsc{time}}]] \sim C\]

b. \([t_1-\text{\textsc{MANY}} \text{\textsc{faculty children}}] = \lambda x. \#\text{f-child}(x) \land |x| : \{|z: \#\text{f-child}(z)| \} \geq g(1)\]

\(^4\) As we saw in the introduction, example (6) with *many* allows for a host-internal associate. But it is not entirely clear to me whether the intuitive reading is cardinal or proportional in nature.
The truth conditions of the perceived reverse proportional reading are characterised by Westerståhl’s (1985) famous example (39). Judged in scenario (38), this sentence intuitively allows for a reading labeled ‘reverse proportional reading’ in the literature and (very) roughly paraphrasable as (39a). Romero (2015) analyses this example as having Scandinavians as POS’s associate, as in (40a), and shows that the truth conditions (40f) resulting from this derivation correspond to the appropriate characterisation of the perceived reading.5

(38) Scenario: Of a total of 81 Nobel Prize winners in literature, 14 come from Scandinavia.

(39) Many Scandinavians have won the Nobel Prize in literature.

a. Rough paraphrase: ‘Many winners of the Nobel Prize in literature are Scandinavians.’

(40) a. LF: \([\text{POS C} \left[ I_\text{NP A f1-MANY Scandinavians\text{ }ALT} \right]] \sim C\]

5 The truth conditions of the perceived reverse proportional reading are characterised by Westerståhl (1985) as in (i). Cohen (2001) shows that the proportion \(|P \cap Q| : |P|\) matters when intuitively judging the sentence and amends the truth conditions to (ii). Romero (2015), in turn, shows that the distribution of the different proportions \(|P' \cap Q| : |P'|, |P'' \cap Q| : |P''|, |P'' \cap Q| : |P'''|, \ldots\) for different alternatives \(P', P'', P''', \ldots\) of \(P\) matters and corrects the truth conditions to (iii). The result obtained from derivation (40) matches the last characterisation.

(i) Westerståhl’s (1985) characterisation of the reverse proportional reading of Many Ps are Q:

\(|P \cap Q| : |Q| > p, \text{ where } p \text{ is a large proportion}\)

(ii) Cohen’s (2001) characterisation of the reverse proportional reading of Many Ps are Q:

\(|P \cap Q| : |P| > |\cup \text{ALT}(P) \cap Q| : |\cup \text{ALT}(P)|\)

(iii) Romero’s (2015) characterisation of the reverse proportional reading of Many Ps are Q:

\(|P \cap Q| : |P| > \theta(\{|P' \cap Q| : |P'| : P' \in \text{ALT}(P)|\})\)
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b. \([t_1\text{-}\text{MANY Scandinavians}] = \lambda x. \{\text{Scandin}(x) \land |x| : \{z:\text{Scandin}(z)\} \geq g(1)\}\]

c. \([\text{NP} \land t_1\text{-}\text{MANY Scandinavians}] = \lambda Q_{<e,t>}. \exists x [\text{Scandin}(x) \land |x| : \{z:\text{Scandin}(z)\} \geq g(1) \land Q(x)]\]

d. \([\text{NP} \land \text{t}_1\text{-}\text{MANY Scandinavians have won the NP in literature}] = \lambda d. \exists x [\text{Scandin}(x) \land |x| : \{z:\text{Scandin}(z)\} \geq d \land \text{NP-winner}(x)]\]

e. \([C] \subseteq \{\lambda d'. \exists x [\text{Scandin}(x) \land |x| : \{z:\text{Scandin}(z)\} \geq d' \land \text{NP-winner}(x)], \\
\lambda d'. \exists x [\text{Mediterr}(x) \land |x| : \{z:\text{Mediterr}(z)\} \geq d' \land \text{NP-winner}(x)], \\
\lambda d'. \exists x [\text{MEastern}(x) \land |x| : \{z:\text{MEastern}(z)\} \geq d' \land \text{NP-winner}(x)], \\
\ldots\}\]

f. \(L([C]) \subseteq \lambda d. \exists x [\text{Scandin}(x) \land |x| : \{z:\text{Scandin}(z)\} \geq d \land \text{NP-winner}(x)]\]

This concludes our review of relative readings of ADJ+est, ADJ+POS and determiner-like MANY+POS. In the next section, we turn to low relative readings of ADJ+est and ADJ+POS, paving the way towards our proposal on attributive \textit{many} in section 4.

3 Reconstruction into a relative clause

3.1 Low reading of ADJ+est

Recall the low reading of example (12), repeated here as (41):

\begin{enumerate}
  \item (41) The longest book that John said Tolstoy had written is on the shelf.
  \begin{enumerate}
    \item \textit{Low reading}: ‘the \(x\) such that John said that the longest book that Tolstoy had written was \(x\)’
  \end{enumerate}
\end{enumerate}

This reading has been analysed as syntactically involving a head raising structure of the Relative Clauses (Bhatt 2002; Hulsey & Sauerland 2006). The syntactic steps leading to the final LF structure are the following. First, the head of the relative clause \textit{longest book} is base-generated inside the Relative Clause and moves through Spec-CP\(_2\) and Spec-CP\(_1\) to its surface position leaving a copy at each stage, as shown in (43a). Second, the lowest copy is maintained and the other ones are deleted, as in (43b). Third, the surviving copy is converted into a definite description using Fox’s (2000) Trace Conversion Rule (42), with the result in (43c). Finally, the same configuration as we saw for degree operators in section 2 obtains: The degree phrase \([\text{est}\ C]\) scopes out, \textit{est’s} associate –here, the pronoun \textit{pro}\(_1\) within the surviving copy– is focus-marked, and the squiggle operator \(\sim\) relates the comparison class variable \(C\) to the LF sister of \([\text{est}\ C]\), as in (43d):

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(42) Trace Conversion Rule (Fox 2000):

a. Variable insertion: \((\text{Det}) \text{Pred}_i \Rightarrow (\text{Det}) [\text{Pred} \lambda.y.y=\text{pro}_1]\)

b. Determiner Replacement: \((\text{Det}) [\text{Pred} \lambda.y.y=g(i)] \Rightarrow \text{the} [\text{Pred} \lambda.y.y=\text{pro}_1]\)

(43) a. Copies at LF:
The longest book\(_1\) that \([CP_1 \lambda \text{longest book}\_1 \lambda \text{that John said} [CP_2 \lambda \text{longest book}\_1 \lambda \text{that Tolstoy had written} \lambda \text{longest book}\_1]]\)

b. Copy deletion:
The longest book\(_1\) that \([CP_1 \lambda \text{longest book}\_1 \lambda \text{that John said} [CP_2 \lambda \text{longest book}\_1 \lambda \text{that Tolstoy had written} \lambda \text{longest book}\_1]]\)

c. Trace conversion:
The longest book\(_1\) that \([CP_1 \lambda \text{longest book}\_1 \lambda \text{that John said} [CP_2 \lambda \text{longest book}\_1 \lambda \text{that Tolstoy had written} \lambda \text{longest book}\_1]]\)

d. \(-est\) movement and marking of the focus associate:
The longest book\(_1\) that \([CP_1 \lambda \text{longest book}\_1 \lambda \text{that John said} [CP_2 \lambda \text{longest book}\_1 \lambda \text{that Tolstoy had written} \lambda \text{longest book}\_1]]\)

To carry out the semantic derivation with the superlative morpheme embedded under an attitude verb, we need the intensional version of \(-est\), given in (44). Additionally, since John may not have specified in his utterance all the books that Tolstoy had written, the comparison class based on the books written by Tolstoy in \(w'\) will generally vary from one attitude world \(w'\) to the next. This means that the value of \(C\) needs to be relativized to the corresponding evaluation world \(w'\): \([C_{w'}]\) contains only degree properties \(D_{<d, st>}\) in \([\phi]\) that are true of some degree \(d\) in \(w'\), as stated in (45). The derivation proceeds as in (46):

(44) \([-est]=\lambda Q_{<d, st>}, \lambda P_{d, st}, \lambda w. \forall Q \in Q[Q \neq P \rightarrow Q_w \subset P_w]\)

(45) \([\phi \sim C_{w'}]\) is defined only if \([C_{w'}] \subseteq [\phi]\) and \(\forall D_{<d, st>} \in [C_{w'}]: \exists d[D(d)(w')];\)

(46) a. [The 1 \([CP_1 \lambda w'\) that \(w' [-est C_{w'}]\) 2[Tolstoy had written the t2-long book \(\lambda y.y=\text{pro}_{1,F} \sim C_{w'}]]\) is on the shelf]

b. \([\lambda 2 [\text{Tolstoy had written the t2-long book} \lambda y.y=\text{pro}_{1,F}] = \lambda d. \lambda w''. \text{Tolstoy wrote}_{w''} ty[y is d-long, w'' book, w'' \wedge y=g(1)]\]

c. \([C_{w'}] = \{ \lambda d. \lambda w''. \text{Tolstoy wrote}_{w''} ty[y is d-long, w'' book, w'' \wedge y=a],\)
\[
\lambda d. \lambda w''. \text{Tolstoy wrote}_{w''} ty[y is d-long, w'' book, w'' \wedge y=b],\]
\[
\lambda d. \lambda w''. \text{Tolstoy wrote}_{w''} ty[y is d-long, w'' book, w'' \wedge y=c], \ldots \}\]

d. \([CP_2] = \lambda w'. \forall Q \in [C_{w'}]\)

\([Q \neq \lambda d. \lambda w''. \text{Tolstoy wrote}_{w''} ty[y is d-long, w'' book, w'' \wedge y=g(1)] \rightarrow Q_{w'} \subset \lambda d. \text{Tolstoy wrote}_{w''} ty[y is d-long, w'' book, w'' \wedge y=g(1)]]\]
Attributive many

e. [(46a)] = λw. txe [John saidw: λw’. ∀Q ∈ [Cw’]]

[(Q ≠ λd.λw”. T wrotew’ t[y is d-longw” bookw” ∧ y=x] →
Qw’ ⊆ λd. T wrotew’ t[y is d-longw” bookw” ∧ y=x]]

isw’ on the shelf

3.2 Low reading of ADJ+POS

We parsimoniously extend this analysis to adjectives in the positive form. Consider example (48), modified from Hulsey & Sauerland (2006), and scenario (47). We are interested in deriving the low relative reading paraphrased in (48a) and validated by the scenario:6

(47) Scenario: Siouxsie said, pointing at a book on the table: “Lydia has written this book. For a 9-year old, this is a long book to write.”

(48) The long book that Siouxsie said that (for a 9-year old) Lydia had written was on the table.

a. Low relative reading: ‘the x of which Siouxsie said that Lydia wrote the book x and that x was a long book for somebody like Lydia (e.g., a 9 year old) to write’

To this end, we use the intensional version of POS, given in (49). Additionally, in order to derive the relative reading comparing 9-year olds and their books with each other, we need two elements in the sentence to be ALT-marked, namely, Lydia and pro1, as shown in (50a). Furthermore, the value of the comparison class variable C is, as before, relativized to the evaluation world w’, and thus the value in (50c) has already satisfied the prerequisites in (45). Finally, when the function Lw’ combines with the set of degree properties [Cw’] in (50d), it takes the extension of each of those properties at w’ and computes the neutral segment from them. The resulting truth conditions are spelled out in (50e), which capture the intended low relative reading:

(49) [POS] = λQ<,<d,≥t,≥t>. λP<,<d,≥t>. λw. Lw(Q) ≤ Pw

(50) a. LF: [The 1 that [CP1 that S said [CP2 λw’ that w’ [POS Cw’] 2[LydiaALT wrote [the t2-long book λy.y=pro1.ALT]] ∼ Cw’]] was on the table]

b. [2 [LydiaALT wrote the t2-long book λy.y=pro1.ALT]]

= λd.λw”.Lydia wrote t[y is a d-longw” bookw” ∧ y=g(1)]

6 We concentrate on readings in which the attitude holder has a de re attitude about the relevant individual x_e. For de re readings about an intensional object –e.g., an individual concept–, one could incorporate insights from Grosu & Krifka (2007) into the present analysis.
4 Proposal: Low reading of many

We are ready to tackle the low reading of many in examples like (52) (= (13)). To make the comparison class more concrete, we will target a low relative reading according to which Mary’s statement compared the amount of women dated by John with the amount of women dated by other people like John (e.g., 18-year olds). The corresponding scenario is given in (51) and a roughly paraphrase in (52a):7

(51) Scenario: Mary said, pointing at a group of women nearby: “The women John has dated are standing over there. For an 18-year old, these are many women to have dated.”

(52) The many women that Mary said John had dated were standing over there.

a. Low reading: ‘the x such that Mary said [that John had dated the women sum x and that x is many for somebody like John (e.g., an 18-year old) to have dated]’

Sentences like (i) and (ii) are often grouped together under the label ‘amount relatives’ (Carlson 1977; Heim 1987), or ‘maximalizing relatives’ (Grosu & Landman 1998), even though the former extracts over degrees and the latter over individuals. Sentence (52) in the text is of the latter kind, with the addition that the head many women is interpreted under an intensional verb. Note, furthermore, that the low relative reading that we are targeting is a de re reading about an individual x_e, not about an intensional object. See footnote 6.

(i) Mary shouldn’t even have the few drinks that she can take.  (Sauerland 1998)

a. ‘Consider the number n such that Mary can (maximally) take n-many drinks and n-many drinks is little. Mary shouldn’t even have n-many drinks.’

(ii) The very few books that there were on his shelves were all mysteries.  (Heim 1987)

a. ‘Consider the x such that the books on his shelves were x and x were very few. x were all mysteries.’
We will tackle this reading in two subsequent attempts. The first attempt simply transposes the LF structure we just used for $\text{ADJ}+\text{POS}$ to $\text{MANY}+\text{POS}$ (subsection 4.1). This attempt will fail to deliver the appropriate comparison class and, hence, the appropriate neutral segment for the comparison. In the second attempt, an exhaustivity operator is added to the LF, first informally (subsection 4.2) and then formally (subsection 4.3), which will derive the appropriate truth conditions.

### 4.1 First attempt

Transposing the LF structure used for $\text{ADJ}+\text{POS}$ to $\text{MANY}+\text{POS}$ gives us the structure (53) for sentence (52).

\[ \text{LF: [The 1 [CP1 that M said [CP2 that [POS C] 2[IP John ALT had dated [the t2-MANY women }\lambda y.y=\text{pro1}]~ \text{C]] were nearby]} \]

Assume for concreteness that, for a given world $w'$ compatible with Mary’s utterance, the following holds: the set of 18-year olds in $w'$ contains only John, Bill and Herbert, the women John dated in $w'$ are $a+b+c$, the women Bill dated in $w'$ are $d+e$, and the women Herbert dated in $w'$ are $f+g$. This means that, for that world $w'$, the comparison class $[C_{w'}]$ will be as in (55).\(^8\) Note that this comparison class contains not only the degree property corresponding to John and to the maximal women sum $a+b+c$ that he dated in $w'$, but also the degree properties corresponding to John and to smaller women sums that he dated in $w'$, e.g., the women sum $a+b$. This is because the degree property $D$ corresponding to John and $a+b$ is: (i) a member of the alternative semantic value $[2[IP]]^\text{alt}$ and (ii) such that $D(d)(w') = 1$ for some degree $d$, as required by (45):

\[ \lambda d.\lambda w'' .\text{John dated}_{w''} \sigma y[\ast \text{woman}_{w''}(y) \wedge |y| \geq d \wedge y = g(1)] \]

\[ [C_{w'}] = \{ \lambda d.\lambda w''.\text{John dated}_{w''} \sigma y[\ast \text{woman}_{w''}(y) \wedge |y| \geq d \wedge y = a+b+c ], \lambda d.\lambda w''.\text{John dated}_{w''} \sigma y[\ast \text{woman}_{w''}(y) \wedge |y| \geq d \wedge y = a+b ] \}
\]

\(^8\) If, additionally, there is an 18-year old –e.g. Al– who has not dated any woman in $w'$, we would need a degree property like (i), where $\top$ is a dummy individual whose cardinality is 0 and of which any combination of (other) non-contradictory properties is true at $w'$. We will ignore this complication in the remainder of this paper.

\[(i) \quad \lambda d.\lambda w''.\text{Al dated}_{w''} \sigma y[\ast \text{woman}_{w''}(y) \wedge |y| \geq d \wedge y = \top] \]
\[ \lambda d. \lambda w'. \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=b+c], \]
\[ \lambda d. \lambda w'. \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=a+c], \]
\[ \lambda d. \lambda w'. \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=a], \]
\[ \lambda d. \lambda w'. \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=b], \]
\[ \lambda d. \lambda w'. \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=c], \]
\[ \lambda d. \lambda w'. \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=d+e], \]
\[ \lambda d. \lambda w'. \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=d], \]
\[ \lambda d. \lambda w'. \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=e], \]
\[ \lambda d. \lambda w'. \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=f+g], \]
\[ \lambda d. \lambda w'. \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=f], \]
\[ \lambda d. \lambda w'. \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=g], \}

The remainder of the computation proceeds as follows:

(56) \[ \square \text{CP}_2 = \lambda w'. L_{w'}(\square C_{w'}) \subseteq \lambda d. \text{John dated}_{w'} \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=g(1)] \]

(57) \[ \lambda w'. L_{w'}(\square C_{w'}) \subseteq \lambda d. \text{John dated}_{w'} \sigma y[\text{*woman}_{w'}(y) \land \abs{y} \geq d \land y=x] \]

were \( w \) nearby.

There is a problem with the truth conditions in (65d). Function \( L \) will combine with the set of degree properties (55) and, for each of these properties, it will extract its extension at \( w' \). This leads to the multi-set of degree sets—depicted as intervals—in (58), where each 18-year old contributes not one but several degree intervals. If function \( L \) calculates the neutral segment based on this multi-set, we will end up with a wrong neutral segment skewed towards low numbers (as if many 18-year olds had dated exactly one woman). Instead of (58), the multi-set we need is (59), where each 18-year old contributes exactly one interval, namely, his maximal interval:

(58) \[ \{ [1,3], [1,2], [1,2], [1,2], [1], [1], [1], [1], [1], [1], [1], [1] \} \]
\[ \implies \text{John’s intervals} \]
\[ \implies \text{Bill’s intervals} \]
\[ \implies \text{Herbert’s intervals} \]

(59) \[ \{ [1,3], [1,2], [1,2] \} \]
\[ \implies \text{John’s maximal interval} \]
\[ \implies \text{Bill’s maximal interval} \]
\[ \implies \text{Herbert’s maximal interval} \]

### 4.2 Second attempt, informally

Our example (52) has two \textsc{alt}-associates of \textsc{pos}, namely, \textit{John} and \textit{pro1}. We just saw that, for each alternative \( x \) to John, we want as the alternative to \textit{pro1}
the maximal, exhaustive sum of women that $x$ dated. We propose to secure this maximality by adding the exhaustivity operator $\text{Exh}$ in (60) to the LF (cf. Chierchia et al. (2012)) and associating it with $\text{pro}_1$ via F-marking. This means, crucially, that we have nested ALT/F-marking on $\text{pro}_1$, as shown in the informal LF (61):  

\begin{equation} \label{eq:60} [\text{Exh}] = \lambda C_{<s,f,J>} \lambda p_{<s,f,J>} . \lambda w . p(w) = 1 \land \forall q \in C . [q(w) = 1 \rightarrow p \subseteq q] \end{equation} 

\begin{equation} \label{eq:61} \text{LF: The 1 } [\text{CP}_1 \text{ that M said } [\text{CP}_2 \text{ that } \text{POS C}_{j,m} 2[\text{IP}_1 \text{ Exh } D_i \text{ [IP}_2 \text{ John}_{\text{ALT}}] \text{ dated the } t_2\text{-}\text{MANY women } \lambda y . y = [[\text{pro}_1]_{\text{ALT}_m} \text{FI}_1] \sim D_i ] \sim C_{j,m} ]] \text{ were nearby.} \end{equation} 

To see informally how nested foci have been interpreted in the literature, consider the dialog in (62) (Rooth 1992; Wold 1996), with focal stress marked in capitals. Under the intended reading, water functions both as the focus-associate of only –giving rise to the set of alternatives $D_i$– and as the focus-associate of also –giving rise to the set of alternatives $C_m$–, as informally represented in (62):  

\begin{align*} (62) \quad & \text{A: John once only drank WIne.} \\
& \text{B: John also once only drank WAter.} \\
(63) \quad & \text{LF: } [\text{IP}_1 [\text{Also } C_m] \text{ once } [ \text{only } D_i ] [\text{IP}_2 \text{ John drank [water}_{\text{Fm}}]_{\text{FI}_1}] \sim D_i ] \sim C_m ] \\
\end{align*} 

Informally, the meaning composition proceeds as follows. The set of alternatives $D_i$ has the shape in (64a). Once we combine only, $D_i$ and IP2, we obtain (roughly) the ordinary semantic value in (64b). Now we have to build the set $C_m$ of alternatives that are like $[[\text{only } D_i] \text{ IP}_2]$ except that they result from substituting $[\text{water}]$ with another object of the same semantic type. This gives us the set (64c). The resulting truth conditions are given in (64d):  

\begin{align*} (64) \quad & \text{a. } [D_i] = \{ \lambda w'. \text{John drank}_{w'} \text{ water}, \lambda w'. \text{John drank}_{w'} \text{ wine,} \\
& \quad \lambda w'. \text{John drank}_{w'} \text{ beer, } \ldots \} \\
& \text{b. } [[\text{only } D_i] \text{ IP}_2] = \lambda w'. \text{John drank}_{w'} \text{ water and nothing else} \\
& \text{c. } [C_m] = \{ \lambda w'. \text{John once drank}_{w'} \text{ water and nothing else,} \\
& \quad \lambda w'. \text{John once drank}_{w'} \text{ wine and nothing else,} \\
& \quad \lambda w'. \text{John once drank}_{w'} \text{ beer and nothing else, } \ldots \} \\
& \text{d. } [\text{IP}_1] = \lambda w : \exists p \in C_m[p \neq [\lambda w'. \text{John once drank}_{w'} \text{ water and nothing else}] \text{ and } p(w) = 1]. \text{John once drank}_{w} \text{ water and nothing else} \\
\end{align*} 

Footnote 9: In this subsection, we use indices on comparison class variables $-D_i, C_{j,m}$– and on F/ALT-marking $-\text{ALT}_m, \text{ALT}_j, F_i$ – in a purely informal way to intuitively represent the dependencies between them.
The idea is to extend the procedure for interpreting nested F-marking to ALT-marking in general and to apply it to our example. Very informally, what we want to obtain for the embedded CP in LF (61) is the following. When considering the 18-year old John, the set of alternatives \(D_j\) will have the shape in (65a) and \(2[E_{\text{Exh}}D_j] IP_2\) will have the degree property (65b) as semantic value. Then we consider the 18-year old Bill and “recompute” the set of alternatives \(D_i\) and the value of \(2[E_{\text{Exh}}D_i] IP_2\), and do the same for the 18-year old Herbert. The degree properties so obtained are collected into a set, which will be the value of \(C_{m,j}\), as in (65c). The truth conditions of the embedded CP will be (65d):

\[
(65) \begin{align*}
\text{a. } [D_i] &= \{ \lambda w''. \text{John dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq g(2) \land y=a+b+c], \\
& \quad \lambda w''. \text{John dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq g(2) \land y=a+b], \\
& \quad \lambda w''. \text{John dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq g(2) \land y=b+c], \\
& \quad \lambda w''. \text{John dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq g(2) \land y=a+c], \\
& \quad \lambda w''. \text{John dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq g(2) \land y=a], \\
& \quad \lambda w''. \text{John dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq g(2) \land y=b], \\
& \quad \lambda w''. \text{John dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq g(2) \land y=c] \}\}
\end{align*}
\]

\[
\text{b. } [2[E_{\text{Exh}}D_i] IP_2] = \lambda d. \lambda w''. \text{John dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq d \land y=a+b+c] \text{ and no other woman}_{w''},
\]
\[
\forall p \in D_i \ [p(w'')] = 1 \rightarrow
[\lambda w''. \text{John dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq g(2) \land y=a+b+c]] \subseteq p\]
\]
\[
= \lambda d. \lambda w''. \text{John dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq d \land y=a+b+c] \text{ and no other woman}_{w''},
\]

\[
\text{c. } [C_{m,j}] = \{ \lambda d. \lambda w''. \text{John dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq d \land y=a+b+c] \text{ and no other woman}_{w''}, \\
\lambda d. \lambda w''. \text{Bill dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq d \land y=d+e] \text{ and no other woman}_{w''}, \\
\lambda d. \lambda w''. \text{Herbert dated}_{w''} \sigma y[\#\text{woman}_{w''}(y) \land |y| \geq d \land y=f+g] \text{ and no other woman}_{w''} \}
\]

\[
\text{d. } [CP_2] = \lambda w'. L_{w'}([C_{m,j}]) \subseteq \\
\lambda d. \text{John dated}_{w'} \sigma y[\#\text{woman}_{w'}(y) \land |y| \geq d \land y=a+b+c] \text{ and no other woman}_{w'}
\]

This subsection has presented the basic idea of the proposal in an informal way. To derive the desired results compositionally, we need to apply formal accounts of nested F-marking, such as those in Rooth (1992) or Wold (1996), to ALT-marking in general. We do so for Wold’s (1996) account in the next subsection.

4.3 Second attempt, formally

Wold’s (1996) system of F-marking interpretation has three main features. We extend each of them to ALT-marking in general.
First, the (partial) assignment g serves two purposes. On the one hand, it is used to interpret indices on pronouns and traces, e.g., \textit{pro}$_1$. This is its standard use in the literature, illustrated in (66). On the other hand, each ALT-marking carries an index, and assignment g is used to interpret those indices. The semantics for ALT-marked elements is defined in (67) and illustrated in (68)-(69) for an assignment g that is defined only for index 1:

\begin{align*}
\text{(66) a. } & \lbrack John \rbrack^g = \text{john} \\
\text{b. } & \lbrack \text{pro}_1 \rbrack^g = g(1)
\end{align*}

(67) Semantics for focus marking ALT$_i$:
\begin{align*}
\lbrack \alpha_{\text{ALT}} \rbrack^g & = \begin{cases} g(i) & \text{if } i \in \text{Dom}(g) \\ \alpha^g & \text{if } i \notin \text{Dom}(g) \end{cases} \\
\lbrack \alpha \rbrack^g & = \begin{cases} g(i) & \text{if } i \in \text{Dom}(g) \\ \alpha^g & \text{if } i \notin \text{Dom}(g) \end{cases}
\end{align*}

\begin{align*}
\text{(68) a. } & \lbrack \text{John} \rbrack_{\text{ALT}}^5 = \lbrack \text{John} \rbrack^g = \text{john} \\
\text{b. } & \lbrack \text{John} \rbrack_{\text{ALT}}^5 \cup \{ <5, x> \} = x \\
\text{(69) a. } & \lbrack \text{pro}_1 \rbrack_{\text{ALT}}^5 = \lbrack \text{pro}_1 \rbrack^g = g(1) \\
\text{b. } & \lbrack \text{pro}_1 \rbrack_{\text{ALT}}^5 \cup \{ <5, x> \} = x
\end{align*}

Second, ALT-markings are selectively closed off. This is achieved via co-indexation between the index of ALT-marking and the index of the relevant operator.

Third, there is no mediating squiggle operator ∼ or open variable C. The closing off of alternatives is done directly by the ALT-sensitive operator, e.g., \textit{only}, \textit{Exh} and \textit{POS}, as defined in (70)-(72):

\begin{align*}
\text{(70) } & \lbrack \text{only}_i \phi_{<s,t>} \rbrack^g \text{ is defined only if } i \notin \text{Dom}(g); \text{ if defined} \\
& = \lambda w. \lbrack \phi \rbrack^g(w). \forall q [q \in \{ \lbrack \phi \rbrack^g \cup \{ <i, x> \} : x \in \text{De}_e \} \land p \notin q \rightarrow q(w) = 0] \\
\text{(71) } & \lbrack \text{Exh}_i \phi_{<s,t>} \rbrack^g \text{ is defined only if } i \notin \text{Dom}(g); \text{ if defined} \\
& = \lambda w. \lbrack \phi \rbrack^g(w) \land \forall q [q \in \{ \lbrack \phi \rbrack^g \cup \{ <i, x> \} : x \in \text{De}_e \} \land q(w) = 1 \rightarrow \lbrack \phi \rbrack^g \subseteq q] \\
\text{(72) } & \lbrack \text{POS}_i \phi_{<d, s, t>} \rbrack^g \text{ is defined only if } i \notin \text{Dom}(g); \text{ if defined} \\
& = \lambda w. \ L^w_w(\{ \lbrack \phi \rbrack^g \cup \{ <i, x> \} : x \in \text{De}_e \}) \subseteq \lambda d. \lbrack \phi \rbrack^g(d)(w)
\end{align*}

With these tools at hand, let us demonstrate how the top-down semantic derivation of our example (52), repeated below as (73), proceeds. The starting point is the LF (74), which contains three instances of indexed F/ALT-marking: F-marking F$_7$ on \textit{pro}$_1$, to be closed off by Exh$_7$, and ALT-marking ALT$_8$ on \textit{pro}$_1$ and ALT$_9$ on \textit{John}, both to be closed off by POS$_8$).

10 This means that the job done in (45) by the world-relativized variable \textit{C}$_w$ and the squiggle operator has to be carried out now by the ALT-sensitive operator itself. For POS, this means that, out of the set of degree properties fed into \textit{L}$_w$, \textit{L}$_w$ will select the degree properties P such that \( \exists d [P(d)(w) = 1] \) and will compute the neutral segment based on their extension at \textit{w}. 497
The many women Mary said that John had dated were standing over there.

LF of (73):

\[
[IP1 \{NP The [CP1 1 Mary said [CP2 POS8,9 2[IP2 Exh7 [IP3 JohnALT9 dated the t2-MANY women λv_e.v=[pro1,ALT8,F7]]]]] were standing over there]\]
\]

For simplicity, we start with an empty assignment \(g\). We will concentrate on the semantic derivation of the relative clause. Its top CP node receives the partial interpretation in (75a). This line calls for the interpretation of the embedded CP under the modified assignment \(g^{u/1}\), which is done in (75b). The latter line asks us to run the derivation of the embedded [2 IP2] under two different assignments: once under \(g^{u/1}\) and once under \(g^{u/1} \cup \{<8,y>,<9,z>\}\). This is done in (75c) and (75c') respectively. These two lines, in turn, require us to interpret IP3 under four different assignments, namely, \(g^{u/1/2}, g^{u/1/2} \cup \{<7,x>\}, g^{u/1/2} \cup \{<8,y>,<9,z>\}\) and \(g^{u/1/2} \cup \{<7,x>,<8,y>,<9,z>\}\). This task is carried out in (75d)-(75d'').

(75)

\[a. \quad [I [Mary said CP2]]^g = \lambda u_e.\lambda w.\forall w' \in \text{SAY}_\text{mary}(w): \Gamma[CP2]^{g^{u/1}}(w') \]

\[b. \quad [CP2]^{g^{u/1}} = [POS8,9 2[IP2]]^{g^{u/1}} = \lambda w'. \Gamma(\{2 IP2\}^{g^{u/1}} \cup \{<8,y>,<9,z>\}: y,z \in D_e) \subseteq \lambda d. [2 IP2]^{g^{u/1}}(d)(w') \]

\[c. \quad [2 IP2]^{g^{u/1}} = [2 [Exh7 IP3]]^{g^{u/1}} = \lambda d. \lambda w''. [IP3]^{g^{u/1/2}}(w'') \land \forall q \in \{ [IP3]^{g^{u/1/2}} \cup \{<7,x>\}: x \in D_e \} \land q(w'') = 1 \rightarrow [IP3]^{g^{u/1/2}}(q) \]

\[c'. \quad [2 IP2]^{g^{u/1}} \cup \{<8,y>,<9,z>\} = [2 [Exh7 IP3]]^{g^{u/1}} \cup \{<8,y>,<9,z>\} = \lambda d. \lambda w''. [IP3]^{g^{u/1/2}}(w'') \land \forall q \in \{ [IP3]^{g^{u/1/2}} \cup \{<7,x>,<8,y>,<9,z>\}: x \in D_e \} \land q(w'') = 1 \rightarrow [IP3]^{g^{u/1/2}}(q) \]

\[d. \quad [IP3]^{g^{u/1/2}} = [JohnALT9 dated the t2-MANY women λv_e.v=[pro1,ALT8,F7]]^{g^{u/1/2}} = \lambda w'''. \text{John dated}_{u} \sigma v_e[\text{woman}_{u/m}(v) \land |v| \geq d \land v=u] \]

\[d'. \quad [IP3]^{g^{u/1/2}} \cup \{<7,x>\} = [JohnALT9 dated the t2-MANY women λv_e.v=[pro1,ALT8,F7]]^{g^{u/1/2}} \cup \{<7,x>\} = \lambda w'''. \text{John dated}_{u} \sigma v_e[\text{woman}_{u/m}(v) \land |v| \geq d \land v=x] \]

\[d''. \quad [IP3]^{g^{u/1/2}} \cup \{<8,y>,<9,z>\} = [JohnALT9 dated the t2-MANY women λv_e.v=[pro1,ALT8,F7]]^{g^{u/1/2}} \cup \{<8,y>,<9,z>\} = \lambda w'''. \text{z dated}_{u} \sigma v_e[\text{woman}_{u/m}(v) \land |v| \geq d \land v=y] \]

\[d'''. \quad [IP3]^{g^{u/1/2}} \cup \{<7,x>,<8,y>,<9,z>\} = [JohnALT9 dated the t2-MANY women λv_e.v=[pro1,ALT8,F7]]^{g^{u/1/2}} \cup \{<7,x>,<8,y>,<9,z>\} = \lambda w'''. \text{z dated}_{u} \sigma v_e[\text{woman}_{u/m}(v) \land |v| \geq d \land v=x] \]
We assemble all the pieces together in (76). The first line headed by an equal sign is copied from (75a). The second line inserts the value obtained for $[CP_2]^{g^{\eta/1}}$. The third line substitutes in the values obtained for $[2\ IP_2]^{g^{\eta/1}}$ and $[2\ IP_2]^{g^{\eta/1}\cup\{<8, y>, <9, z>\}}$. The final line adds the values obtained for $[IP_3]^{g^{\eta/1d/2}}$, $[IP_3]^{g^{\eta/1d/2}\cup\{<7, x>, <8, y>, <9, z>\}}$ and $[IP_3]^{g^{\eta/1d/2}\cup\{<7, x>, <8, y>, <9, z>\}}$. Put in simple words, the property on the last line of (76) is true of a (plural) individual $u$ at a world $w'$ iff, according to Mary’s utterance worlds $w'$ in $w$: John dated in $w'$ the women plural sum $u$ and no other woman and the cardinality of this $u$ is large compared to the cardinality of the maximal women sums that other 18-year olds dated in $w'$.

(76) $\lambda u_\cdot \lambda w_\cdot \forall w' \in \text{SAY}_{\text{mary}}(w): [CP_2]^{g^{\eta/1}}(w')$

$= \lambda u_\cdot \lambda w_\cdot \forall w' \in \text{SAY}_{\text{mary}}(w):$

$L_{w'}([2\ IP_2]^{g^{\eta/1}\cup\{<8, y>, <9, z>\}}; y, z \in D_e) \subseteq \lambda d. [2\ IP_2]^{g^{\eta/1}}(d(w'))$

$= \lambda u_\cdot \lambda w_\cdot \forall w' \in \text{SAY}_{\text{mary}}(w):$

$L_{w'}((\lambda d. \lambda w_\cdot [[IP_3]^{g^{\eta/1d/2}\cup\{<8, y>, <9, z>\}}(w'') \land \forall q \in [[IP_3]^{g^{\eta/1d/2}\cup\{<7, x>, <8, y>, <9, z>\}}: x \in D_e} \land q(w''))=1 \rightarrow [IP_3]^{g^{\eta/1d/2}}(w') \land \forall q \in [[IP_3]^{g^{\eta/1d/2}\cup\{<7, x>, <8, y>, <9, z>\}}: x \in D_e} \land q(w')=1 \rightarrow [IP_3]^{g^{\eta/1d/2}}(w') \subseteq q]$}

Finally, sentence (73) asserts that we are in a world $w$ in which the unique individual $u$ satisfying that property at $w$ was standing over there at $w$. These are the correct truth conditions for the intended low relative reading of the sentence.

5 Array of readings of attributive many

As noted in the introduction, when looking at attributive many, the literature has mostly considered cardinal readings. We note that the entire palette of readings that we have seen for determiner-like uses obtains for attributive uses as well: cardinal vs. proportional quantificational import and host-external vs. host-internal resolution
of the comparison class. We will illustrate them briefly, using the informal LFs from subsection 4.2 for simplicity.

For cardinal readings, we already saw a case of host-external association in our example (73). Host-internal association is exemplified in (77), which is simply the attributive version of example (33). The main ingredients of the derivation are sketched in (78):

(77) The many books by Douglas<sub>ALT</sub> that (Mary said) John read were fun.

(78) a. LF: [The 1 [IP₁ [POS C<sub>j,m</sub>]] 2[ [Exh D<sub>₁</sub>] [IP₂ the t₂-MANY<sub>card</sub> books λ<sub>y</sub>.y=[[[pro₁]<sub>ALTm</sub>]₂] by Douglas<sub>ALT</sub>~D₁]~C<sub>j,m</sub> were fun]

b. [C] ⊆
\{
\lambda·d·}\lambda·w'' . \text{John read}_{w''} \sigma y [^*\text{book}_{w''}(y) \land by_{w''}(y,douglas) \land |y| \geq d \land y=a+b+c+d+e+f] \text{ and no other book}_{w''} \text{ by Douglas},
\lambda·d·}\lambda·w'' . \text{John read}_{w''} \sigma y [^*\text{book}_{w''}(y) \land by_{w''}(y,mcdawn) \land |y| \geq d \land y=h] \text{ and no other book}_{w''} \text{ by McDawn},
\lambda·d·}\lambda·w'' . \text{John read}_{w''} \sigma y [^*\text{book}_{w''}(y) \land by_{w''}(y,hings) \land |y| \geq d \land y=j] \text{ and no other book}_{w''} \text{ by Hings, ...} \}

c. [(78a)] = \lambda·w. the unique plural x such that:
\text{L}([C]) \subseteq \lambda·d. \text{John read}_{w} \sigma y [^*\text{book}_{w}(y) \land by_{w}(y,douglas) \land |y| \geq d \land y=x] \text{ and no other book}_{w} \text{ by Douglas}

was fun in w

We turn to proportional readings. For the host-external association, we take Partee’s (1989) original example (5) and construct its attributive version in (79). The main steps of the derivation, parallel to the ones above, are shown in (80):

(79) The many (of the) faculty children that (Mary said) had a good<sub>ALT</sub> time stayed long.

(80) a. LF: [The 1 [IP₁ [POS C<sub>j,m</sub>]] 2[ [Exh D<sub>₁</sub>] [IP₂ the t₂-MANY<sub>prop</sub> faculty children λ<sub>y</sub>.y=[[[pro₁]<sub>ALTm</sub>]₂] had a good<sub>ALT</sub> time]~D₁]~C<sub>j,m</sub> stayed]
For the host-internal association, we turn Westerståhl’s (1985) example (39) into its attributive version (81). Again, the main steps in the derivation are given below:

(81) The many Scandinavians that (Mary said) have won the Nobel Prize keep a low profile.

(82) a. LF: [The 1 that [POS C_{j,m}] 2 [Exh D_i] the t_2-MANY prop Scandinavians \lambda.y.y=[([pro_1]_{ALT}\text{t}_1 \text{won-NP } \sim \text{D}_{j,m}) keep a low profile]

As the reader can check for herself, the resulting (78c), (80c) and (82c) match the intended cardinal/proportional, host-external/internal reading of each sentence.

6 Conclusions

Constructions involving ordinary adjectives in the superlative form (ADJ+est), ordinary adjectives in the positive form (ADJ+POS) and determiner-like uses of many/few (MANY+POS) have received a unified analysis in recent literature. The present paper has strived to extend this unified analysis to cover attributive uses of many as well.

The main objective was to develop an analysis of low readings of attributive MANY+POS in Relative Clauses. This has been achieved by using LFs independently motivated for low readings of ADJ+est and, crucially, adding an exhaustivity operator that guarantees that only maximal alternatives arising from the ALT-marked pronominal part of the trace \text{-pro}_{j,ALT} will be taken into account. Once this analysis is in place, it can be used for simpler attributive cases if desired.

Additionally, we have noted that the entire palette of readings of many found in determiner-like uses obtains for attributive uses as well: They allow for cardinal and proportional quantificational import and for host-external and host-internal resolution of the comparison class.
References


Attributive many

Cascadilla.
Wilson, E. Cameron. 2015. Deriving the most internal relative reading. In P. Berezovskaya N. Bader & A. Schöller (eds.), Sinn und Bedeutung 20, 779–797. semanticsarchive.net.

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