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: $|P \cap Q| > n$, with n a large natural number.
 - b. PROPORTIONAL reading: $|P \cap Q| : |P| > p$, with p a large proportion.
- (2) Few Ps are Q.
 - a. CARDINAL reading: $|P \cap Q| < n$, with n a small natural number.

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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 painters, sculptors or singers.
 - b. ... compared to 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 *more* as MANY+-*er* and Hackl (2009) on *most* as MANY+-*est*): (7)-(9). The choice between the stems MANY_{card} and MANY_{prop} delivers the quantificational import of the sentence. The argument fed into the λQ -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. long– in superlative and positive form. As a result, ADJ+*est*, ADJ+*POS* and MANY+*POS* receive a unified analysis (where ADJ is the stem of an ordinary gradable adjective).

(7)
$$[\![MANY_{card}]\!] = \lambda d_d.\lambda x_e.|x| \ge d$$

$$= \lambda d_d.\lambda P_{\langle e,t\rangle}.\lambda x_e.P(x) \wedge |x| \ge d$$

(8)
$$[MANY_{prop}] = \lambda d_d \cdot \lambda P_{\langle e,t \rangle} \cdot \lambda x_e \cdot P(x) \wedge |x| : |P_{Atomic}| \ge d$$

(9)
$$[POS] = \lambda Q_{\langle dt,t \rangle} . \lambda P_{\langle d,t \rangle} . L_{\langle \langle dt,t \rangle, \langle dt \rangle} (Q) \subseteq P$$

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 $pro_{\langle e,t\rangle}$ 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. $[pro_{\langle e,t\rangle}] = \lambda x_e$. *student(x) \wedge 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'

- 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 ADJ+*est*, ADJ+*POS* and determiner-like MANY+*POS*, but also for attributive MANY+*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 ADJ+est, ADJ+POS and determiner-like uses of MANY+POS. Section 3 is concerned with low readings in Relative Clauses: Subsection 3.1 presents the analysis of the low reading of ADJ+est in the literature and section 3.2 parsimoniously extends this analysis to ADJ+POS. Section 4 develops the proposal for the low reading of attributive MANY+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 λP -argument corresponds to the comparison term –e.g., the set of degrees that Lucía reaches in tallness in (16)– and the λQ -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:

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(15) \llbracket -est \rrbracket = \lambda Q_{< dt,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).
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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)]
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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):¹

- (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_F. \rightarrow compares *recipients* of John's letters
 - b. John_F wrote the longest letter to Mary. \mapsto compares *senders* of letters to Mary
- (19) Ivan ima naj-dobri albumi na/to $U2_F$. [Bulgarian] Ivan has est-good albums of/by U2
 - 'Ivan has better albums by U2 than by any other band.'
 - → 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) $\llbracket \phi \sim C \rrbracket$ is defined only if $\llbracket C \rrbracket \subset \llbracket \phi \rrbracket^f$; $= \llbracket \phi \rrbracket$ if defined.
- (21) Relative reading of (17):
 - a. LF: [[-est C][1[John_F climbed A t_1 -high mountain]] \sim C]
 - b. $[\![I[John\ climbed\ A\ t_I-high\ mountain J]\!] = \lambda d. \exists x [climb(john,x) \land mount(x) \land high(x,d)]$
 - c. $[\![C]\!] \subseteq \{\lambda d'.\exists x[\text{climb}(\text{john},x) \land \text{mount}(x) \land \text{high}(x,d')], \lambda d'.\exists x[\text{climb}(\text{bill},x) \land \text{mount}(x) \land \text{high}(x,d')], \lambda d'.\exists x[\text{climb}(\text{paul},x) \land \text{mount}(x) \land \text{high}(x,d')], \ldots\}$
 - d. [[21a]] = 1 iff $\forall Q \in [[C]] [Q \neq \lambda d. \exists x [\operatorname{climb}(j,x) \land \operatorname{mount}(x) \land \operatorname{high}(x,d)] \rightarrow Q \subset \lambda d. \exists x [\operatorname{climb}(j,x) \land \operatorname{mount}(x) \land \operatorname{high}(x,d)]]$

¹ 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).

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).² A simple example is offered in (23):

(22)
$$[POS] = \lambda Q_{\langle dt,t \rangle} \cdot \lambda P_{\langle d,t \rangle} \cdot L_{\langle dt,t \rangle,\langle dt \rangle}(Q) \subseteq P$$
 (=(9))

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

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.³ 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}].
 - \mapsto shirts that are expensive compared to other clothing that John buys

To derive the relative reading, Schwarz (2010) and Romero (2015) extend Heim's (1999) analysis of *est* 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):

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(28) Relative reading of (24):
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a. LF: [[POS C] [1 [Mia<sub>ALT</sub> has a t<sub>1</sub>-expensive hat]] ~ C]
b. [[1[Mia has a t<sub>1</sub>-expensive hat]]] = λd.∃x[have(mia,x) ∧ hat(x) ∧ expensive(x,d)]
c. [[C]] ⊆ {λd'.∃x[have(mia,x) ∧ hat(x) ∧ expensive(x,d')], λd'.∃x[have(noa,x) ∧ hat(x) ∧ expensive(x,d')], λd'.∃x[have(ida,x) ∧ hat(x) ∧ expensive(x,d')],...}
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d. $\lceil (24) \rceil = 1$ iff $L(\lceil C \rceil) \subseteq \lambda d$. $\exists x [\text{have}(\text{mia}, x) \land \text{hat}(x) \land \text{expensive}(x, d)]$

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) $[MANY_{card}] = \lambda d_d . \lambda x_e . |x| \ge d$
- (30) (For an 8-year old,) Lucía_{ALT} has read many books.
- (31) a. LF: [[POS C] [1[Lucía_{ALT} has read [NP A t_1 -MANY books]]] \sim C] b. $[\![C]\!] \subseteq \{\lambda d'.\exists x[*book(x) \land |x| \ge d' \land read(lucia, x)], \lambda d'.\exists x[*book(x) \land |x| \ge d' \land read(anna, x)], \lambda d'.\exists x[*book(x) \land |x| \ge d' \land read(sarah, x)], \ldots\}$ c. $L([\![C]\!]) \subseteq \lambda d.\exists x[*book(x) \land |x| \ge d \land read(lucia, x)]$

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:

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McFire McDawn Hings Keath Douglas 1 (out of 2) 1 (out of 3) 1 (out of 5) 2 (out of 4) 6 (out of 60)
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- (33) (For how unappealing Scottish authors are to John,) John has read many books by Douglas_{ALT}.
- (34) a. LF: [[POS C] [1[John has read [NP A t_1 -MANY books by Douglas_{ALT}]]] \sim C]

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b. [\![C]\!] \subseteq \{\lambda d'.\exists x[*book(x) \land by(x,mcfire) \land |x| \ge d' \land read(john,x)], \lambda d'.\exists x[*book(x) \land by(x,mcdawn) \land |x| \ge d' \land read(john,x)], \lambda d'.\exists x[*book(x) \land by(x,hings) \land |x| \ge d' \land read(john,x)], \lambda d'.\exists x[*book(x) \land by(x,keath) \land |x| \ge d' \land read(john,x)], \lambda d'.\exists x[*book(x) \land by(x,douglas) \land |x| \ge d' \land read(john,x)]\} c. L([\![C]\!]) \subseteq \lambda d.\exists x[*book(x) \land by(x,douglas) \land |x| \ge d' \land read(john,x)]
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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 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)
$$[MANY_{prop}] = \lambda d_d \cdot \lambda P_{\langle e,t \rangle} \cdot \lambda x_e \cdot P(x) \wedge |x| : |P_{Atomic}| \ge d$$

- (36) Many (of the) faculty children had a good_{ALT} time.
- (37) a. LF: [[**POS C**] [1[[NP A t_1 -MANY faculty children] had a good_{**ALT**} time]] \sim C] b. $[t_1$ -MANY faculty children] = λx . *f-child(x) $\wedge |x|$: $|\{z: f\text{-child}(z)\}| \geq g(1)$

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.

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c. \llbracket [NP \land t_1\text{-MANY } faculty J] \rrbracket = \lambda Q_{<e,t>}. \exists x \ [*f\text{-child}(x) \land |x| : |\{z : f\text{-child}(z)\}| \ge g(1) \land Q(x)]
d. \llbracket II \land t_1\text{-MANY } faculty \ children \ had \ a \ good \ time J \rrbracket = \lambda d. \exists x \ [*f\text{-child}(x) \land |x| : |\{z : f\text{-child}(z)\}| \ge d \land \text{have-good-time}(x)]
e. \llbracket C \rrbracket \subseteq \{\lambda d'.\exists x \ [*f\text{-child}(x) \land |x| : |\{z : f\text{-child}(z)\}| \ge d' \land \text{have-good-time}(x)], \lambda d'.\exists x \ [*f\text{-child}(x) \land |x| : |\{z : f\text{-child}(z)\}| \ge d' \land \text{have-regular-time}(x)], \lambda d'.\exists x \ [*f\text{-child}(x) \land |x| : |\{z : f\text{-child}(z)\}| \ge d' \land \text{have-bad-time}(x)], \dots \}
f. L(\llbracket C \rrbracket) \subseteq \lambda d.\exists x \ [*f\text{-child}(x) \land |x| : |\{z : f\text{-child}(z)\}| \ge d \land \text{have-good-time}(x)]
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Proportional *many* allows for a host-internal associate too. A case in point is 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: [[**POS** C] [1[[NP A t_1 -MANY Scandinavians_{ALT}] have won the Nobel Prize in literature]] \sim C]

- (i) Westerståhl's (1985) characterisation of the reverse proportional reading of *Many Ps are Q*: $|P \cap Q| : |Q| > p$, where p is a large proportion
- (ii) Cohen's (2001) characterisation of the reverse proportional reading of *Many Ps are Q*: $|P \cap Q|: |P| > |\cup ALT(P) \cap Q|: |\cup ALT(P)|$
- (iii) Romero's (2015) characterisation of the reverse proportional reading of *Many Ps are Q*: $|P \cap Q|:|P| > \theta(\{|P' \cap Q|:|P'|: P' \in ALT(P)\})$

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 $|P' \cap Q| : |P'|, |P'' \cap Q| : |P''|, |P''' \cap Q| : |P'''|, \dots$ for different alternatives P', P'', P''', \dots of P matters and corrects the truth conditions to (iii). The result obtained from derivation (40) matches the last characterisation.

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b. \llbracket t_1\text{-MANY } Scandinavians \rrbracket = \lambda x. *Scandin(x) \land |x| : |\{z:Scandin(z)\}| \geq g(1)
c. \llbracket I_{NP} \land t_1\text{-MANY } Scandinavians I \rrbracket = \lambda Q_{<e,t>}. \exists x \ [*Scandin(x) \land |x| : |\{z:Scandin(z)\}| \geq g(1) \land Q(x) ]
d. \llbracket I_I \land t_I\text{-MANY } Scandinavians \ have \ won \ the \ NP \ in \ literature I \rrbracket = \lambda d. \exists x \ [*Scandin(x) \land |x| : |\{z:Scandin(z)\}| \geq d \land NP\text{-winner}(x) ]
e. \llbracket C \rrbracket \subseteq \{\lambda d'.\exists x \ [*Scandin(x) \land |x| : |\{z:Scandin(z)\}| \geq d' \land NP\text{-winner}(x) ], \lambda d'.\exists x \ [*Mediterr(x) \land |x| : |\{z:Mediterr(z)\}| \geq d' \land NP\text{-winner}(x) ], \lambda d'.\exists x \ [*Meastern(x) \land |x| : |\{z:Meastern(z)\}| \geq d' \land NP\text{-winner}(x) \}, \dots \}
f. L(\llbracket C \rrbracket) \subseteq \lambda d. \exists x \ [*Scandin(x) \land |x| : |\{z:Scandin(z)\}| \geq d \land NP\text{-winner}(x) \}
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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 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):

- (41) The longest book that John said Tolstoy had written is on the shelf.
 - a. Low reading: 'the *x* such that John said that the longest book that Tolstoy had written was *x*'

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 *longest book* is base-generated inside the Relative Clause and moves through Spec-CP₂ and Spec-CP₁ 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 [est C] scopes out, est's associate –here, the pronoun 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 [est C], as in (43d):

- (42) Trace Conversion Rule (Fox 2000):
 - a. Variable insertion: (Det) Pred_i \Rightarrow (Det) [Pred $\lambda y.y=pro_i$]
 - b. Determiner Replacement: (Det) [Pred $\lambda y.y=g(i)$] \Rightarrow the [Pred $\lambda y.y=pro_i$]
- (43) a. Copies at LF:

The <u>longest book₁</u> that [$_{CP1}$ Op longest book₁ that John said [$_{CP2}$ Op longest book₁ that Tolstoy had written Op longest book₁]]

b. Copy deletion:

The longest book₁ $\lambda 1$ that [$_{CP1}$ Op longest book₁ that John said [$_{CP2}$ Op longest book₁ that Tolstoy had written **Op longest book**₁]]

c. Trace conversion:

The longest book_T $\lambda 1$ that [$_{CP1}$ Op longest book_T that John said [$_{CP2}$ Op longest book_T that Tolstoy had written **the longest book** $\lambda y.y$ =**pro**₁]]

d. -*est* movement and marking of the focus associate:

The longest book_T $\lambda 1$ that [$_{CP1}$ Op longest book_T that John said [$_{CP2}$ Op longest book_T that [-est C] $\lambda 2$ [Tolstoy had written the t₂-long book $\lambda y.y=pro_{1,F}$] \sim C]]

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 $[\![\phi]\!]^f$ that are true of some degree d in w', as stated in (45). The derivation proceeds as in (46):

- $(44) \quad \llbracket -est \rrbracket = \lambda \boldsymbol{Q}_{<< d, st>, t>}. \lambda P_{< d, st>}. \lambda w. \ \forall \ \mathbf{Q} \in \boldsymbol{Q} [\mathbf{Q} \neq P \rightarrow Q_w \subset P_w]$
- (45) $\llbracket \phi \sim C_{w'} \rrbracket$ is defined only if $\llbracket C_{w'} \rrbracket \subseteq \llbracket \phi \rrbracket^f$ and $\forall D_{< d, st>} \in \llbracket C_{w'} \rrbracket : \exists d [D(d)(w')];$ = $\llbracket \phi \rrbracket$ if defined.
- (46) a. [The 1 [$_{CP1}$ that John said [$_{CP2} \lambda w'$ that w' [-est $\mathbf{C}_{w'}$] 2[Tolstoy had written the \mathbf{t}_2 -long book $\lambda y.y=\mathsf{pro}_{1,F}$] $\sim \mathbf{C}_{w'}$]] is on the shelf]
 - b. $[\![\lambda 2\ [Tolstoy\ had\ written\ the\ t_2\text{-long\ book}\ \lambda y.y=pro_1]\!] = \lambda d.\lambda w''$. Tolstoy wrote_{w''} $\iota y[y \text{ is } d\text{-long}_{w''}\ book_{w''} \land y=g(1)]$
 - c. $[C_{w'}] = \{ \lambda d. \lambda w''$. Tolstoy wrote_{w''} $ty[y \text{ is } d\text{-long}_{w''} \text{ book}_{w''} \land y=a],$ $\lambda d. \lambda w''$. Tolstoy wrote_{w''} $ty[y \text{ is } d\text{-long}_{w''} \text{ book}_{w''} \land y=b],$ $\lambda d. \lambda w''$. Tolstoy wrote_{w''} $ty[y \text{ is } d\text{-long}_{w''} \text{ book}_{w''} \land y=c], \dots \}$
 - d. $[CP_2] = \lambda w'$. $\forall Q \in [C_{w'}]$ $[Q \neq \lambda d.\lambda w''$. Tolstoy wrote_{w''} $\iota y[y \text{ is } d\text{-long}_{w''} \text{ book}_{w''} \land y=g(1)] \rightarrow Q_{w'} \subset \lambda d$. Tolstoy wrote_{w'} $\iota y[y \text{ is } d\text{-long}_{w'} \text{ book}_{w'} \land y=g(1)]]$

```
e. [(46a)] = \lambda w. \iota x_e [John said<sub>w</sub>: \lambda w'. \forall Q \in [C_{w'}]

[Q \neq \lambda d . \lambda w''. T wrote<sub>w''</sub> \iota y[y \text{ is } d\text{-long}_{w''} \text{ book}_{w''} \land y = x] \rightarrow

Q_{w'} \subset \lambda d. T wrote<sub>w'</sub> \iota y[y \text{ is } d\text{-long}_{w'} \text{ book}_{w'} \land y = x]]]

is<sub>w</sub> 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 pro_1 , 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 $L_{w'}$ combines with the set of degree properties $[\![C_{w'}]\!]$ 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:

$$(49) \quad [POS] = \lambda \mathbf{Q}_{\langle \langle d, st \rangle, t \rangle}.\lambda P_{\langle d, st \rangle}.\lambda w. L_w(\mathbf{Q}) \subseteq P_w$$

(50) a. LF: [The 1 that [$_{CP1}$ that S said [$_{CP2}$ $\lambda w'$ that w' [POS $C_{w'}$] 2[Lydia_{ALT} wrote [the t₂-long book λ y.y=pro_{1.ALT}]] $\sim C_{w'}$]] was on the table]

b.
$$[2 [Lydia_{ALT} wrote the t_2-long book \lambda y.y=pro_{1,ALT}]]$$

= $\lambda d.\lambda w''$.Lydia wrote $\iota y[y \text{ is a } d\text{-long}_{w''} \land y=g(1)]$

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.

```
c. \llbracket C_{w'} \rrbracket = \{ \lambda d. \lambda w''. \text{Lydia wrote}_{w''} \ ty[y \text{ is } d-\text{long}_{w''} \ \text{book}_{w''} \land y=a], \\ \lambda d. \lambda w''. \text{Amy wrote}_{w''} \ ty[y \text{ is } d-\text{long}_{w''} \ \text{book}_{w''} \land y=b], \\ \lambda d. \lambda w''. \text{Gina wrote}_{w''} \ ty[y \text{ is } d-\text{long}_{w''} \ \text{book}_{w''} \land y=c], \dots \}
d. \llbracket \text{CP}_2 \rrbracket = \\ \lambda w'. \ L_{w'}(\llbracket C_{w'} \rrbracket) \subseteq \lambda d. \text{Lydia wrote}_{w'} \ ty[y \text{ is } d-\text{long}_{w'} \ \text{book}_{w'} \land y=g(1)]
e. \llbracket (50a) \rrbracket = \\ \lambda w. tx_e[\text{Siouxsie said}_w: \\ \lambda w'. \ L_{w'}(\llbracket C_{w'} \rrbracket) \subseteq \lambda d. \text{Lydia wrote}_{w'} \ ty[y \text{ is } d-\text{long}_{w'} \ \text{book}_{w'} \land y=x]]
was_w on the table.
```

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]'

- (i) Mary shouldn't even have the few drinks that she can take. (Sauerland 1998)
 - a. 'Consider the <u>number n such that</u> 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 <u>x such that</u> the books on his shelves were x and x were very few. x were all mysteries.'

⁷ 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.

We will tackle this reading in two subsequent attempts. The first attempt simply transposes the LF structure we just used for ADJ+POS to MANY+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 ADJ+POS to MANY+POS gives us the structure (53) for sentence (52). [POS C] and the converted copy [the t_2 -MANY women $\lambda y.y = pro_1$] are embedded under the intentional verb say —hence the low reading—and both John and pro_1 function as POS ALT-associates—hence the relative reading comparing John and his dates to other people like John and their dates:

(53) LF: [The 1 [$_{CP1}$ that M said [$_{CP2}$ that [**POS** C] 2[$_{IP}$ John_{ALT} had dated [the t₂-MANY women λ y.y=pro_{1.ALT}]] \sim 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 $\llbracket C_{w'} \rrbracket$ 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 $\llbracket 2[IP] \rrbracket^{alt}$ and (ii) such that D(d)(w') = 1 for some degree d, as required by (45):

- (54) $[2[John_{ALT} had dated the t_2-MANY women \lambda y.y=pro_{1,ALT}]]$ = $\lambda d.\lambda w''$.John dated_{w''} $\sigma y[*woman_{w''}(y) \land |y| \ge d \land y = g(1)]$
- (55) $[\![C_{w'}]\!] = \{ \lambda d.\lambda w''. \text{John dated}_{w''} \sigma y [\text{*woman}_{w''}(y) \land |y| \ge d \land y = a + b + c], \\ \lambda d.\lambda w''. \text{John dated}_{w''} \sigma y [\text{*woman}_{w''}(y) \land |y| \ge d \land y = a + b],$

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) $\lambda d.\lambda w''$. Al dated_{w''} σy [*woman_{w''}(y) $\wedge |y| \ge d \wedge y = \top$]

```
\begin{array}{l} \lambda d.\lambda w''. \text{John dated}_{w''} \ \sigma y [*\text{woman}_{w''}(y) \land |y| \geq d \land y = b + c \ ], \\ \lambda d.\lambda w''. \text{John dated}_{w''} \ \sigma y [*\text{woman}_{w''}(y) \land |y| \geq d \land y = a + c \ ], \\ \lambda d.\lambda w''. \text{John dated}_{w''} \ \sigma y [*\text{woman}_{w''}(y) \land |y| \geq d \land y = a \ ], \\ \lambda d.\lambda w''. \text{John dated}_{w''} \ \sigma y [*\text{woman}_{w''}(y) \land |y| \geq d \land y = b \ ], \\ \lambda d.\lambda w''. \text{John dated}_{w''} \ \sigma y [*\text{woman}_{w''}(y) \land |y| \geq d \land y = c \ ], \\ \lambda d.\lambda w''. \text{Bill dated}_{w''} \ \sigma y [*\text{woman}_{w''}(y) \land |y| \geq d \land y = d \ ], \\ \lambda d.\lambda w''. \text{Bill dated}_{w''} \ \sigma y [*\text{woman}_{w''}(y) \land |y| \geq d \land y = e \ ], \\ \lambda d.\lambda w''. \text{Herbert dated}_{w''} \ \sigma y [*\text{woman}_{w''}(y) \land |y| \geq d \land y = f + g \ ], \\ \lambda d.\lambda w''. \text{Herbert dated}_{w''} \ \sigma y [*\text{woman}_{w''}(y) \land |y| \geq d \land y = f \ ], \\ \lambda d.\lambda w''. \text{Herbert dated}_{w''} \ \sigma y [*\text{woman}_{w''}(y) \land |y| \geq d \land y = f \ ], \\ \lambda d.\lambda w''. \text{Herbert dated}_{w''} \ \sigma y [*\text{woman}_{w''}(y) \land |y| \geq d \land y = g \ ] \ \end{array}
```

The remainder of the computation proceeds as follows:

```
(56)  [CP_2] = \lambda w'.L_{w'}([C_{w'}]) \subseteq \lambda d. \text{John dated}_{w'} \sigma y[*\text{woman}_{w'}(y) \land |y| \ge d \land y = g(1)] 
(57)  [(53)] = \lambda w.\sigma x[\text{Mary said}_{w}: \lambda w'.L_{w'}([C_{w'}]) \subseteq \lambda d. \text{John dated}_{w'} \sigma y[*\text{woman}_{w'}(y) \land |y| \ge d \land y = x] 
 \text{were}_{w} \text{ 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:

4.2 Second attempt, informally

Our example (52) has two ALT-associtates of POS, namely, John and pro_1 . We just saw that, for each alternative x to John, we want as the alternative to pro_1

the maximal, exhaustive sum of women that x dated. We propose to secure this maximality by adding the exhaustivity operator Exh in (60) to the LF (cf. Chierchia et al. (2012)) and associating it with pro_I via F-marking. This means, crucially, that we have nested ALT/F-marking on pro_I , as shown in the informal LF (61):⁹

- $(60) \quad [\![Exh]\!] = \quad \lambda C_{\langle st,t \rangle}.\lambda p_{\langle s,t \rangle}.\lambda w. \ p(w)=1 \land \forall q \in C \ [q(w)=1 \rightarrow p \subseteq q]$
- (61) LF: The 1 [$_{CP1}$ that M said [$_{CP2}$ that **POS** $\mathbf{C_{j,m}}$ 2[$_{IP1}$ **Exh** $\mathbf{D_i}$ [$_{IP2}$ **John**_{ALTj} dated the $\mathbf{t_2}$ -MANY women $\lambda \mathbf{y.y} = [[\mathbf{pro_1}]_{ALTm}]_{Fi}$] $\sim \mathbf{D_i}$] $\sim \mathbf{C_{j,m}}$] were nearby.

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):

- (62) A: John once only drank WIne.B: John also once only drank WAter.
- (63) LF: [$_{IP1}$ [Also C_m] once [[only D_i] [$_{IP2}$ John drank [water $_{Fm}$] $_{Fi}$] $\sim D_i$] $\sim C_m$]

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 IP_2 , we obtain (roughly) the ordinary semantic value in (64b). Now we have to build the set C_m of alternatives that are like $[[only \ D_i] \ IP_2]$ except that they result from substituting [water] with another object of the same semantic type. This gives us the set (64c). The resulting truth conditions are given in (64d):

```
a. [[D<sub>i</sub>]] = { λw'. John drank<sub>w'</sub> water, λw'. John drank<sub>w'</sub> wine, λw'. John drank<sub>w'</sub> beer, ... }
b. [[only D<sub>i</sub>] IP<sub>2</sub>]] = λw'. John drank<sub>w'</sub> water and nothing else c. [[C<sub>m</sub>]]] = { λw'. John once drank<sub>w'</sub> water and nothing else, λw'. John once drank<sub>w'</sub> wine and nothing else, λw'. John once drank<sub>w'</sub> beer and nothing else, ... }
d. [[IP<sub>1</sub>]]] = λw: ∃p ∈ C<sub>m</sub>[p ≠ [λw'. John once drank<sub>w'</sub> water and nothing else] and p(w) = 1]. John once drank<sub>w</sub> water and nothing else
```

⁹ In this subsection, we use indices on comparison class variables $-D_i$, $C_{j,m}$ and on F/ALT-marking $-ALT_m$, 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_2 in LF (61) is the following. When considering the 18-year old John, the set of alternatives D_i will have the shape in (65a) and $2[[Exh D_i] IP_2]$ 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 $2[[Exh D_i] IP_2]$, 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_2 will be (65d):

```
(65)
            a. [D_i] = \{ \lambda w''. \text{John dated}_{w''} \sigma y [*woman_{w''}(y) \land |y| \ge g(2) \land y = a + b + c], \}
                                \lambda w''.John dated<sub>w''</sub> \sigma y[*woman<sub>w''</sub>(y) \wedge |y| \geq g(2) \wedge y = a + b],
                                \lambda w''. John dated<sub>w''</sub> \sigma y[*woman<sub>w''</sub>(y) \wedge |y| \geq g(2) \wedge y = b + c],
                                \lambda w''.John dated<sub>w''</sub> \sigma y[*woman<sub>w''</sub>(y) \wedge |y| \geq g(2) \wedge y = a + c],
                                \lambda w''.John dated<sub>w''</sub> \sigma y[*woman<sub>w''</sub>(y) \wedge |y| \geq g(2) \wedge y=a],
                                \lambda w''. John dated<sub>w''</sub> \sigma y[*woman<sub>w''</sub>(y) \wedge |y| \geq g(2) \wedge y=b],
                                \lambda w''.John dated<sub>w''</sub> \sigma y[*woman<sub>w''</sub>(y) \wedge |y| \geq g(2) \wedge y=c] }
            b. [2[Exh D_i] IP_2]
                = \lambda d.\lambda w''. John dated<sub>w''</sub> \sigma y[*woman<sub>w''</sub>(y) \wedge |y| \geq d \wedge y = a + b + c] and
                                    \forall p \in D_i \ [p(w'') = 1 \rightarrow
                                    [\lambda w'''.John dated<sub>w'''</sub> \sigma y[*woman<sub>w'''</sub>(y) \land |y| \ge g(2) \land y=a+b+c]] \subseteq p]
                = \lambda d.\lambda w''. John dated<sub>w''</sub> \sigma y[*woman<sub>w''</sub>(y) \wedge |y| \ge d \wedge y = a + b + c] and no
                                    other woman<sub>w"</sub>
            c. [C_{m,i}] = \{ \lambda d. \lambda w''. \text{John dated}_{w''} \sigma y [*woman_{w''}(y) \land |y| \ge d \land y = a + b + c] \}
                                    and no other woman_{w''},
                                   \lambda d.\lambda w''.Bill dated<sub>w''</sub> \sigma y[*woman<sub>w''</sub>(y) \wedge |y| \geq d \wedge y = d + e] and
                                    no other woman<sub>w"</sub>,
                                   \lambda d.\lambda w''. Herbert dated<sub>w''</sub> \sigma y[*woman<sub>w''</sub>(y) \wedge |y| \ge d \wedge y = f+g]
                                    and no other woman<sub>w''</sub> }
            d. [CP_2] = \lambda w' . L_{w'}([C_{m,j}]) \subseteq
                \lambda d. John dated<sub>w'</sub> \sigma y[*woman<sub>w'</sub>(y) \wedge |y| \geq d \wedge y=a+b+c] and no other woman<sub>w'</sub>
```

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., pro_I . 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:

(66) a.
$$[John]^g$$
 = john
b. $[pro_1]^g$ = g(1)

- (67) Semantics for focus marking ALT_i: $[\![\alpha_{ALT_i}]\!]^g = g(i) \quad \text{if } i \in \text{Dom}(g)$ $[\![\alpha]\!]^g \quad \text{if } i \notin \text{Dom}(g)$
- (68) a. $[John_{ALT5}]^g = [John]^g = john$ b. $[John_{ALT5}]^{g \cup \{<5,x>\}} = x$
- (69) a. $[pro_{1,ALT5}]^g = [pro_1]^g = g(1)$ b. $[pro_{1,ALT5}]^{g \cup \{<5,x>\}} = x$

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

Third, there is no mediating squiggle operator \sim or open variable C. The closing off of alternatives is done directly by the ALT-sensitive operator, e.g., *only*, Exh and POS, as defined in (70)-(72):¹⁰

(70)
$$[\![only_i \ \phi_{\langle s,t\rangle}]\!]^g$$
 is defined only if $i \notin Dom(g)$; if defined $= \lambda w: [\![\phi]\!]^g(w). \ \forall q[q \in \{ [\![\phi]\!]^{g \cup \{\langle i,x\rangle\}} : x \in D_e \} \land p \not\subseteq q \rightarrow q(w) = 0]$

- (71) $\llbracket Exh_i \ \phi_{\langle s,t \rangle} \rrbracket^g$ is defined only if $i \notin Dom(g)$; if defined $= \lambda w$. $\llbracket \phi \rrbracket^g(w) \land \forall q[q \in \{\llbracket \phi \rrbracket^{g \cup \{\langle i,x \rangle\}} : x \in D_e\} \land q(w) = 1 \rightarrow \llbracket \phi \rrbracket^g \subseteq q]$
- (72) $[POS_i \ \phi_{< d, st>}]^g$ is defined only if $i \notin Dom(g)$; if defined $= \lambda w. \ L_w(\{ [\![\phi]\!]^{g \cup \{< i, x>\}} : x \in D_e \}) \subseteq \lambda d. [\![\phi]\!]^g(d)(w)$

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 constains three instances of indexed F/ALT-marking: F-marking F_7 on pro_1 , to be closed off by Exh_7 , and ALT-marking ALT_8 on pro_1 and ALT_9 on John, both to be closed off by $POS_{8,9}$:

¹⁰ This means that the job done in (45) by the world-relativized variable 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 L_w , 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 w.

- (73) The many women Mary said that John had dated were standing over there.
- (74) LF of (73):

[$_{IP1}$ [$_{NP}$ The [$_{CP1}$ 1 Mary said [$_{CP2}$ **POS**_{8,9} 2[$_{IP2}$ **Exh**₇ [$_{IP3}$ John_{ALT9} dated the t₂-MANY women λv_e .v=[pro_{1.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_1 node receives the partial interpretation in (75a). This line calls for the interpretation of the embedded CP_2 under the modified assignment $g^{u/1}$, which is done in (75b). The latter line asks us to run the derivation of the embedded $[2 \text{ IP}_2]$ 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 IP_3 under four different assignments, namely, $g^{u/1d/2}$, $g^{u/1d/2} \cup \{<7,x>\}$, $g^{u/1d/2} \cup \{<8,y>,<9,z>\}$ and $g^{u/1d/2} \cup \{<7,x>,<8,y>,<9,z>\}$. This task is carried out in (75d)-(75d'''):

```
a. [1] [Mary said CP_2I][g]
(75)
                  = \lambda \mathbf{u}_e.\lambda \mathbf{w}.\forall \mathbf{w}' \in SAY_{mary}(\mathbf{w}): [CP_2]^{g^{u/1}}(\mathbf{w}')
             b. [CP_2]^{g^{u/1}} = [POS_{8.9} / 2 IP_2]^{g^{u/1}}
                  = \lambda w'. L_{w'}(\{[2IP_2]\}g^{u/1}\cup\{\langle 8,y\rangle,\langle 9,z\rangle\};y,z\in D_e\})\subset \lambda d.[2IP_2]g^{u/1}(d)(w')
             c. [2 IP_2]^{g^{u/1}} = [2 [Exh_7 IP_3]]^{g^{u/1}}
                  = \lambda d.\lambda w''.[IP_3]^{g^{u/1d/2}}(w'') \wedge \forall q[q \in \{[IP_3]]^{g^{u/1d/2} \cup \{<7,x>\}} : x \in D_e\} \wedge q(w'') = 1
                                       \to \llbracket IP_3 \rrbracket^{g^{u/1d/2}} \subseteq \mathfrak{q}
             \mathtt{c'}. \llbracket 2\ \mathit{IP}_{2} \rrbracket^{g^{u/1} \cup \{<8,y>,<9,z>\}} = \llbracket 2\ [\mathit{Exh}_{7}\ \mathit{IP}_{3} J \rrbracket^{g^{u/1} \cup \{<8,y>,<9,z>\}}
                  = \lambda d.\lambda w''. [IP_3]^{g^{u/1d/2}} \cup \{\langle 8, y \rangle, \langle 9, z \rangle\} (w'') \wedge
                                       \forall q[q \in \{ [IP_3]]^{g^{u/1d/2} \cup \{<7,x>,<8,y>,<9,z>\}} : x \in D_e \} \land q(w'')=1
                                        \rightarrow \llbracket IP_{3} \rrbracket^{g^{u/1d'/2}} \cup \{\langle 8,y\rangle,\langle 9,z\rangle\} \subseteq \mathfrak{q} \rceil
             d. [IP_3]^{g^{u/1d/2}}
                  = [John_{ALT9} dated the t_2-MANY women \lambda v_e.v=[pro_{1,ALT8}]_{F7}]^{g^{u/1d/2}}
                  = \lambda w'''.John dated<sub>w'''</sub> \sigma v_e[*woman<sub>w'''</sub>(v) \wedge |v| \geqd \wedge v=u]
             d'. [IP_3]^{g^{u/1d/2} \cup \{<7,x>\}}
                  = [John_{ALT9} dated the t_2-MANY women \lambda v_e.v=[pro_{1,ALT8}]_{F7}]^{g^{u/1d/2} \cup \{<7,x>\}}
                  = \lambda w'''.John dated<sub>w'''</sub> \sigma v_e[*woman<sub>w'''</sub>(v) \wedge |v| \geqd \wedge v=x]
             \mathbf{d''}. \llbracket IP_3 \rrbracket g^{u/1d/2} \cup \{ <8, y>, <9, z> \}
                  = [John_{ALT9}] dated the t_2-MANY women \lambda v_e.v=[pro_{1,ALT8}]_{F7}]^{g^{u/1d/2}} \cup \{\langle 8,y \rangle, \langle 9,z \rangle\}
                  = \lambda w'''. z dated<sub>w'''</sub> \sigma v_e[*woman<sub>w'''</sub>(v) \wedge |v| >d \wedge v=y]
             \mathbf{d'''}. \llbracket IP_3 \rrbracket g^{u/1d/2} \cup \{<7, x>, <8, y>, <9, z>\}
                  = [John_{ALT9} dated the t_2-MANY women \lambda v_e.v=[pro_{1,ALT8}]_{F7}]]^{g^{u/1d/2}} \cup \{<7,x>,<8,y>,<9,z>\}
                  = \lambda w'''. z dated<sub>w'''</sub> \sigma v_e[*woman<sub>w'''</sub>(v) \wedge |v| \geqd \wedge 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 $[\![CP_2]\!]^{g^{u/1}}$. The third line substitutes in the values obtained for $[\![2IP_2]\!]^{g^{u/1}}$ and $[\![2IP_2]\!]^{g^{u/1}} \cup \{<8,y>,<9,z>\}$. The final line adds the values obtained for $[\![IP_3]\!]^{g^{u/1d/2}}$, $[\![IP_3]\!]^{g^{u/1d/2}} \cup \{<7,x>\}$, $[\![IP_3]\!]^{g^{u/1d/2}} \cup \{<8,y>,<9,z>\}$ and $[\![IP_3]\!]^{g^{u/1d/2}} \cup \{<7,x>,<8,y>,<9,z>\}$. 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'.

```
[1] [Mary said CP_2I]g
(76)
              = \lambda \mathbf{u}_e \cdot \lambda \mathbf{w} \cdot \forall \mathbf{w}' \in SAY_{mary}(\mathbf{w}) : [CP_2]^{g^{u/1}}(\mathbf{w}')
              = \lambda \mathbf{u}_e . \lambda \mathbf{w} . \forall \mathbf{w}' \in SAY_{mary}(\mathbf{w}):
                            L_{w'}(\{[2IP_2][s^{u/1}\cup\{<8,y>,<9,z>\}:y,z\in D_e\})\subseteq \lambda d.[2IP_2][s^{u/1}(d)(w')
              = \lambda \mathbf{u}_e . \lambda \mathbf{w} . \forall \mathbf{w}' \in SAY_{marv}(\mathbf{w}):
                            L_{w'}(\{\lambda d.\lambda w''. \llbracket IP_3 \rrbracket^{g^{u/1d/2} \cup \{<8,y>,<9,z>\}}(w'') \land\\
                                            \forall q[q \in {[[IP_3]]^{g^{u/1d/2} \cup \{<7,x>,<8,y>,<9,z>\}}: x \in D_e} \land
                                            \mathbf{q}(\mathbf{w}'')=1 \to \llbracket IP_3 \rrbracket^{g^{u/1d/2}} \cup \{\langle 8,y \rangle, \langle 9,z \rangle\} \subseteq \mathbf{q}] \colon y,z \in \mathbf{D}_e\}) \subseteq
                            \lambda d. [IP_3]^{g^{u/1d/2}}(w') \wedge \forall q[q \in \{[IP_3]]^{g^{u/1d/2} \cup \{<7,x>\}} : x \in D_e\} \wedge q(w') = 1
\rightarrow [IP_3]^{g^{u/1d/2}} \subseteq q]
               = \lambda \mathbf{u}_e . \lambda \mathbf{w} . \forall \mathbf{w}' \in SAY_{marv}(\mathbf{w}):
               L_{w'}(\{\lambda d.\lambda w''.z \ dated_{w''} \ \sigma v_e[*woman_{w''}(v) \land |v| > d \land v=y] \land 
                      \forall q[q \in \{\lambda w'''.z \text{ dated}_{w'''} \sigma v_e[*wom_{w'''}(v) \land |v| \geq d \land v=x]: x \in D_e\} \land q(w'') \rightarrow
                      [\lambda w'''.z \, dated_{w'''} \, \sigma v_e[*woman_{w'''}(v) \land |v| \ge d \land v=y]] \subseteq q]:y,z \in D_e\}) \subseteq
               \lambdad.John dated<sub>w'</sub> \sigma v_e[*woman<sub>w'</sub>(v) \wedge |v|\geqd \wedge v=u] \wedge
                      \forall q [q \in \{\lambda w'''.John \ dated_{w'''} \ \sigma v_e [*woman_{w'''}(v) \land |v| \geq d \land v = x] : x \in D_e\} \land
                      q(w')=1 \rightarrow [\lambda w'''.John \ dated_{w'''} \sigma v_e[*woman_{w'''}(v) \land |v|>d \land v=u]] \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_{ALT} that (Mary said) John read were fun.
- (78) a. LF: [The 1 [IP1 that [POS $C_{j,m}$] 2[[Exh D_i] [IP2 John read the t_2 -MANY card books $\lambda y.y$ =[[pro₁]ALTm]F_i by Douglas_{ALTj}] \sim D_i] \sim C_{j,m}] were fun]

```
b. [\![C]\!]\subseteq \{\lambda d.\lambda w''.\text{John read}_{w''}\ \sigma y[*\text{book}_{w''}(y) \land \text{by}_{w''}(y,\text{douglas}) \land |y| \ge 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 \text{by}_{w''}(y,\text{mcdawn}) \land |y| \ge 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 \text{by}_{w''}(y,\text{hings}) \land |y| \ge d \land y=j] \ \text{and no other book}_{w''}\ \text{by Hings}, \ldots\}
```

c. $[\![(78a)]\!] = \lambda w$. the unique plural x such that: $L([\![C]\!]) \subseteq \lambda d$. John $\operatorname{read}_w \sigma y[*\operatorname{book}_w(y) \wedge \operatorname{by}_w(y,\operatorname{douglas}) \wedge |y| \ge d \wedge y = x]$ and no other book_w 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_{ALT} time stayed long.
- (80) a. LF: [The 1 [IP1 that [POS $C_{j,m}$] 2[[Exh D_i] [IP2 the t_2 -MANY_{prop} faculty children $\lambda y.y=$ [[pro₁]_{ALTm}]_{Fi} had a good_{ALTj} time] \sim D_i] \sim C_{j,m}] stayed] b. $||C|| \subseteq$

```
 \{\lambda d.\lambda w''. \ \sigma y[\text{*f-child}_{w''}(y) \land |y|:|\{y:\text{f-child}_{w''}(y)\}| \ge d \land y=\text{a+b+c}] \ \text{had}_{w''}  a good time and no other faculty \text{child}_{w''} \ \text{did}_{w''},   \lambda d.\lambda w''. \ \sigma y[\text{*f-child}_{w''}(y) \land |y|:|\{y:\text{f-child}_{w''}(y)\}| \ge d \land y=\text{d}] \ \text{had}_{w''}  a regular time and no other faculty \text{child}_{w''} \ \text{did}_{w''},   \lambda d.\lambda w''. \ \sigma y[\text{*f-child}_{w''}(y) \land |y|:|\{y:\text{f-child}_{w''}(y)\}| \ge d \land y=\text{e}] \ \text{had}_{w''}
```

a bad time and no other faculty child_{w''} (y) |y|: |y

c. $[\![(78a)]\!] = \lambda w$. the unique plural x such that: $L([\![C]\!]) \subseteq \lambda d. \text{ } \sigma y[\text{*f-child}_w(y) \land |y|:|\{y:\text{f-child}_w(y)\}| \ge d$ $\land y=x] \text{ had}_w \text{ a good time and no other faculty child}_w \text{ did}_w$ stayed long in w

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_{ALT} that (Mary said) have won the Nobel Prize keep a low profile.
- (82) a. LF: [The 1 [$_{IP1}$ that [$_{POS}$ C $_{j,m}$] 2[[$_{Exh}$ D $_{i}$] [$_{IP2}$ the t_2 -MANY $_{prop}$ Scandinavians $_{ALTj}$ $\lambda y.y=$ [[$_{pro_1}$] $_{ALTm}$] $_{Fi}$ won-NP] \sim D $_{i}$] \sim C $_{j,m}$] keep a low profile] b. [$_{C}$] \subseteq { $\lambda d.\lambda w''$. σy [*Scandin $_{w''}(y) \wedge |y|$:|{y:Scandin $_{w''}(y)$ }| $\geq d \wedge y=a+b+c+d$] won $_{w''}$ -NP and no other Scandinavian $_{w''}$ did $_{w''}$, $\lambda d.\lambda w''$. σy [*Mediterr $_{w''}(y) \wedge |y|$:|{y:Mediterr $_{w''}(y)$ }| $\geq d \wedge y=h+i$] won $_{w''}$ -NP and no other Mediterranean $_{w''}$ did $_{w''}$, $\lambda d.\lambda w''$. σy [*MEastern $_{w''}(y) \wedge |y|$:|{y:MEastern $_{w''}(y)$ }| $\geq d \wedge y=j+k$] won $_{w''}$ -NP and no other Middle Eastern $_{w''}$ did $_{w''}$, ...} c. [[81a)] = λw . the unique plural x such that: $L([\![C]\!]) \subseteq \lambda d$. σy [*Scandin $_{w}(y) \wedge |y|$:|{y:Scandin $_{w}(y)$ }| $\geq d \wedge y=x$] won $_{w}$ -NP and no other Scandinavian $_{w}$ child did $_{w}$ keep a low profile in w

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 $-pro_{I,ALT}$ — 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.

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