The conservativity of *many*[*]

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1 Introduction

■ Natural language determiners cannot denote just any function in $D_{<et,<et,t>>}$ but only those functions that satisfy certain constraints. Conservativity is one of the constraints that have been argued for (Keenan & Stavi 1986; Barwise & Cooper 1981, U3; van der Does & van Eicjk 1996):[1]

(1) A determiner denotation $f \in D_{<et,<et,t>>}$ is conservative iff, for any P and $Q \in \mathrm{D}_{<e,t>}$:
$f(P)(Q) = 1$ iff $f(P)(P \cap Q) = 1$

(2) Conservativity Universal:
Determiners in natural language are always interpreted as conservative functions.

■ Cardinal and proportional readings of the determiners *many* and *few* (Partee, 1988).

(3) Many Ps are Q.
   a. CARDINAL reading: $|P \cap Q| > n$, where n is a large natural number.
   b. PROPORTIONAL reading: $|P \cap Q| : |P| > p$, where p is a large proportion.

(4) Few Ps are Q.
   a. CARDINAL reading: $|P \cap Q| < n$, where n is a small natural number.
   b. PROPORTIONAL reading: $|P \cap Q| : |P| < p$, where p is a small proportion.

(5) 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.

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

(7) Many faculty children had a good time.

■ Once the context-dependent parameters n and p have been fixed for a given context, the functions denoted by $many_{\mathrm{card/prop}}$ and $few_{\mathrm{card/prop}}$ are conservative.

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[1]Keenan & Stavi's (1986) Conservativity Universal is actually restricted to extensional determiners, defined in (i). This includes simple and complex determiners like *every* and *some* and excludes certain complex determiners like *an undisclosed number of*. As for *many* and *few*, see Partee (1988, 3) for arguments that they are extensional.

(i) A determiner Det is extensional iff, whenever N1 and N2 are co-extensional,
$[\![\text{Det N1 VP}]\!] = 1$ iff $[\![\text{Det N2 VP}]\!] = 1$

■ So-called "reverse" proportional reading of *many* and *few*.
Besides its regular proportional reading (which is false in scenario (8), since, among all the Scandinavians, 14 does not count as many), sentence (9) has another proportional reading roughly paraphrasable as in (10) that makes it true in that scenario (Westerståhl, 1985). The same point has been made for *few* (Cohen, 2001; Herburger, 1997): Sentence (11) has a reading paraphrasable as (12).

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

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

(10) Paraphrase: 'Many winners of the Nobel Prize in literature are Scandinavians.'

(11) Few cooks applied.

(12) Paraphrase: 'Few applicants were cooks.'

■ Formalizing these intuitive paraphrases gives us the truth conditions in (13)-(14). Crucially, these truth conditions render $many_{\text{rev-prop}}$ and $few_{\text{rev-prop}}$ non-conservative.

(13) Many Ps are Q.
REVERSE PROP. reading: $|P \cap Q| : |Q| > p$, where p is a large proportion.

(14) Few Ps are Q.
REVERSE PROP. reading: $|P \cap Q| : |Q| < p$, where p is a small proportion.

■ Efforts have been made in the literature to derive the reverse proportional reading of *many* and *few* in a principled way (Cohen, 2001; Herburger, 1997; de Hoop & Solà, 1996, a.o.), the key issue being whether, in such a principled derivation, the determiners remain conservative or challenge the conservativity universal.

■ Goals of this paper:

i. To clarify the exact truth conditions of the reverse proportional reading.
↪ We will propose an amendment to Cohen's (2001) truth conditions

ii. To derive these truth conditions compositionally while maintaining conservativity
↪ POINT OF DEPARTURE: the reverse proportional reading is available only if (part of) the N' complement of the determiner is focused (F) (Herburger, 1997) or functions as contrastive topic (CT) (Cohen, 2001).
↪ INGREDIENTS OF THE PROPOSAL:
- Decomposition: $many$ = MANY+POS, few = FEW+POS.
- There is only one proportional determiner MANY_{prop} and only one proportional determiner FEW_{prop}, both of which are conservative.
- The degree operator POS in determiners does exactly what it does in adjectives (cf. *tall*): scope and retrieval of its comparison class C via an associate, which we will implement as a F- or CT-associate.[2]

■ Roadmap:

§2 Truth conditions of the reverse proportional reading
§3 Background and novel observation on POS with adjectives
§4 Proposal
§5 Further predictions
§6 Conclusions

[2] I will talk about the F/CT associate of POS loosely, without commitment as to whether POS is conventionally or non-conventionally F- (or CT-) sensitive (see Beaver & Clark (2008)).

2 Truth conditions of the reverse proportional reading

- Truth conditions suggested by Westerståhl's (1985) paraphrase (see also Herburger (1997)):

(15) Westerståhl (1985):
   a. Paraphrase: 'Many of the Nobel Prize winners are Scandinavians.'
   b. Reverse Proportional reading of *Many Ps are Q*:
      $|P \cap Q| : |Q| > p$, where p is a large proportion.

- Problem pointed out by Cohen (2001): the truth conditions in (15b) make no reference to the proportion $|P \cap Q| : |P|$, but this proportion matters.
   - While three Andorrans having won the prize suffices to make sentence (17) true in scenario (16), it is doubtful that the same number renders sentence (18) true.
   - Yet, the formalization in (15) only asks us to consider $|P \cap Q| : |Q|$, which is 3/112 for either sentence.

(16) Scenario: 112 Nobel Prize winners in literature. 3 out of a total of 60,000 Andorrans have won it. 3 out of a total of 20,000,000 Scandinavians have won it.

(17) Many Andorrans have won the Nobel Prize in literature.

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

- Cohen (2001)'s proposal: (19)
  P, which functions as a contrastive topic, invokes a set of alternatives $\mathrm{ALT}(P)$.
  The resulting truth conditions render *many* non-conservative.

(19) Cohen (2001):
   a. Paraphrase: 'The proportion of Scandinavians that have won the Nobel Prize in literature is large compared to the proportion of the world population that have won the Nobel Prize in literature.'
   b. Reverse Proportional reading of *Many Ps are Q*:
      $|P \cap Q| : |P| > |\cup \mathrm{ALT}(P) \cap Q| : |\cup \mathrm{ALT}(P)|$

- Still a problem: (19) makes no use of the point-wise alternatives $|P' \cap Q|:|P'|$, $|P'' \cap Q|:|P''|$, $|P''' \cap Q|:|P'''|$, etc., but these alternatives matter.
   - In scenario (21a), the distribution of A-students per school peeks at the interval [5, 6]. This makes 8 A-students count as many and sentence (20) is judged true.
   - In scenario (21b), the distribution of A-students peeks at the interval [6, 7, 8, 9]. This makes 8 A-students hardly count as many and thus sentence (20) is intuitively judged false.
   - Yet, the analysis in (19) only asks us to consider the proportion of students of this school that got an A (namely, 8/1000 in both scenarios) and the overall proportion of students in this town that got an A (namely, 140/24000 in both scenarios), hence wrongly predicting the same truth value in both cases.

(20) Many students in this school got an A on the final exam.

(21) Scenario: 24 schools in this town, with 1000 students each. 140 out of the total 24000 students in this town got an A on the final exam. In the school we are referring to, 8 of the 1000 students got an A. For most schools, ...

a. ... the number of students that got an A ranges between 5 and 6, e.g. as in Fig. 1.

b. ... the number of students that got an A ranges between 6 and 9, e.g. as in Fig. 2.

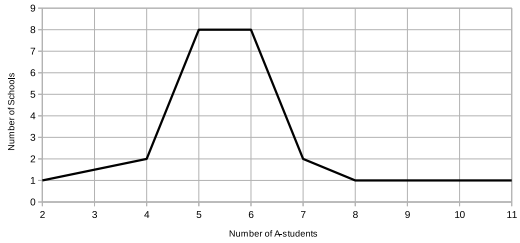

Figure 1

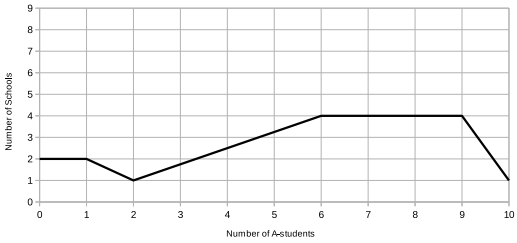

Figure 2

■ Proposal for the truth conditions of the reverse proportional reading: (22).
Function θ combines with the set containing these alternative proportions and yields a threshold value for that set.[3]

(22) a. Paraphrase: 'The proportion of Scandinavians that have won the Nobel Prize in literature is large compared to a threshold based on the proportions of inhabitants of other worlds regions that have won the Nobel Prize in literature.'

b. Reverse Proportional reading of *Many Ps are Q*:

$$|P \cap Q|{:}|P| \quad > \quad \theta(\{|P' \cap Q|{:}|P'| : P' \in \mathrm{ALT}(P)\})$$

■ Note that these truth conditions still make reverse proportional *many* non-conservative. This takes us to our second goal: to arrive at these correct truth conditions compositionally while maintaing that all natural language determiners denote conservative functions.

3 *POS* with adjectives

3.1 Background on *POS* with adjectives

■ A family of degree operators: comparative, superlative, positive (Heim, 1999, 2006; von Stechow, 2009, a.o.): (23), (25) and (27).[4]
For *POS*, L takes a set of sets of degrees on a given scale and returns the so-called neutral segment on that scale plus the limit edge points: (28).

[3] We leave open what mathematical operations θ applies to that set to obtain the threshold value. For a proposal compatible with (22), see Schöller & Franke (2015), who, based on ideas from Fernando & Kamp (1996), experimentally test a algorithm to obtain threshold values for sentences with cardinal *many*.

[4] For simplicity, we treat degree operators extensionality and leave out their presuppositions. For illustration, the intensional treatment of *-est* with presuppositions is given in (i).

(i) $[\![\text{-}est]\!] = \lambda \boldsymbol{Q}_{<<s,dt>,t>}.\ \lambda P_{<s,dt>} : P \in \boldsymbol{Q}\ .\ \lambda w.\ \forall Q \in \boldsymbol{Q}[Q \neq P \rightarrow Q(w) \subset P(w)]$

(23) $[\![\text{-}er]\!] = \lambda Q_{<d,t>}.\lambda P_{<d,t>}.\ Q \subset P$

(24) a. (Greta is 1,26m). Lucía is taller (than that).
b. $\lambda d.\text{tall}(\text{greta}, d) \ \subset \ \lambda d.\text{tall}(\text{lucia}, d)$

(25) $[\![\text{-}est]\!] = \lambda \boldsymbol{Q}_{<dt,t>}.\lambda P_{<d,t>}.\ \forall Q \in \boldsymbol{Q}[Q \neq P \rightarrow Q \subset P]$

(26) a. Lucía is tallest (among the girls in her class).
b. $\forall Q \in \{\lambda d.\text{tall}(\text{greta}, d), \lambda d.\text{tall}(\text{sarah}, d), \lambda d.\text{tall}(\text{lucia}, d), \lambda d.\text{tall}(\text{liv}, d), \ldots\}$
$[Q \neq \lambda d.\text{tall}(\text{lucia}, d) \ \rightarrow \ Q \subset \lambda d.\text{tall}(\text{lucia}, d)]$

(27) $[\![POS]\!] = \lambda \boldsymbol{Q}_{<dt,t>}.\lambda P_{<d,t>}.\ L_{<<dt,t>,<dt>>}(\boldsymbol{Q}) \subseteq P$

(28) |- - - - - - - - - - - - - - - - - -[/////////]- - - - - - - - - - - - - - - - - ∞

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

■ Compositionality: Once the λQ-argument has been filled up (by the denotation of overt material or by a context-dependent variable C), we have a generalized quantifier over degrees, which must gain appropriate scope. For concreteness, this scoping operation is implemented as LF movement: (30).

(30) LF: [[-er/-est/POS C] 1 [Lucia is t_1-tall]]

■ Superlative morpheme *-est* (Heim, 1999; Szabolcsi, 1986):

- The absolute/relative ambiguity: (31).
- The exact relative reading depends (at least partly) on the information structure of the sentence: (32).

(31) John climbed the highest mountain.
a. Absolute: "John climbed a mountain higher than any other (relevant) mountain".
b. Relative: "John climbed a higher mountain than anybody else (relevant) climbed".

(32) a. John wrote the longest letter to $\text{Mary}_{\mathbf{F}}$. $\mapsto$ compares *recipients* of John's letters
b. $\text{John}_{\mathbf{F}}$ wrote the longest letter to Mary. $\mapsto$ compares *senders* of letters to Mary

■ Deriving the relative reading (Heim, 1999):

- *-est* scopes out of its NP host and
- the comparison class C is retrieved (partly) from the focus value of the LF sister of *[-est C]* via the squiggle operator

(33) Relative reading of *-est*:
a. LF: [[**-est C**][1[$\text{John}_{\mathbf{F}}$ climbed A t_1-high mountain]] $\sim$ C]
b. $[\![1[\textit{John climbed a } t_1\textit{-high mountain}]]\!] = \lambda d'.$John climbed a d'-high mountain
c. $[\![C]\!] \subseteq \{\lambda d'.$ John climbed a d'-high mountain, $\lambda d'.$ Bill climbed a d'-high mountain, $\lambda d'.$ Paul climbed a d'-high mountain, $\ldots\}$
d. $[\![(31)]\!] = 1$ iff $\forall Q \in [\![C]\!]\ [Q \neq \lambda d.\exists x[\text{climb}(j, x) \wedge \text{mount}(x) \wedge \text{high}(x, d)] \rightarrow$
$Q \subset \lambda d.\exists x[\text{climb}(j, x) \wedge \text{mount}(x) \wedge \text{high}(x, d)]]$

■ Positive operator *POS* (Schwarz, 2010):

- ◦ Parallel absolute/relative ambiguity: (34).
- ◦ The exact relative reading depends on what element *POS* associates with: (35).

(34) 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)'.

(35) Paul gave Mia an expensive hat.
↦ a hat that is expensive for somebody like Paul (e.g. unemployed people) to give
↦ a hat that is expensive for somebody like Mia (e.g. a 3-year old) to get

■ Deriving the relative reading, as adapted from Schwarz (2010) in (36):[5]

(36) Relative reading of *POS*:

a. LF: [[**POS C**] [1 [Mia$_{\mathbf{F/CT}}$ has a t_1-expensive hat]] ∼ C]

b. $[\![C]\!] \subseteq \{\lambda d'.$ Mia has a d'-expensive hat, $\lambda d'.$ Katie has a d'-expensive hat, $\ldots\}$

c. $[\![(34)]\!] = 1$ iff $L([\![C]\!]) \subseteq \lambda d.\exists x[\text{have}(m,x) \wedge \text{hat}(x) \wedge \text{expensive}(x,d)]$

3.2 A novel observation on *POS* with adjectives

■ In the relative readings in (35) above, the associate of *POS* (namely, *Mia* or *Paul*) is external to the original host NP *[an expensive hat]*.

■ We note that the associate may be internal to the host NP as well: in (37)-(38), the comparison class (39) corresponds to having *car* as the associate of *POS*.

(37) Scenario: Rockefeller just gave Kate a very expensive car. Still, this present compares poorly to his previous astronomically expensive presents (e.g. apartment in Manhattan, island in Pacific, etc.)

(38) (For what he has been giving her, now) Rockefeller gave Kate an inexpensive car$_{\mathbf{F/CT}}$.

(39) $[\![C]\!] \subseteq \{\lambda d'.R$ gave K a d'-inexpensive car, $\lambda d'.R$ gave K a d'-inexpensive apartment in Manhattan, $\lambda d'.R$ gave K a d'-inexpensive island in the Pacific, $\ldots\}$

Summary of Section 3:

- ◦ Adjectives decompose into STEM+*-er/-est/POS*
- ◦ In the relevant readings, *POS* scopes out of its host NP to gain sentential scope and it retrieves its comparison class C (partly) from the LF sister of *[POS C]* by cycling in different alternatives to *POS*' associate.
- ◦ This associate may be external or internal to the original host NP.

[5] The use of focus/topic alternatives is not from Schwarz (2010). Schwarz uses a 3-place lexical entry for *POS* and thus does not need to generate alternatives from the information structure of the sentence. We assume the 2-place entry and need to generate alternatives somehow. To this end, we will assume that the associate of *POS* (e.g. *Paul* or *Mia* in (35)) functions as focus or as contrastive topic.

4 Proposal

■ The ingredients of the proposal:

i. *Many* is decomposed into the parametrized determiner MANY and the degree operator *POS* (cf. *more* decomposed as MANY+*-er* (Hackl, 2000) and *most* as MANY+*-est* (Hackl, 2009)). Similarly, *few* is decomposed into the parametrized determiner FEW and *POS* (Penka, 2011).

ii. There is only one proportional determiner MANY_{prop} and only one proportional determiner FEW_{prop}, both of which are conservative.

iii. Just as we saw with the relative reading of adjectives, *POS* in determiners *many* and *few* scopes sententially and retrieves a comparison class C from its syntactic scope based on its F-/CT-associate. The exact reading obtained depends on the associate.

The regular proportional reading arises when *POS*' associate is external to the NP host and the reverse proportional reading obtains when the associate is internal to the NP host.

4.1 Proportional readings of *many*

■ Once we sever *POS* from *many*, we are left with two parametrized determiners MANY:

(40) $[\![\text{MANY}_{\text{card}}]\!] = \lambda d_d.\lambda P_{<e,t>}.\lambda Q_{<e,t>}.|P \cap Q| \geq d$

(41) $[\![\text{MANY}_{\text{prop}}]\!] = \lambda d_d.\lambda P_{<e,t>}.\lambda Q_{<e,t>}.(|P \cap Q| : |P|) \geq d$

■ When we use $\text{MANY}_{\text{prop}}$ and *POS* is associated with an element external to the host NP, the regular proportional reading arises:

(42) Many (of the few) faculty children had a $\text{good}_{\mathbf{F/CT}}$ time.

(43) (Regular) proportional reading:

a. LF: [[**POS C**] [1[[t_1-$\text{MANY}_{\text{prop}}$ faculty children] has a $\text{good}_{\mathbf{F/CT}}$ time]] ∼ C]

b. $[\![C]\!] \subseteq \{\lambda d'.(|\{x : \text{fac-child}(x)\} \cap \{x : \text{have-good-time}(x)\}| : |\{x : \text{fac-child}(x)\}|) \geq d',$
$\lambda d'.(|\{x : \text{fac-child}(x)\} \cap \{x : \text{have-bad-time}(x)\}| : |\{x : \text{fac-child}(x)\}|) \geq d',$
$\lambda d'.(|\{x : \text{fac-child}(x)\} \cap \{x : \text{have-regular-time}(x)\}| : |\{x : \text{fac-child}(x)\}|) \geq d', \ldots\}$

c. $L([\![C]\!]) \subseteq \lambda d.(|\{x : \text{fac-child}(x)\} \cap \{x : \text{have-good-time}(x)\}| : |\{x : \text{fac-child}(x)\}|) \geq d$

■ When we use $\text{MANY}_{\text{prop}}$ but *POS* is associated with an element internal to the host NP, we obtain the reverse proportional reading.

(44) Many $\text{Scandinavians}_{\mathbf{F/CT}}$ have won the Nobel Prize in literature.

(45) Reverse proportional reading:

a. LF: [[**POS C**] [1[[t_1-$\text{MANY}_{\text{prop}}$ $\text{Scandinavians}_{\mathbf{F/CT}}$] have won NP]] ∼ C]

b. $[\![C]\!] \subseteq \{\lambda d'.(|\{x : \text{Scandinavian}(x)\} \cap \{x : \text{NP-winner}(x)\}| : |\{x : \text{Scandinavian}(x)\}|) \geq d',$
$\lambda d'.(|\{x : \text{Mediterranean}(x)\} \cap \{x : \text{NP-winner}(x)\}| : |\{x : \text{Mediterr.}(x)\}|) \geq d',$
$\lambda d'.(|\{x : \text{M.Eastern}(x)\} \cap \{x : \text{NP-winner}(x)\}| : |\{x : \text{M.Eastern}(x)\}|) \geq d', \ldots\}$

c. $L([\![C]\!]) \subseteq \lambda d.(|\{x : \text{Scandinavian}(x)\} \cap \{x : \text{NP-winner}(x)\}| : |\{x : \text{Scandinavian}(x)\}|) \geq d$

■ The truth conditions derived in (45b)-(45c) correspond precisely to the characterization of the reverse proportional reading argued for in Section 2.

4.2 Proportional readings of *few*

■ Once we separate *POS* from *few*, we are left with two parametrized determiners FEW:

(46) $[\![\text{FEW}_{\text{card}}]\!] = \lambda d_d.\lambda P_{<e,t>}.\lambda Q_{<e,t>}.|P \cap Q| < d$ (TO BE REVISED)

(47) $[\![\text{FEW}_{\text{prop}}]\!] = \lambda d_d.\lambda P_{<e,t>}.\lambda Q_{<e,t>}.(|P \cap Q| : |P|) < d$ (TO BE REVISED)

■ When we use FEW_{prop} and *POS* is associated with an element in the sentence external to the host NP, the regular proportional reading obtains:

(48) Few (of the many) demonstrators had a $\text{good}_{\mathbf{F/CT}}$ time.

(49) (Regular) proportional reading:

a. LF: [**[POS C]** [1[[t_1-FEW_{prop} demonstrators] has a $\text{good}_{\mathbf{F/CT}}$ time]] ∼ C]

b. $[\![C]\!] \subseteq \{\lambda d'.(|\{x : \text{demonstr}(x)\} \cap \{x : \text{have-good-time}(x)\}| : |\{x : \text{demonstr}(x)\}|) < d',$
$\lambda d'.(|\{x : \text{demonstr}(x)\} \cap \{x : \text{have-bad-time}(x)\}| : |\{x : \text{demonstr}(x)\}|) < d',$
$\lambda d'.(|\{x : \text{demonstr}(x)\} \cap \{x : \text{have-regular-time}(x)\}| : |\{x : \text{demonstr}(x)\}|) < d',$
$\ldots\}$

c. $L([\![C]\!]) \subseteq \lambda d.(|\{x : \text{demonstr}(x)\} \cap \{x : \text{have-good-time}(x)\}| : |\{x : \text{demonstr}(x)\}|) < d$

■ When we use FEW_{prop} but *POS* is associated with an element in the sentence internal to the host NP, the reverse proportional reading results, with the truth conditions we argued for:[6]

(50) Few $\text{cooks}_{\mathbf{F/CT}}$ applied.

(51) Reverse proportional reading:

a. LF: [**[POS C]** [1[[t_1-FEW_{prop} $\text{cooks}_{\mathbf{F/CT}}$] applied]] ∼ C]

b. $[\![C]\!] \subseteq \{\lambda d'.(|\{x : \text{cooks}(x)\} \cap \{x : \text{apply}(x)\}| : |\{x : \text{cooks}(x)\}|) < d',$
$\lambda d'.(|\{x : \text{someliers}(x)\} \cap \{x : \text{apply}(x)\}| : |\{x : \text{someliers}(x)\}|) < d',$
$\lambda d'.(|\{x : \text{waiters}(x)\} \cap \{x : \text{apply}(x)\}| : |\{x : \text{waiters}(x)\}|) < d', \ldots\}$

c. $L([\![C]\!]) \subseteq \lambda d.(|\{x : \text{cooks}(x)\} \cap \{x : \text{apply}(x)\}| : |\{x : \text{cooks}(x)\}|) < d$

Summary of Section 4:
We have proposed a compositional analysis that derives the correct truth conditions for the reverse proportional reading of *many* and *few*, and this has been achieved using only conservative determiners —namely, $\text{MANY}_{\text{prop}}$ and FEW_{prop}— and exploiting independently motivated properties of *POS*.

[6] When cardinal $\text{MANY}_{\text{card}}$ and FEW_{card} are used, different readings are derived too depending on whether the associate is external or internal to the host NP. See Romero (2015) for details.

5 Further predictions

- We have argued that the ingredients leading to the final truth conditions (52) and (53) for simple reverse proportional examples should not be fused in a single lexical entry but come from different, separable components:
  - *many* = MANY (quantifying over individuals) + *POS* (operating on degrees)
  - *few* = FEW (quantifying over individuals) + *POS* (operating on degrees)
  - *few* = MANY + LITTLE + *POS*, following Penka (2011), who in turn builds on Heim (2006) on antonyms like *tall*/*short*. The negative element LITTLE is defined in (54):

(52) REVERSE PROPORTIONAL reading of *Many Ps are Q*:
$$|P \cap Q| : |P| \quad > \quad \theta(\{|P' \cap Q| : |P'| : P' \in \mathrm{ALT}(P)\})$$

(53) REVERSE PROPORTIONAL reading of *Few Ps are Q*:
$$|P \cap Q| : |P| \quad < \quad \theta(\{|P' \cap Q| : |P'| : P' \in \mathrm{ALT}(P)\})$$

(54) $[\![\text{LITTLE}]\!] \quad = \lambda d_d.\lambda D_{<d,t>}.D(d) = 0$

- The question arises whether another operator, e.g. an intensional verb, can intervene between the individual quantificational part MANY and the degree operator *POS* (cf. Heim, 2001; Kennedy, 1999). The answer is 'yes'.

- **Case 1**: matrix scope of *POS* when the associate is in the matrix clause
  - *POS* with adjectives or adverbs (Schwarz, 2010):

(55) John wants me to talk loud (for a vocal coach).
  a. Understood as the speaker being a vocal coach.
  b. Understood as John being a vocal coach.

(56) LF1: John wants [[POS C] 1[$\text{me}_{\mathbf{F/CT}}$ to talk t_1-loud]]

(57) LF2: [[POS C] 1 [$\text{John}_{\mathbf{F/CT}}$ wants me to talk t_1-loud]]

  - *POS* with *many*:

(58) Prof. Smith wants Paul to read many (of the) papers (for a new comer).
  a. Understood as Paul being a new comer.
  b. Understood as Prof. Smith being a new comer.

(59) LF1: Prof. Smith wants [[POS C] 1[$\text{Paul}_{\mathbf{F/CT}}$ to read t_1-MANY papers]]

(60) LF2: [[POS C] 1 [$\text{Prof. Smith}_{\mathbf{F/CT}}$ wants Paul to read t_1-MANY papers]]

- **Case 2**: scope ambiguity detectable with negative antonyms
  - *POS* in cardinal readings of *few*:
    Building on the scope ambiguity between *-er* and an intensional verb in (61) (Heim, 2006), Penka (2011) notes that a parallel ambiguity arises between *POS* and an intensional verb: (62)-(64):

(61) (This draft is 15 pages.) The paper is required to be less long than that.
   a. 'Being under 15 pages is a necessity.'
   b. 'Being under 15 pages is a possibility.'

(62) They are required / need to write few letters.
   a. 'For them (e.g. the inmates of a prison with restricted allowance for correspondence), writing few letters is a necessity.'
   b. 'For them (e.g. staff of an office that gets away with doing little work), writing few letters is a possibility.'

(63) a. LF1: [need [$_{\text{DegP}}$ **POS** C] 1[[$_{\text{DegP}}$ t_1 little] 2 they$_{\mathbf{F/CT}}$ write t_2-MANY letters]]
   b. $\lambda w.\ \forall w' \in \text{Acc}(w)[L([\![C]\!]) \subseteq \lambda d.|\{x : \text{papers}(x, w')\} \cap \{x : \text{read}(\text{they}, x, w')\}| < d]$

(64) a. LF2: [[$_{\text{DegP}}$ **POS** C] 1[[$_{\text{DegP}}$ t_1 little] 2 need [they$_{\mathbf{F/CT}}$ read t_2-MANY letters]]]
   b. $\lambda w.\ L([\![C]\!]) \subseteq \lambda d.\exists w' \in \text{Acc}(w)[|\{x : \text{papers}(x, w')\} \cap \{x : \text{read}(\text{they}, x, w')\}| < d]$

- Positive *POS* in reverse proportional readings of *few*: parallel ambiguity in (65)

(65) Few Chinese$_{\mathbf{F/CT}}$ need to have won the Nobel Prize in literature.
   a. 'Having a small proportion of Chinese that have won the literature Nobel Prize (compared to the proportions of other countries) is a necessity, e.g., for China to be eligible for financial support from the International Literature Foundation.'
   b. 'Having a small proportion of Chinese that have won the literature Nobel Prize (compared to the proportions of other countries) is a possibility, e.g., for China to be included among the best literary countries.'

6 Conclusions

- By decomposing *many* into the positive degree operator *POS* and the parametrized determiner MANY, the so-called reverse proportional reading has been derived while appealing solely to independently motivated behavior of *POS* and while keeping a single, conservative lexical entry for MANY$_{\text{prop}}$.
- The same holds for *few*.
- Importantly, contrary to the analyses by Westerståhl (1985), Herburger (1997) and Cohen (2001), the proposed analysis derives the correct truth conditions for this reading.
- Furthermore, extending observations in the literature, the proposed decomposition correctly predicts the existence of further scopal readings that are unexpected in non-decomposition analyses.
- Some open issues:
  Adjectival uses of cardinal *many/few*, as exemplified in (66), suggest that cardinal MANY$_{\text{card}}$ / FEW$_{\text{card}}$ may be adjectives rather than determiners. See also Hackl (2009)'s analysis of the absolute reading of *most* based on an adjectival version of MANY$_{\text{card}}$. We leave a potential extension in this direction for future research.

(66) The many/few students of the University of Konstanz protested.

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