Q-adjectives, Type Shifting and Cross-Linguistic Variation*

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1. Q-adjectives

The challenge of Q-adjectives: Cross-categorical usage

(1) a. Many/few students attended the lecture. — Quantificational
b. John's friends are many/few. — Predicative
c. The many/few students who attended enjoyed the lecture. — Attributive
d. Many fewer than 100 students attended the lecture — Differential
e. Fred is much taller than Barney — Adj. Differential

(1a): Quantifiers?
(1b-c): Cardinality predicates?
(1d-e): Not cardinality predicates

The analysis of Solt (2009, 2014): Q-adjectives across all of their uses denote gradable predicates of scalar intervals / gradable quantifiers over degrees:

(2) a. $[[\text{many}]] = \lambda d \lambda I_{<dt>}.I(d)$ <d,<dt,t>>
b. $[[\text{few}]] = \lambda d \lambda I_{<dt>}.\neg I(d)$

The positive form derives from composition with null POS. Preliminarily:

(3) a. $[[\text{POS many}]] = \lambda d \lambda I_{<dt>}.I(d_{Std})$ <dt,t>
b. $[[\text{POS few}]] = \lambda d \lambda I_{<dt>}.\neg I(d_{Std})$

NB: We probably need different standards for *many* and *few*; see below

Additional components of the analysis:

- Introduction of degrees via phonologically null syntactic head Meas:

(4) $[[\text{Meas}]] = \lambda x \lambda d.\mu_{DIM}(x) = d$

- Composition via intersective modification / Restrict (Chung & Ladusaw 2003)
- Quantificational force via Existential Closure

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Compositional implementation:

(5) a. SS: $[[_{DP}[_{MeasP}\,[_{QP}\,\text{POS many}]\,\text{Meas students}]]$ attended the lecture]
b. LF: $[_{QP}\,\text{POS-many}]_1[[_{DP}[_{MeasP}\,t_1\,\text{Meas students}]]$ attended the lecture]

(6) a. $[[\,t_1\,\text{Meas students attended}]] =$
$= \lambda d \exists x[\text{students}(x) \wedge \mu_{\#}(x) = d \wedge \text{attended}(x)]$

b. $[[\text{POS-many}]]\,([[\,t_1\,\text{Meas students attended}]\,]]\,) =$
$= \exists x[\text{students}(x) \wedge \mu_{\#}(x) = d_{Std} \wedge \text{attended}(x)]$

c. $[[\text{POS-few}]]\,([[\,t_1\,\text{Meas students attended}]\,]]\,) =$
$= \neg\exists x[\text{students}(x) \wedge \mu_{\#}(x) = d_{Std} \wedge \text{attended}(x)]$

Advantages:

- Correct semantics for quantificational *few* without 'van Benthem's problem'

(7) few > ∃

- Extends to non-quantificational uses
- *Much* support and *more*

(8) a. John is diligent; in fact, he is too much so
b. Smarter / more [=much + -er] intelligent

2. Cardinal numerals and type shifting

Parallels between *few, many* and cardinal numerals:

(9) a. Few students presented at the workshop
b. Many students presented at the workshop
c. Three students presented at the workshop

(10) There are few/many/three/*every/*most students on the program

(11) The few/many/three students who presented (cf. *the every/most students)

Kennedy (to appear): de-Fregean semantics for number:

(12) $[[\text{three}]] = \lambda I_{<dt>}.\max\{d: I(d)\} = 3$ <dt,t>

(13) Three students attended the lecture
$\max\{d: \exists x[\text{students}(x) \wedge \mu_{\#}(x) = d \wedge \text{attended}(x)]\} = 3$

- Upper bounded reading

Type shift via BE operator (Partee 1987):

(14) $BE = \lambda\mathcal{Z}_{<\alpha t,t>}\lambda x_{\alpha}.\ \mathcal{Z}(\lambda y.y=x)$

- Collects all elements of all singleton sets that satisfy predicate into set

(15) $BE(three) = \lambda d.d = 3$ $\quad$ <d,t>

Lower type interpretation of cardinal responsible for 'at least' readings. On one option:

(16) Three students attended the lecture

a. [[three students]]= ([[three]])([[Meas students]])

$= (\lambda d.d = 3)(\ \lambda d\lambda x.students(x) \wedge \mu_{\#}(x) = d)$

$= \lambda d\lambda x.students(x) \wedge \mu_{\#}(x) = d \wedge d = 3$ $\quad$ via Restrict

b. $\exists x\exists d[students(x) \wedge \mu_{\#}(x) = d \wedge d = 3 \wedge attended(x)]$

$= \exists x[students(x) \wedge \mu_{\#}(x) = 3 \wedge attended(x)]$

3. Do Q-adjectives undergo type-shifting?

Application of BE to Q-adjectives (after composition with POS):

(17) a. $BE(POS\ many) = \lambda d.d \geq d_{Std}$ $\quad$ <d,t>

b. $BE(POS\ few) = \lambda d.d < d_{Std}$

Quantificational Use

What we derive in parallel to (16):

(18) Many students attended the lecture

$\exists x\exists d[students(x) \wedge \mu_{\#}(x) = d \wedge d \geq d_{Std} \wedge attended(x)]$

- Equivalent to (6b)

(19) Few students attended the lecture

$\exists x\exists d[students(x) \wedge \mu_{\#}(x) = d \wedge d < d_{Std} \wedge attended(x)]$

- This is a lower-bounded reading; it does not rule out the possibility that there is some group of cardinality $\geq d_{Std}$ who attended.

- It doesn't seem that (18) has this reading.
  - But maybe there is a phantom reading per Marty et al. (2014)? Hard to tell (though testable)

Attributive Use

A type-lowered interpretation would allow Q-adjective to be interpreted within DP on attributive use

(20) The few students

a. [[BE(POS few) Meas students]] = ([[BE(POS few)]]) ([[Meas students]])

$= (\lambda d.d < d_{Std})(\ \lambda d\lambda x.students(x) \wedge \mu_{\#}(x) = d)$

$= \lambda d\lambda x.students(x) \wedge \mu_{\#}(x) = d \wedge d < d_{Std}$

$\rightarrow \lambda x\exists d.students(x) \wedge \mu_{\#}(x) = d \wedge d < d_{Std}$

b. [[the BE(POS few) Meas students]] = $\iota\lambda x\exists.d[students(x) \wedge \mu_{\#}(x) = d \wedge d < d_{Std}]$

where $\iota P = \max(P)$ iff $\max(P)$ exists; otherwise undefined

- *the few students* is the maximum plurality of students if their number is few; otherwise undefined

However, evidence of clausal structure…

(21) a. ?the few students
b. the few students who attended

(22) a. The fortunately few families who were displaced by the flood
b. The frankly few really good computer games released this year
c. The undoubtedly many business travelers who need wireless

… and NPI licensing suggests Q-adjective has scope over remainder of NP

(23) a. Few people who ever visited made donations.
b. Few people who visited ever made donations.
c. The few people who ever visited made donations.
d. *The few people who visited ever made donations.

Analysis in Solt (2014): covert *there* relatives; *few* as degree quantifier, as in quantificational use

- No evidence for type <d,t> interpretation here.

Collective and cumulative readings

Marty et al. (2014): Collective readings of doubly bounded numerical noun phrases show evidence of reading based on Existential Closure

(24) Between 40 and 60 soldiers surrounded the castle

- Not falsified by a second group of soldiers

Extended to *many* / *few*:

(25) a. Many soldiers surrounded the castle — Collective?
b. Few soldiers surrounded the castle — "

Krifka (1999): cumulative readings involve existential quantification over pluralities

(26) Three boys ate seven apples

$\exists x[\text{three-boys}(x) \wedge \exists y[\text{apples}(y) \wedge \text{ate}(x,y)]]$

- 3 boys & 7 apples total

(27) … and the other three boys ate four apples

- Supports existential semantics

Extended to *many* / *few*:

(28) a. Few boys ate seven apples — ✓Distrib ×Cum
b. Many boys ate seven apples — ✓Distrib ×?Cum

(29) a. Five guests drank 10 bottles of wine — ✓Distrib ✓Cum
b. Few guests drank 10 bottles of wine — ✓Distrib ×Cum
c. Many guests drank (only) 10 bottles of wine — ✓Distrib ×?Cum

(30) a. Three of our employees do 90% of all the work — ✓Distrib ✓Cum
b. Few of our employees do 90% of all the work — ✓Distrib ×Cum
c. Many of our employees do only 10% of all the work — ✓Distrib ×?Cum

(31) a. Ten women gave birth to twelve babies — ✓Distrib ✓Cum
b. Ten women gave birth to few babies — ✓Distrib ×?Cum
c. Ten women gave birth to many babies — ✓Distrib ?Cum

(32) a. Three potatoes are (is?) enough to make a soup — ✓Distrib ✓Cum
b. Few potatoes are (is?) enough to make a soup — ✓Distrib ×Cum
c. Many potatoes are (is?) enough to make a soup — ✓Distrib ×?Cum
d. Many potatoes are (is?) excessive for a small soup — ✓Distrib ×?Cum

- If cumulative readings based on type-lowered interpretation for quantity word, this is apparently not available to *few* and (?) *many*

Some possibly related facts:

- Specific indefinite readings:

(33) a. If three relatives of mine die, I'll inherit a million dollars (Reinhardt '97)
✓ There are 3 specific relatives s.t. if they (all) die, I get rich

b. If few relatives of mine die, I'll inherit a million dollars
× There is a specific small group of relatives s.t. if they all die I get rich
✓ For me to get rich, my relatives need to stay alive

c. If many relatives of mine die, I'll inherit a million dollars
×? There is a specific large group of relatives s.t. if they all die I get rich

- I*n*-adverbials

(34) a. John wrote the paper in 3 days
b. *John wrote the paper in few days
c. *John wrote the paper in many days

An analysis of (34a) per Krifka (1989):

(35) a. $\lambda e.\text{writing}(e) \wedge \text{Ag}(e)=\text{John} \wedge \text{Pat}(e)=\text{paper} \wedge \exists t[\text{CONV}(t) \wedge \text{days}(t)= 3 \wedge \tau(e) \subseteq \tau]$ ✓

b. $\lambda e.\max\{d: \text{writing}(e) \wedge \text{Ag}(e)=\text{John} \wedge \text{Pat}(e)=\text{paper} \wedge \exists t[\text{CONV}(t) \wedge \text{days}(t)= d \wedge \tau(e) \subseteq \tau]\} = 3$ ×

Interim conclusion: *few* does not have a type <d,t> interpretation. Less clear this is ruled out for *many*

4. Are lower-type readings really absent?

Fewer than n patterns with cardinal numerals, not *few*:

(36) a. Fewer than 10 guests drank 10 bottles of wine — ✓Distrib ✓Cum
b. Fewer than 5 of our employees do 90% of all the work — ✓Distrib ✓Cum
c. Ten women gave birth to fewer than 8 babies — ✓Distrib ✓Cum

(37) Fewer than 10 potatoes are (is?) enough to make a soup — ✓Distrib ?✓Cum

(38) If fewer than five relatives of mine die, I'll inherit a million dollars
??There is a specific group of relatives numbering <5 s.t.
if they (all) die, I get rich

(39) John wrote the paper in fewer (less) than five days

(40) Fewer than 10 people ever drank 10 bottles of wine ✓Distrib ×Cum

- NPI not licensed on cumulative interpretation

Similar (?) for *more* vs. *many*:

(41) a. More than 10 guests drank only 5 bottles of wine ✓Distrib ✓Cum
b. ?More than 10 of our employees do only 5% of all the work ✓Distrib ?Cum
c. Ten women gave birth to more than 12 babies ✓Distrib ✓Cum

Missing readings for *few* expressed by *a few*:

(42) a. A few guests drank 10 bottles of wine ✓Distrib ✓Cum
b. A few of our employees do 90% of all the work ✓Distrib ✓Cum
c. Ten women gave birth to a few babies ✓Distrib ✓?Cum

(43) A few potatoes are (is?) enough to make a soup ✓Distrib ✓Cum

(44) If a few relatives of mine die, I'll inherit a million dollars
✓There are a few specific relatives s.t. if they (all) die, I get rich

(45) John wrote the paper in a few days.

Could the type-lowered interpretation for *few* be spelled out as *a few*?

(46) a. (Only) a very few students presented at the conference
b. An incredibly few collectors have the good fortune to own one

- Suggests compositional relation between *few* and *a few*

(47) A few students attended the lecture

$\exists x \exists d[\text{students}(x) \wedge \mu_{\#}(x) = d \wedge d < d_{Std} \wedge \text{attended}(x)]$

- Problem: this is too weak (1 or 2 – or perhaps even 0 – would suffice). Maybe fixable?

Conclusion: Type lowered interpretations are available to at least some modified forms of Q-adjectives – and to *a few*.

5. A possible (technical) explanation for the difference?

Three and *fewer than n* have degree quantifier interpretations to which BE can apply:

(48) a. $[[\text{three}]] = \lambda I_{<dt>}.\max\{d: I(d)\} = 3$

b. $[[\text{fewer than } n]] = \lambda n \lambda I_{<dt>}.\max\{d: I(d)\} < n$

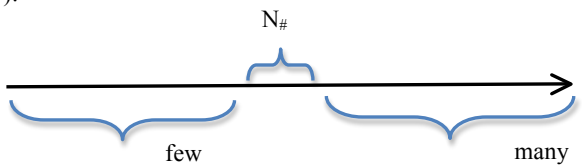
- Need to derive somehow from underlying semantics for *few* and *-er*

c. $[[\text{fewer than 10}]] = \lambda I_{<dt>}.\max\{d: I(d)\} < 10$

(49) $BE(\text{fewer than 10}) = \lambda d.d < 10$

Suppose POS defined as degree quantifier introducing 'neutral range' as standard (von Stechow 2009):

(50)



(51) $[[\text{POS}]] = \lambda I_{<dt,t>}.\forall d \in N_{\#}\,[I(d)]$

(2b) $[[\text{few}]] = \lambda d \lambda I_{<dt>}.\neg I(d)$

- POS cannot compose *in situ* with *few*; thus 'bare' *few* never has type to which BE applies
- Judgments relating to *many* become crucial

Alternate possibility: blocking by *a few*?

6. Some possible cross-linguistic variation

German *wenig* 'few' diverges in some ways from English *few*:

(52) a. *Only few students came to the party.
b. Only a few students came to the party.
c. Nur wenige Studenten sind zur Party gekommen.

(53) a. *John wrote the paper in few days.
b. John wrote the paper in a few days.
c. Hans hat das Paper in nur wenigen Tagen geschrieben.

- German *wenig* can occur in some contexts where English requires *a few*

- So maybe *wenig* has the type <d,t> interpretation that seems to be missing for *few*?

(54) a. Weniger als 10 Gäste haben 10 Flaschen Wein getrunken ✓Distrib ✓Cum
b. Wenige Gäste haben 10 Flaschen Wein getrunken ✓Distrib ×Cum

- Same contrast as in English….

7. Overall Conclusions

➔ Q-adjectives have a quantificational type – gradable quantifiers over degrees.

➔ Data suggest that in principle, they can shift to a lower type – though this appears to be limited to modified forms (for reasons that remain to be understood)

➔ Supports alignment of Q-adjectives and cardinal numerals

➔ Studying cross-linguistic variation will be helpful

References

Benthem, Johan F.A.K. van (1986), Essays in Logical Semantics. Reidel. Dordrecht.

Kennedy, Chris (to appear). A "De-Fregean" Semantics (and Neo-Gricean Pragmatics) for Modified and Unmodified Numerals. To appear in *Semantics and Pragmatics*.

Krifka, Manfred (1999). At least some determiners aren't determiners. In K. Turner (Ed.), The semantics/pragmatics interface from different points of view (pp. 257-291). Oxford: Elsevier.

Krifka, Manfred (1989). Nominal Reference, Temporal Constitution and Quantification in Event Semantics. In Renate Bartsch, Johan van Benthem & Peter von Emde Boas (eds.), Semantics and Contextual Expression, 75-115. Dordrecht: Foris Publication.

Marty, Paul, Emmanuel Chemla and Benjamin Spector (2014). Phantom readings: the case of modified numerals, *Language, Cognition and Neuroscience*, published on line on June 27, 2014.

Solt, S. (2006). Why a few? And why not *a many? In C. Ebert and C. Endriss (eds.), *Proceedings of the Sinn und Bedeutung* 10. ZAS Working Papers in Linguistics. 44, 6, 333-346.

Solt, Stephanie (2014). Q-Adjectives and the semantics of quantity. *Journal of Semantics*. Published online 3 February 2014.

Solt, S. (2009). The semantics of adjectives of quantity. PhD Dissertation, City University of New York.

von Stechow, Arnim. (2009), 'The temporal degree adjectives früh(er)/spät(er) 'early(er)'/'late(r)' and the semantics of the positive'. In Anastasia Giannakidou & Monika Rathert (eds.), Quantification, Definiteness, and Nominalization .Oxford University Press. Oxford. 214–33.