

Witnessable Quantifiers License Type-e Meaning

Evidence from Contrastive Topic, Equatives and Supplements

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Central Question

- **Q:** What semantic types can plural quantificational DP's denote?
- **A:** It depends on the quantifier.

Main Goals

- Defend type distinction among QP's along lines of Reinhart 1997
- Present three new diagnostics for type-e readings of QP's:
 - Contrastive Topic
 - Equatives
 - Supplements
- Show that more quantifiers allow type-e readings than Reinhart assumed; all and only **witnessable** quantifiers

Definition

A determiner *Det* is WITNESSABLE iff $Det(P)(Q) \Rightarrow \exists x: P(x) \wedge Q(x)$

Some students passed. \Rightarrow There is a student who passed.

Most students passed. \Rightarrow There is a student who passed.

Few students passed. $\not\Rightarrow$ There is a student who passed.

- Note: Decreasing quantifiers are never witnessable.

- “Simple indefinites” allow type-e readings (via choice function), hence show exceptional wide scope
- Other QP’s denote generalized quantifiers—type $\langle\langle e,t \rangle, t\rangle$

The Cut

		Reinhart Type-e	Witnessable
“SOMES”	some, ten, several, many, a few	✓	✓
“MOSTS”	most, all, exactly ten, more than ten, half		✓
“FEWS”	few, no, less than ten, not many		

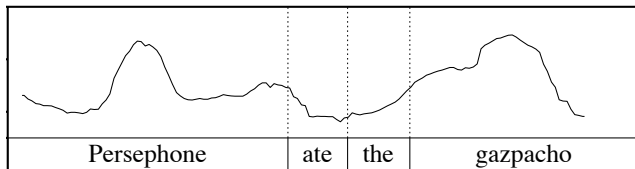
The Diagnostics

- **Contrastive Topic**
- Equatives
- Supplements

Contrastive Topic

(1) A: What did Persephone and Antonio eat?

B: [*Persephone*]_{CT} ... ate the [*gazpacho*]_F.
L+H* L-H% H* L-L%



(2) What did they eat?

What did Persephone eat?

What did Antonio eat?

Persephone ate the gazpacho.

Antonio ate the bologna.

Contrastive Topic Meaning

- CT signals STRATEGY of questions (Roberts 1996, Büring 2003)
- Questions in strategy vary in CT-marked position
- **Idea:** We can use CT to test quantifier type;
(If a QP is type-e, its topic alternatives will be type-e)
- **Result:** Only witnessable quantifiers can be CT-marked in discourses contrasting individuals

Alternative-Based Accounts

- Accounts of CT: Büring 1997, 2003, Lee 1999, Steedman 2008, Tomioka 2010, Wagner 2012, Constant in prep.
- Common Core: CT phrase generates focus alternatives (Rooth 1985)
- Focus alternatives are same type as ordinary value:

$$\begin{aligned} \llbracket \text{Fred}_F \rrbracket^f &= D_e = \{ \text{John, Mary, Fred, Sue, ...} \} \\ \llbracket \text{orange}_F \rrbracket^f &= D_{\langle e,t \rangle} = \{ \lambda x. \text{green}(x), \lambda x. \text{purple}(x), \dots \} \\ \llbracket \text{something}_F \rrbracket^f &= D_{\langle \langle e,t \rangle, t \rangle} = \{ \lambda P. |P| > 0, \lambda P. |P| > 1, \dots \} \\ \llbracket \text{every}_F \rrbracket^f &= D_{\langle \langle e,t \rangle, \langle \langle e,t \rangle, t \rangle \rangle} = \{ \lambda P \lambda Q. P \subseteq Q, \lambda P \lambda Q. |P \cap Q| = 0, \dots \} \end{aligned}$$

- CT marks response to sub-question within larger strategy.
- Strategy contains questions in ct-value $\llbracket \cdot \rrbracket^{ct}$ of response.
- $\llbracket \cdot \rrbracket^{ct} =$ substitute *first* for F-marked phrase, *then* for CT-marked phrase.

$$\begin{aligned}
 (3) \quad & \llbracket [\text{Fred}]_{CT} \text{ ate } [\text{the beans}]_F \rrbracket^{ct} \\
 & = \{ \{ x \text{ ate } y \mid y \in D_e \} \mid x \in D_e \} \\
 & = \left\{ \begin{array}{l} \{ \text{Fred ate the beans, Fred ate the pasta, ...} \} \\ \{ \text{Mary ate the beans, Mary ate the pasta, ...} \} \end{array} \right\} \\
 & = \text{'For each person, what did they eat?'}
 \end{aligned}$$

The GQ Approach (Büring 1997)

(4) A: Where do the grads live?

B: [*Some*]_{CT} grads ... live [in *Amherst*]_F.
L+H* L-H% H* L-L%

$$\llbracket \cdot \rrbracket^{ct} = \left\{ \begin{array}{l} \text{Where do some grads live?} \\ \text{Where do most grads live?} \\ \text{Where do few grads live?} \\ \dots \end{array} \right\}$$

Problems for the GQ Account (Rooth 2005)

- Problem #1: (4) isn't answering an implicit question
'Where do some grads live?'

(We'd expect conversational implicature of complete answer.)

- Problem #2: (4) doesn't imply further questions
'Where do <quantifier> grads live?'

The natural residual question is 'Where do *the other* grads live?'

More Problems for the GQ Account

- Problem #3: A quantifier can contrast with itself:

(5) A: Where do the grads live?

B: [*Some*]_{CT} of them ... live [in *Amherst*]_F.

[*Some*]_{CT} of them ... live [in *Northampton*]_F.

- Problem #4: Why does *few* resist CT-marking?

(6) A: Where do the grads live?

B: # [*Few*]_{CT} of them ... live [in *Amherst*]_F.

$L+H^*$ $L-H\%$ $H^* L-L\%$

(7) A: Where do the grads live?

B: [*Few*]_F of them live [in *Amherst*]_{CT} ...

H^* $L-$ $L+H^* L-H\%$

The Choice-Functional Approach

- Rooth adopts Reinhart's proposal that 'some grads' allows type-e reading
- For Rooth, CT-marked *some* denotes a choice function variable

Choice Functions

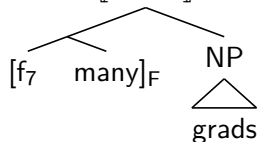
- Choice functions are type $\langle\langle e,t \rangle, e\rangle$
 - Take a property to an individual who has that property
 - CF variables existentially bound (Reinhart 1997) or valued by context (Kratzer 1998, 2003)
-
- Compute alternatives to '[*some*]_{CT} grads' by substituting choice functions
 - $\llbracket \text{some}_F \text{ grads} \rrbracket^f = \{ f_7(\lambda x. \text{grad}(x)), f_8(\lambda x. \text{grad}(x)), \dots \}$
 $= \{ \text{John, Mary, John+Mary, } \dots \}$

Implementing Other Choice-Functional Quantifiers

- Quantifiers as presuppositional CF-modifiers

(8) $\llbracket \text{many} \rrbracket = \lambda f_{\langle\langle e,t \rangle, e \rangle} \lambda P_{\langle e,t \rangle} [f(P) \text{ if } |\text{Atoms}(f(P))| > 5, \text{ else undefined}]$

(9) $\llbracket \text{DP}_e \rrbracket^f = \text{all pluralities of grads}$



(4) A: Where do the grads live? (repeated)

B: [*Some*]_{CT} grads ... live [in *Amherst*]_F.
L+H* L-H% H* L-L%

- Completely answers implicit question about where particular group of grads lives.
- Implies residual question about where another group of grads lives.
- Different instances of *some* can stand for different CF variables, so can contrast.
- Since *few* lacks CF reading, CT-marking would require a discourse with contrasting GQ's.

Contrasting GQ's

- Can we ever contrast GQ denotations?

(10) A: How many of the grads live in Amherst?

B: [*Few*]_F of them.

(Contrastive Focus)

- Contrastive focus GQ evokes exhaustive question: 'Which proportion?'
- Contrastive topic GQ evokes set of questions about different proportions: 'What about *many*?', 'What about *few*?'
- **Cognitive Bias?**
 - Strategies that sort by individuals are common and easily accommodated.
 - Strategies that sort by proportions are uncommon and hard to accommodate.

Contrasting GQ Topics

(11) A is trying to figure out how hard each problem is on an exam she has written. As an experiment, she asks B to have his students take the exam, to see how they do. After B has graded the exams, A asks...

A: Okay, first tell me, which problems did *all* the students solve?

B: *All* the students solved problems one and six.

A: And which problems did *most* of them solve?

B: *Most* of them solved problems two and five.

A: And which problems did *few* of them solve?

B: [*Few*]_{CT} of them ... solved [problems three and *four*]_F.
L+H* L-H% H* L-L%

○ Generalizations:

- Any QP can be CT-marked in a discourse answering questions about contrasting proportions.
- Only type-e QP can be CT-marked in discourse answering questions about contrasting individuals.

Which Quantifiers Support CT?

(12) A: Where do the grads live?

B: []_{CT} (of the) grads ... live [in *Amherst*]_F.
 L+H* L-H% H* L-L%

{ *some* | *ten* | *many* | *several* | *a few*
 most | *half* | *more than ten* | *exactly ten*
 #*few* | #*none* | #*not many* | #*less than ten* }

- o Note: *all* resists CT for pragmatic reasons; see Büring (1997)

The Diagnostics

- Contrastive Topic
- **Equatives**
- Supplements

Equatives

- Equatives are copular clauses equating two expressions of the same type.
- Witnessable QP's can be equated with type-e; non-witnessable QP's can't.

(13) Those people standing over there are _____ of my best students.

{ some | 20 | many | several | a few
most | all | more than 20 | exactly 20 | half
*few | *none | *not many | ??less than 20 }

- Logic behind the diagnostic:
 - If object denotes plurality, we have well-formed equation of pluralities
 - If object denotes GQ, sentence will have type mismatch or be uninformative

(Non-)Options for GQ Interpretation

- Option #1: QR object
- Option #2: Type shift subject to property with 'ident' (Partee 1987)
 $x_e \rightarrow \lambda y[y = x]$
- Option #3: Type shift GQ to property with Montague's BE
 $\mathcal{P}_{\langle\langle e,t \rangle, t \rangle} \rightarrow \lambda x[\mathcal{P}(\lambda y[y = x])]$
- **Problem:** Resulting property $[\lambda x.x = \text{those people}]$ unsatisfiable by atomic individuals
- Option #4: Type shift GQ to individual with Partee's 'lower' operation
 $\mathcal{P}_{\langle\langle e,t \rangle, t \rangle} \rightarrow \text{the generator of principal ultrafilter } \mathcal{P}$
(unique x s.t. for some set S : $\mathcal{P} = \text{all supersets of } x \text{ in } S$)
- **Problem:** Standard GQ meanings not lowerable
(not principal ultrafilters)

Features of the Equative Diagnostic

- What are the essential properties of the equative frame?

- **Feature #1**: QP appears in object position. Compare:

(14) ?Most/many of my best students are those people over there.

- **Feature #2**: QP is partitive. Compare:

(15) Those people standing over there are [_____ students]_{DP}.

$$\left\{ \begin{array}{l} \text{some} \mid 20 \mid ??\text{many} \mid ?\text{several} \mid ?\text{a few} \\ ??\text{most} \mid ??\text{all} \mid ?\text{more than } 20 \mid ?\text{exactly } 20 \\ * \text{few} \mid * \text{no} \mid * \text{not many} \mid ??\text{less than } 20 \end{array} \right\}$$

- When is the partitive needed and why?
- Whatever the reason, the problem extends to both “somes” and “mosts”.

Features of the Equative Diagnostic

- Feature #3: Subject is individual-denoting. Compare:

(16) A: Who were the winners of last night's elections?

B: { **The winners** | **They** } were { few | none } of the people I would have expected.

- (16) is SPECIFICATIONAL; subject is type $\langle e,t \rangle$
- Test for specificational clauses with pronoun gender in tag questions (Mikkelsen 2004)

(17) a. The winner was one of the people you expected, wasn't { it | ??she }?

b. That woman standing over there is one of your best students, isn't { she | ??it }?

Features of the Equative Diagnostic

- **Feature #4**: QP isn't a property and doesn't quantify over properties.
- (18) They say we are rebellious, impulsive, irresponsible, inexperienced, idealistic. In fact, we are {none | few | some | many | most | all} of these things.
- Test for predicational clauses with availability of small clause paraphrase (Mikkelsen 2004)
- (19) a. I consider them {none | few | some | many | most | all} of these things.
- b. I consider those people standing over there *(to be) {most | more than three | half | all} of my best students.

The Diagnostics

- Contrastive Topic
- Equatives
- **Supplements**

- Supplementing expressions add parenthetical information secondary to the main claim.
- Supplements “anchor” to the phrase they adjoin to and add information about.

(20) a. Ames, **the former spy**, is now behind bars. Potts (2005: 13)
 NOMINAL APPPOSITION

 b. Ames, **who stole from the FBI**, is now behind bars.
 SUPPLEMENTARY RELATIVE

- Following Potts (2005), composition of supplement and anchor is detached from rest of composition.

Supplements to Quantificational DP's

- (21) Two students, John and Mary, had unusual first names.
- If 'two students' is interpreted as GQ, we don't capture oddness of (21)
 - Even if we allow composition of GQ and supplement (e.g. type-shift plurality to property)...
 - Supplement gets weak meaning 'Two students are John and Mary'.
 - We miss that John and Mary are the same two with unusual names
 - If 'two students' is interpreted as type-e, we capture the oddness:
 - At-Issue: The two students $f_7(\text{students})$ have unusual names.
 - Supplement: The two students $f_7(\text{students})$ are John and Mary.
 - Fixing the two students across the two propositions comes for free if CF variables are bound once at the level of discourse, as in Kratzer 1998.

Which QP's Anchor Nominal Appositions?

- If a QP is robustly GQ-type, it should be unable to anchor nominal appositions

(22) _____ students, the ones who wanted to pass, came on time.

{ some | ten | many | several | a few
 most | half the | more than ten | exactly ten
 *no | ??few | ??not many | ?less than ten }

- *all (the)* doesn't work in (22) because the supplement 'the ones ...' inherently picks out a subset

(23) All contestants qualified to enter the next round, (namely) John, Mary, Sue and Bill, should now proceed to the stage.

Which QP's Anchor Non-Restrictive Relatives?

- Relative clause supplements (“non-restrictive” or “appositive” relatives) add further support
- Discourse adverbials force non-restrictive readings (Emonds 1979: 64)
apparently, incidentally, as it happens, evidently, by the way, frankly

(24) _____ students, who incidentally hadn't come to class in weeks, failed the exam.

{ some | ten | many | several | a few
most | more than ten | exactly ten | at least ten
??few | ??not many | ??hardly any | ??less than ten }

Non-Restrictive Relative Anchors

- RC supplements only anchor to type-e expressions — Karttunen (1969: §1.1), Sells (1985), Heycock and Kroch (1999: 374), Potts (2002), Del Gobbo (2003: 152)

(25) Mary is [courageous]_{AP}, which [___]_e is something I will never be.

- Like non-nominals, GQ's can anchor supplements where the gap corresponds to an abstract entity. (Note use of *which* instead of *who*.)

(26) Less than twenty students, which is a fraction of what we'd hoped for, signed the petition.

- **Generalization:** Only witnessable QP's license supplements to the individuals being quantifier over.

Discourse Referents and Type-e Meaning

- Question #1: Does being a potential antecedent for discourse anaphora imply denoting type-e?
- Answer: No!

(27) Few congressman admire Kennedy, and **they** are very junior.
(Evans 1980)

- On recent dynamic theories of anaphora *all* QP's introduce discourse referents that can be resumed (van den Berg 1996, Nouwen 2003, Brasoveanu 2007, Schlenker 2011)
- But even in a context where 'few congressman' can introduce a referent, it can't denote that referent!

(28) a. Few congressman, and they are very junior, admire Kennedy.
b. ??Few congressman, who are very junior, admire Kennedy.

Maximality Effects

- Question #2: Does denoting type-e imply being a potential antecedent for discourse anaphora?
- Bare numerals and modified numerals contrast in ability to introduce referents (Kadmon 1987, Kamp and Reyle 1993)
- (29) a. Five students left shortly after the exam started.
They could not understand the questions. (not necessarily all early-leavers)
- b. More than four students left shortly after the exam started.
They could not understand the questions. (all early-leavers)
- Standard claim:
 - “Reference set” (restrictor \cap scope) introduced for free
 - Bare numerals introduce another, potentially different, referent
 - Modified numerals don’t introduce a referent

Non-Maximal Referents for Modified Numerals

- Idea:

- Out of context, modified numerals are taken as type-GQ answers to “which proportion” questions
- With contextual support, modified numerals can denote type-e, and introduce non-maximal referents

(30) More than fifteen students in my class own iPads.
They use them to take notes.

(31) More than twenty students in my class are in favor of firing the dean.
They wrote a letter to that effect and left it in my mailbox.

Non-Monotonic Quantifiers

- Why do non-monotonic quantifiers resist non-maximal readings?

(32) Exactly fifteen students in my class own iPads.

They use them to take notes.

- Suppose 'exactly fifteen' takes CF to a quantifier which returns degenerate GQ's that "correspond" to specific pluralities

(33) $\llbracket \text{exactly three} \rrbracket = \lambda f \lambda P \lambda Q. [P \cap Q = \lambda x. x \in \text{Atoms}(f(P))]$
if $|\text{Atoms}(f(P))| = 3$, else undefined

(34) a. $\llbracket \text{f7 students} \rrbracket = \text{John} + \text{Mary} + \text{Bill}$

b. $\llbracket \text{f7 exactly three students} \rrbracket =$
 $\{ \{ \text{J} + \text{M} + \text{B} \}, \{ \text{J} + \text{M} + \text{B} + \text{prof1} \}, \{ \text{J} + \text{M} + \text{B} + \text{prof1} + \text{prof2} \}, \dots \}$

- Degenerate GQ's are shiftable to type-e by (slightly modified) 'lower'

Summary

- Three diagnostics indicate that witnessable quantifiers license type-e meaning
- Type-e denotation ties directly to focus alternative type, options for composition
- Type-e denotation not directly tied anaphora-licensing

Appendix: Rating Study

- 15 sentence frames
 - 5 equatives
 - 5 nominal appositions
 - 5 non-restrictive relatives
- 15 quantifiers
 - 5 SOMES (standard wide-scope indefinites)
 - 5 MOSTS (witnessable traditionally non-wide-scope indefinites)
 - 5 FEWS (non-witnessable non-wide-scope indefinites)
- 150 subjects, each assigned to one of 15 conditions pairing frame × quantifier
- A given subject sees each frame and each quantifier just once

Frames: Non-Restrictive Relatives

- (35) a. In a recent study of fifty college students, _____ participants, who apparently weren't afraid of incriminating themselves, admitted to having tried marijuana.
- b. _____ students, who incidentally hadn't come to class in weeks, failed the exam.
- c. _____ children, who as it happened were gluten sensitive, refused to eat the meal.
- d. _____ candidates, who evidently knew they had no chance of winning the election, stayed at home while the ballots were being counted.
- e. _____ kids at the birthday party, who apparently had never seen a magician before, were impressed by the magic show.

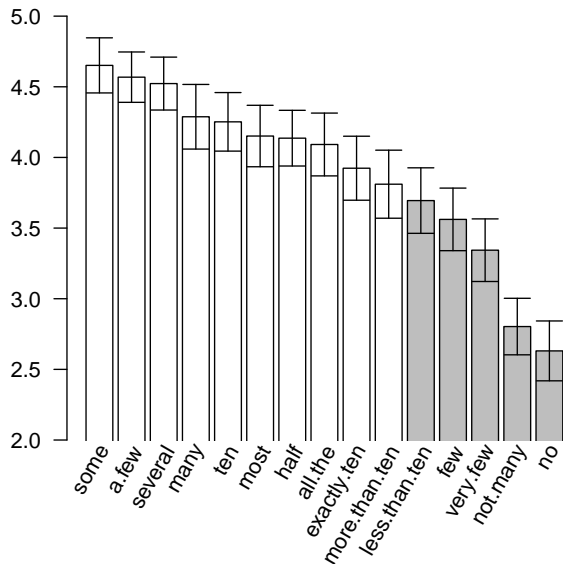
Frames: Nominal Appositions

- (36) a. In the end, _____ animals at the zoo—the ones that had contracted the virus—had to be put to sleep.
- b. _____ delegates—the ones who hadn't slept on the overnight bus ride—skipped the opening ceremonies.
- c. _____ actors—the ones who had nothing to lose—supported the idea of a strike.
- d. _____ sculptures—the ones a local critic had praised—sold for higher than the expected price.
- e. _____ students—the smart ones—showed up early for the exam.

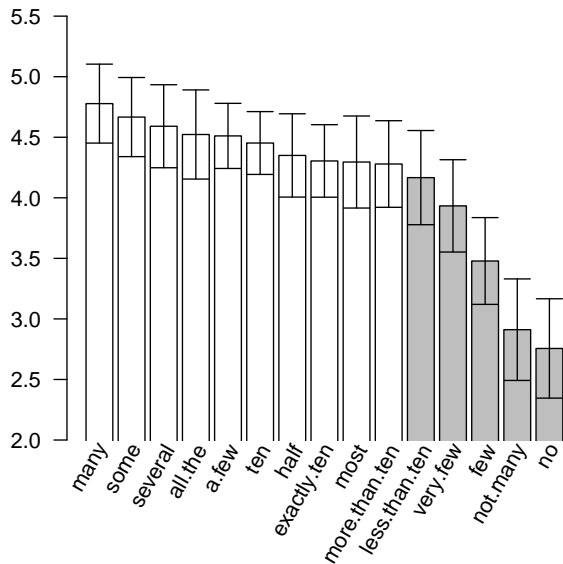
Frames: Equatives

- (37) a. Those kids playing over there are _____ of my daughter's friends.
- b. Those people waiting downstairs are _____ of the applicants qualified for the position.
- c. Those buildings down there are _____ of the ones that will be demolished.
- d. Those apples on the counter are _____ of the ones Sonia gave me.
- e. Those trees on the hill are _____ of Southern California's last remaining redwoods.

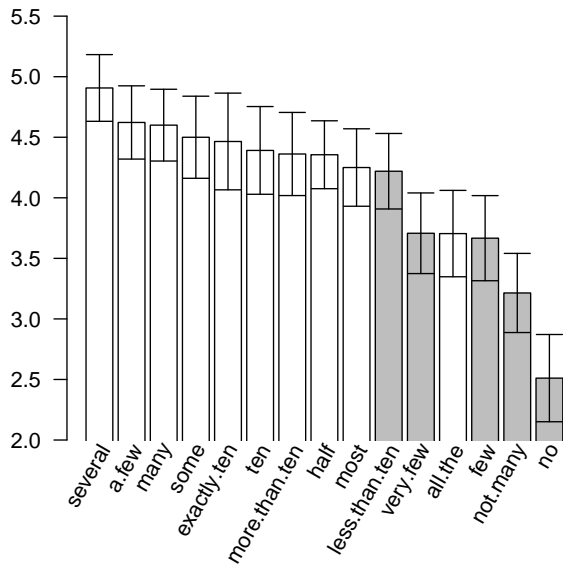
Results: All Conditions



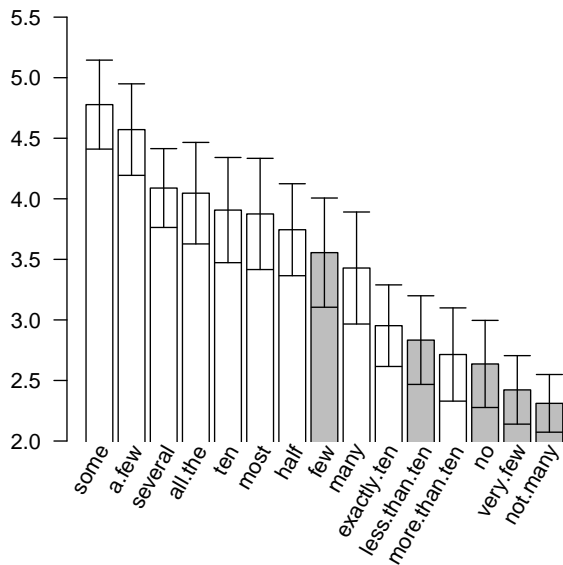
Results: Non-Restrictive Relatives



Results: Nominal Appositions



Results: Equatives



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