Quantified indicative conditionals and the relative reading of *most*[*]

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February 26, 2018

1 Prelude: an old embarrassment

Quantified Indicative Conditionals (QICs)

Sentences with a nominal quantifier in subject position, modified by an *if*-clause

(1) a. Every student passes if she studies hard.
 b. No student fails if she studies hard.

The embarrassment:

- (1a) and (1b) are intuitively equivalent
- but, there is (still) no consensus as to how to compositionally derive this (or whether it can be done at all)

> "The embarrassment had been known for a long time, but nobody dared talk about it. Then Higginbotham (1986) dragged it into the open."
>
> (Kratzer, in press)

[*]Thanks are due to Doris Penka, the Stanford SemPrag group, and audiences at the 2016 Stanford SemFest, CUSP 9 at UC Santa Cruz, and Sinn und Bedeutung 21 for helpful comments and discussion. In addition, Sven Lauer gratefully acknowledges support from the EU FP7 Marie Curie Zukunftskolleg Incoming Fellowship Program, University of Konstanz (grant no. 291784).

A basket of conditionals:

(I) **The material conditional (Higginbotham's problem):**

- letting the material conditional $\supset$ represent natural language *if*, we get reasonable truth conditions for (1a), but patently wrong truth conditions for (1b)

> **Material conditional:**
>
> (2) a. Every student passes if she studies hard.
> $\equiv \forall x[\textsc{student}x][\textsc{study-hard}(x) \supset \textsc{pass}(x)]$
> $\rightsquigarrow$ *All students are such that studying hard ensures passing*
>
> b. No student fails if she studies hard.
> $\equiv \neg\exists x[\textsc{student}(x)][\textsc{study-hard}(x) \supset \neg\textsc{pass}(x)]$
> $\equiv \forall x[\textsc{student}(x)][\textsc{study-hard}(x) \; \& \; \textsc{pass}(x)]$
> $\rightsquigarrow$ *All students both study hard and pass*

- since we have independent reasons to suspect that $\supset$ is not a good representation for *if*, the results in (2) are not too troubling

(II) **The restrictor conditional (Kratzer, 1986):**

- Kratzer (1986) proposes that *if* is not a binary connective, but instead a "device for restricting the domains of various operators" (see also Lewis, 1975)
- an *if*-clause enters into the restriction of a (possibly covert) modal quantifier in the conditional consequent

(3) If my hen has laid eggs today, the cathedral will collapse tomorrow.
$\equiv \Box$[my hen has laid eggs today][the cathedral will collapse tomorrow]
$\rightsquigarrow$ *All of the worlds where my hen has laid eggs today are worlds where the cathedral collapses tomorrow*

- the restrictor conditional, embedded under nominal quantifiers, also fails to derive the equivalence of (1a) and (1b)!

> **Lewis-Kratzer restrictor conditional:**
>
> (4) a. Every students passes if she studies hard.
> $\equiv \forall x[\textsc{student}(x)][\Box[\textsc{study-hard}(x)][\textsc{pass}(x)]]$
> $\rightsquigarrow$ *For all students, studying hard necessarily results in passing*
>
> b. No student fails if she studies hard.
> $\equiv \neg\exists x[\textsc{student}(x)][\Box[\textsc{study-hard}(x)][\neg\textsc{pass}(x)]]$
> $\equiv \forall x[\textsc{student}(x)][\Diamond[\textsc{study-hard}(x)][\textsc{pass}(x)]]$
> $\rightsquigarrow$ *For all students, studying hard possibly results in passing*

(III) **The 'folkloric' solution (von Fintel 1998, cf. von Fintel and Iatridou 2002):**

- things start to look better if we extend the restrictor analysis
- von Fintel (1998) lets the *if*-clause enter the restriction of a nominal quantifier directly

> **'Folkloric' conditional:**
>
> (5) a. Every student passes if she studies hard.
> $\equiv \forall x[\textsc{student}(x)\ \&\ \textsc{study-hard}(x)][\textsc{pass}(x)]$
> $\rightsquigarrow$ *All students who study hard pass*
>
> b. No students fails if she studies hard.
> $\equiv \neg\exists x[\textsc{student}(x)\ \&\ \textsc{study-hard}(x)][\neg\textsc{pass}(x)]$
> $\rightsquigarrow$ *No student who studies hard does not pass*

- this gives sensible and equivalent truth conditions for (1a) and (1b)

The end of embarrassment?

- probably not ...
- the 'folkloric' solution suggests an equivalence between QICs and quantified statements with restrictive relative clauses, but examples like (6a)-(6b) don't support this:

(6) a. Every coin is silver if it is in my pocket.

b. Every coin that is in my pocket is silver.

- (6a) suggests a non-accidental connection between being in the speaker's pocket and being silver, but (6b) does not (von Fintel and Iatridou, 2002)
- Leslie (2009) shows that we can pull *if*-clauses and restrictive relative clauses apart in certain cases:

(7) **Hopeless Berta.** Berta is struggling with the most basic concepts of a rather advanced course. She has no hope of passing the final exam. Knowing this, she decides to give up, and not study at all. *Berta does not study hard, but she would not pass even if she did.* All the actual hard workers end up passing.

a. Every student passes if she studies hard. **false**

b. Every student who studies hard passes. **true**

- Leslie's example does two things:
  - we see that QICs and quantified statements with restrictive relative clauses cannot in all cases be equivalent
  - specifically, this is because (present-tense) QICs don't just care about *actual* witnesses, but take *possible* witnesses (like Berta) into account as well

(IV) **The modalized restrictor conditional (Leslie, 2009):**

- Leslie proposes to solve both the QIC problem and the non-equivalence problem in one stroke, by (re)introducing a modal quantifier
- this (universal) modal quantifier takes wide scope over a nominal quantifier that is modified by an *if*-clause, as in the folkloric solution

Modalized restrictor conditional:

(8) a. Every student passes if she studies hard.
$\equiv \Box[\forall x[\textsc{student}(x)\ \&\ \textsc{study-hard}(x)][\textsc{pass}(x)]]$
$\rightsquigarrow$ *In all worlds, every student who studies hard passes*

b. No students fails if she studies hard.
$\equiv \Box[\neg\exists x[\textsc{student}(x)\ \&\ \textsc{study-hard}(x)][\neg\textsc{pass}(x)]]$
$\rightsquigarrow$ *In all worlds, no student who studies hard does not pass*

- with the modalized restrictor account, our prospects are starting to look up for the QIC problem, but ...

Today: we'll defend the (extended) restrictor analysis from a serious challenge posed by Kratzer (in press)

1. The challenge: the existence of QIC interpretations which 'reverse' the expected meaning of a restrictor conditional
2. Kratzer's analysis of QICs and the reverse reading
   - rejecting a folkloric- or Leslie-style solution leads to an impasse
   - Kratzer's solution: there's a missing player (pragmatic domain restriction)
3. An alternative route
   - the quantifier, not the conditional, is the source of the trouble
   - focus sensitivity and 'relative' readings for quantified statements
4. The proposal
   - 'reverse' QIC readings are relative readings resulting from the interaction of focus with a focus-sensitive quantifier (*most*)
   - given the right account of *most*, the reverse reading is derived straightforwardly on a restrictor analysis

2 The 'reverse' reading of *most*-QICs

Kratzer (in press) introduces reverse readings with the following scenario:

(9) You: Did you see kids using calculators when you volunteered in your son's school yesterday? What did they use the calculators for?

Me: **Most kids asked for calculators if they had to do DIVISION.** But I am pleased to report that most kids in my son's school do division by hand.

- this context has two important features:
  - the consequent clause (about kids using calculators) is backgrounded by the first speaker
  - the second speaker puts emphasis within the *if*-clause, introducing focus
- Kratzer's claim: this scenario is incompatible with the standard reading (10a), and demonstrates the existence of an unexpected reverse reading (10b)

(10) Most kids asked for calculators if they had to do division.

a. **Standard reading:**
The majority of kids who had to do division asked for calculators.
$\#(\text{calculator-users} \cap \text{divisioners}) > \frac{1}{2}\#(\text{divisioners})$

b. **Reversed reading:**
The majority of kids who asked for calculators were ones who had to do division.
$\#(\text{divisioners} \cap \text{calulator-users}) > \frac{1}{2}\#(\text{calculator-users})$

- the standard reading claims that more kids used calculators for division than those who did division without calculators; this contradicts the continuation in (9)
- the reverse reading, on the other hand, only claims that more kids used calculators for division than those who used calculators for other purposes
- some speakers have trouble accessing the reverse reading: see Kotek et al. (2015) for discussion and experimental data.[1]

[1] Kotek et al. (2015) examines 'superlative' (analogous to the reverse reading here) and 'proportional' readings of *most*; they find (among other things), that fewer than half of their experimental participants seem to access superlative readings at all, and that this reading is particularly difficult – though not impossible – to access when *most* occurs in subject position.

The problem:

Given a standard generalized-quantifier meaning for *most*, we can't derive the reverse reading with a restrictor conditional.

(11) $\textsc{most}[A][B] := |A \cap B| > |A - B|$

- on the **standard reading**, the *if*-clause appears to enter into the restriction of *most*, while the matrix clause provides its nuclear scope
- on the **reverse reading**, it appears as if the matrix clause enters the restriction of *most*, while the *if*-clause provides the nuclear scope!
- the reverse reading is the **converse** of the standard interpretation

Foreshadowing a little:

- we don't think treating the interpretation of (9) as the reversed (10b) gets exactly the right truth conditions
- instead, it's analogous to a relative reading (Kotek et al.'s 'superlative' *most*), which arises in examples like (12)

(12) a. "Most people (43%) said they would rather use cash than credit cards for holiday purchases."[2]

b. "Public speaking was feared by most people (41%) while death was seventh (19%)."[3]

(13) Most kids used calculators if they had to do DIVISION.
$\rightsquigarrow$ *The number of kids using calculators for division was higher than the number of kids using calculators for any other individual problem type, respectively.*

3 Kratzer's analysis

Kratzer uses the reverse reading to support a startling conclusion about QICs:

- the perceived interpretation of QICs does not arise compositionally.
- instead, this interpretation arises through:
  1. a pragmatic process of domain restriction
  2. an embedded application of **conditional perfection** (Geis and Zwicky, 1971).

[2]https://www.creditsesame.com/blog/debt/cash-vs-credit-card-which-one-should-you-use-for-the-holidays/

[3]http://joyfulpublicspeaking.blogspot.com/2012/04/why-do-people-still-refer-to-39-year.html

3.1 A bombshell

Kratzer starts from the following assumptions (about past-tense conditionals):

(A) The equivalence problem is a real one: (14a) $\equiv$ (14b)

(B) The extended restrictor analysis is out, based on data like the coin example (6), and similar arguments (von Fintel and Iatridou, 2002; Higginbotham, 2003; Huitink, 2009)

- representing the conditional operator as $\triangleright$, this leaves us with an embedded structure for QICs:

(14) a. Every student passed if she studied hard.
$\equiv \textsc{every}_x[\text{student}(x)][\text{studied-hard}(x) \triangleright \text{passed}(x)]$

b. No student failed if she studied hard.
$\equiv \textsc{no}_x[\text{student}(x)][\text{studied-hard}(x) \triangleright \neg\text{passed}(x)]$

(C) past-tense QICs like (14a)-(14b) validate **modus ponens**[4]

(15) **Modus ponens:** $\phi \triangleright \psi$ and ϕ jointly entail ψ

(D) past-tense QICs validate **contraposition**[5]

(16) **Contraposition:** $\phi \triangleright \psi$ entails $\neg\psi \triangleright \neg\phi$

Given these assumptions, it follows that $\triangleright$ also supports the following inferences:

(17) **Conditional excluded middle:** For all ϕ, ψ: either $\phi \triangleright \psi$ or $\phi \triangleright \neg\psi$

(18) **Weak Boethius' Thesis:** $\phi \triangleright \neg\psi$ entails $\neg(\phi \triangleright \psi)$

- Conditional excluded middle, typically controversial, follows from the embedding structure assumed by Kratzer and the desired equivalence of (14a) and (14b):

$$(14a) \equiv \forall x[\textsc{study-hard} \triangleright \textsc{pass}] \tag{1}$$

$$(14b) \equiv \neg\exists x[\textsc{study-hard} \triangleright \textsc{fail}] \equiv \forall x\neg[\textsc{study-hard} \triangleright \neg\textsc{pass}] \tag{2}$$

$$(14a) \equiv (14b) \Longrightarrow \textsc{study-hard} \triangleright \textsc{pass} \equiv \neg[\textsc{study-hard} \triangleright \neg\textsc{pass}] \tag{3}$$

- Weak Boethius' thesis, (18), follows from the assumption that at most one of $\textsc{study-hard} \triangleright \textsc{pass}$ or its negation can be true.

[4] *Modus ponens* for non-past conditionals is highly controversial (see, e.g., McGee, 1985). Kratzer's claim is only that it holds for the particular conditional type we are interested in here.

[5] Contraposition is rejected for counterfactuals, as well as some bare conditionals: Kratzer's argument is the same as for *modus ponens*, above.

Pizzi and Williamson's (2005) 'bombshell':

Given a bivalent background logic, every connective $\triangleright$ that satisfies (15)-(18) is equivalent to the **material biconditional**!

We've reached a dead end: this is not a workable analysis for natural language *if*!

3.2 Deus ex machina: pragmatic domain restriction

Kratzer's solution:

- the properties (15)-(18) don't follow from the conditional $\triangleright$ alone, but from the quantifier-conditional interaction
- there is a missing element: whatever is responsible for contextual/pragmatic domain restriction on nominal quantifiers

(19) Every student passed the exam.
$\rightsquigarrow$ *Every student (in the class) passed the exam*

The proposal:

- past-tense QICs embed a **material conditional** under the quantifier, as in (2)
- this would lead to Higginbotham's problem, but ...
- nominal quantifier domains are restricted *pragmatically*, via **domain variables** (von Fintel, 1994; Stanley and Szabó, 2000)
- when the pragmatic restriction *just so happens* to pick up the antecedent of the embedded conditional, we get:

(20) No$_D$ student failed if she studied hard. (=14b)

a. **Semantic meaning:**
$\neg\exists x[\text{student}(x) \wedge D(x)][\text{studied-hard}(x) \supset \neg\text{passed}(x)]$

b. **After pragmatic domain restriction:** $D(x) \mapsto \text{studied-hard}(x)$
$\neg\exists x[\text{student}(x) \wedge \text{studied-hard}(x)][\text{studied-hard}(x) \supset \neg\text{passed}(x)]$

c. **Equivalent to:**
$\neg\exists x[\text{student}(x) \wedge \text{studied-hard}(x)][\neg\text{passed}(x)]$

- (20c) is equivalent to (21), as desired:

(21) (14a) $\equiv \forall x[\text{student}(x) \wedge \text{studied-hard}(x)][\text{passed}(x)]$

With pragmatic domain restriction, we get sensible and equivalent truth conditions for (14a)-(14b), using a material conditional and an embedded structure.

3.3 Reversal

'Reverse' readings for QICs enter the picture at this point:

- if domain restriction proceeds as above, we obtain the **standard reading** for (10):

(22) Most$_D$ kids asked for calculators if they had to do division.

a. **Semantic meaning:**
$\textsc{most}\ x[\text{kid}(x) \wedge D(x)][\text{division}(x) \supset \text{calculator}(x)]$

b. **After pragmatic domain restriction:** $D(x) \mapsto \text{division}(x)$
$\textsc{most}\ x[\text{kid}(x) \wedge \text{division}(x)][\text{division}(x) \supset \text{calculator}(x)]$

c. **Equivalent to:**
$\textsc{most}\ x[\text{kid}(x) \wedge \text{division}(x)][\text{calculator}(x)]$

- on the other hand, if the domain variable picks up the conditional *consequent*, which is plausibly what happens with the information structure in (9), we get (23b):

(23) Most kids asked for calculators if they had to do DIVISION.

a. **Semantic meaning:**
$\textsc{most}\ x[\text{kid}(x) \wedge D(x)][\text{division}(x) \supset \text{calculator}(x)]$

b. **After pragmatic domain restriction:** $D(x) \mapsto \text{calculator}(x)$
$\textsc{most}\ x[\text{kid}(x) \wedge \text{calculators}(x)][\text{division}(x) \supset \text{calculator}(x)]$

- this doesn't quite get us to (10b),[6] so Kratzer additionally postulates an **embedded application of *conditional perfection*** (Geis and Zwicky, 1971), which turns the conditional into a biconditional:

(24) a. **After embedded perfection:**
$\textsc{most}\ x[\text{kid}(x) \wedge \text{calculators}(x)][\text{division}(x) \equiv \text{calculator}(x)]$

b. **Equivalent to:**
$\textsc{most}\ x[\text{kid}(x) \wedge \text{calculators}(x)][\text{division}(x)]$

- (embedded perfection can apply in the previous cases without changing the result)

3.4 Taking stock

Kratzer's analysis gets us the QIC equivalence, but at a cost:

[6] In particular, these truth conditions are satisfied (assuming GQT *most* from 11) in the following scenario, contrary to intuition:

- The class contains 20 children. 18 asked for calculators. Of those, 16 had to do logarithms, and 2 had to do division.
- $\#[\text{kid}(x) \wedge \text{calculator}(x) \wedge [\text{division}(x) \supset \text{calculator}(x)]] = 18$
- $\#[\text{kid}(x) \wedge \text{calculator}(x) \wedge \neg[\text{division}(x) \supset \text{calculator}(x)]] = 0$

- we have independent evidence against the material conditional for, e.g., bare conditionals; this must be reconciled
- the new analysis postulates *embedded* conditional perfection, which is independently controversial
- we predict the possibility of reverse readings for all quantifiers, not just *most*

It is not an accident, however, that example (9) involves *most*!

- crucially, it does not occur with *all*:[7]

  (25) All kids asked for calculators if they had to do long divisions.

  a. **Predicted standard reading (attested)**:
  All kids who had to do long divisions asked for calculators.

  b. **Predicted reverse reading (absent):**
  All kids who asked for calculators were ones who had to do long divisions.

We would like an analysis which:

(i) derives the equivalence of (1a) and (1b) as the outcome of semantic composition

(ii) predicts the reverse reading

- but *only* for the quantifiers that empirically allow it
- . . . and *only* in case material in the *if*-clause is focused

4 Inverse readings from focus-sensitive quantifiers

4.1 An observation

The quantifiers *many* and *few* are known to have an 'inverse proportional' reading (Westerståhl, 1985):

(26) $\textsc{many}[P][Q]$
Many Scandinavians have won the Nobel Prize in literature.

a. **Cardinal:** $|P \cap Q| > n$
'The number of Scandinavians NP-lit winners is large.'

b. **Standard proportional:** $\frac{|P\cap Q|}{|P|} > k$
'The proportion of Scandinavians who are NP-lit winners is high.'

c. **Inverse proportional:**$\frac{|P\cap Q|}{|Q|} > k$
'The proportion of NP-lit winners who are Scandinavian is high.'

[7] With *no*, the two predicted readings are in fact equivalent.

- even if we accept three separate meanings for *many*, we have a problem
- ... packing (26c) into a lexical entry violates the **conservativity universal** for determiners (Barwise and Cooper, 1981; Keenan and Stavi, 1986).

(27) A determiner D is **conservative** if, for sets A and B: $D[A][B] \equiv D[A][A \cap B]$

4.2 Restoring conservativity (Romero, 2015a)

Romero (2015a) derives a version of the inverse-proportional reading (as in 28) from a conservative determiner meaning that is identical to the proportional one:

(28) Many Scandinavians$_{foc}$ have won the Nobel Prize in literature.
$\rightsquigarrow$ *The ratio of Scandinavian NP-lit winners to Scandinavians is high compared to the ratio of NP-lit winners from other world regions to the population of those regions.*

Romero's proposal:
Natural-language *many* is the composition of a parametrized determiner MANY (ambiguous between 29a and 29b) with the morpheme POS associated with bare gradable adjectives.

(29) a. $\text{MANY}_{\text{card}} := \lambda d_n \lambda P_{et} \lambda Q_{et}.\, |P \cap Q| \geq d$, where n is the degree-type
b. $\text{MANY}_{\text{prop}} := \lambda d_n \lambda P_{et} \lambda Q_{et}.(|P \cap Q| : |P|) \geq d$
c. $\text{POS} = \lambda \mathbf{C}_{dt,t} \lambda P_{dt}.\exists d[P(d) \wedge d > \theta(\mathbf{C})]$, where $\mathbf{C}$ is a comparison class

- the standard θ is generated on the basis of the comparison class $\mathbf{C}$.
- as in Heim (1999)'s analysis of superlative *-est*, POS uses focus structure to determine $\mathbf{C}$; it scopes independently of its host
- when POS scopes sententially, $\mathbf{C}$ is the set of sentence-level alternatives determined by substituting the focused element for its (relevant) alternatives
- the inverse proportional reading (28) arises when MANY = $\text{MANY}_{\text{prop}}$ and the focus associate of POS occurs inside the quantifier restriction[8]

(30) Many Scandinavians$_{foc}$ have won the Nobel Prize in literature.
a. **Logical form:**
$\big[[\text{POS } C]\big[1[t_1\text{-MANY}_{prop} \text{ Scandinavians}_{foc} \text{ have won NP-lit}]\big] \sim C\big]$
b. **Alternatives:**
$$[\![\mathbf{C}]\!] \subseteq \left\{ \begin{array}{ll} \frac{|\text{Scandinavian NP-lit winners}|}{|\text{Scandinavians}|}, & \frac{|\text{East-Asian NP-lit winners}|}{|\text{East Asians}|}, \\ \frac{|\text{Mediterranean NP-lit winners}|}{|\text{Mediterraneans}|}, & \ldots \end{array} \right\}$$

[8]Penka (2017) argues that all three meanings in (26) can be derived from a single, cardinal MANY, composed with the comparative morpheme. Which reading is produced depends on the location of focus and the scope of POS.

c. **Truth-conditions:**

$$\frac{|\text{Scandinavian NP-lit winners}|}{|\text{Scandinavians}|} > \theta(\mathbf{C})$$

d. **Paraphrase:**
The ratio of Scandinavian NP-lit winners to Scandinavians is high compared to the ratio of NP-lit winners from other world regions to the population of those regions.

5 Relative readings for *most*-QICs

In a nutshell:

The puzzling reverse reading of *most*-QICs is simply a relative reading, arising analogously to the inverse-proportional reading of *many*, given the following assumptions:

- *most* decomposes into MANY and *-est* (see Hackl, 2009)
- the relevant MANY is Romero's 'parametrized determiner' $\text{MANY}_{\text{card}}$
- the *if*-clause restricts the domain of $\text{MANY}_{\text{card}}$

5.1 Ingredients

We represent *most* as $\text{MANY}_{\text{card}}$ + *-est*:

- $\text{MANY}_{\text{card}}$ counts the number of individuals that satisfy both property arguments:

  (29) a. $\text{MANY}_{\text{card}} := \lambda d_n \lambda P_{et} \lambda Q_{et}. |P \cap Q| \geq d$

- Heim (1999)'s *-est* checks that its argument set has larger cardinality than that of any alternative:

  (31) $[\![\text{-est}]\!] = \lambda \mathbf{C}_{dt,t} \lambda P_{dt}. \exists d \big[P(d) \;\&\; \forall C \in \mathbf{C}[C \neq P \rightarrow \neg C(d)]\big]$

- the focus-sensitive morpheme takes sentential scope:
  - so the alternatives in the comparison class are $\text{MANY}_{\text{card}}$-statements which substitute alternatives for *division* in (9)

  (9) You: Did you see kids using calculators when you volunteered in your son's school yesterday? What did they use the calculators for?

  Me: *Most kids asked for calculators if they had to do DIVISION.* But I am pleased to report that most kids in my son's school do division by hand.

- *if* adds its complement to the restriction of the determiner (as in the folkloric and Leslie solutions to the QIC problem)

5.2 The derivation

(32) Most students asked for calculators$_{top}$ if they had to do division$_{foc}$.

a. **Logical form:**

$$\big[[\text{-est } \mathbf{C}]\big[1[t_1\text{-MANY}[\text{kid} \cap \text{had-to-do-}[\text{division}]_{\mathbf{F}}][\text{asked-for-calc}]] \sim \mathbf{C}\big]$$

b. **Alternatives:**

$$[\![\mathbf{C}]\!] \subseteq \left\{ \begin{array}{llll} \lambda d'.d'\text{-MANY}[& \text{kid} & \cap & \text{had-to-do-division} &][\text{asked-for-calc}]], \\ \lambda d'.d'\text{-MANY}[& \text{kid} & \cap & \text{had-to-do-multiplication} &][\text{asked-for-calc}]], \\ \lambda d'.d'\text{-MANY}[& \text{kid} & \cap & \text{had-to-do-decimals} &][\text{asked-for-calc}]], \\ \ldots \end{array} \right\}$$

c. **Truth-conditions**:

$\exists d : d\text{-MANY}[\text{kid} \cap \text{had-to-do-division}][\text{asked-for-calc}] \wedge \forall C \in \mathbf{C} :$
$C \neq \lambda d'.d'\text{-MANY}[\text{kid} \cap \text{had-to-do-division}][\text{asked-for-calc}]] \rightarrow \neg C(d)$

d. **Paraphrase:**

The number of calculator-using kids who had to do division was larger than the number of calculator-using kids doing any other problem type.

5.3 Consequences, questions, etc.

We have shown that Kratzer's reverse reading isn't a problem for restrictor analyses of QICs:

- we can derive the reverse reading given fairly standard and independently motivated assumptions
- . . . as long as we assume that (bare) *most* has a relative reading
- our final interpretation differs from Kratzer's paraphrase of (9):
  - Kratzer seems to suggest that the right interpretation is that more than half of the calculator-users were kids doing division
  - we derive a reading that might be paraphrased with *the most* instead of *the majority* – specifically, that grouping the calculator-users by problem type gives us the single largest group as kids who had to do division
  - we think the relative reading is correct

In addition to 'rescuing' the restrictor analysis from this particular objection, we improve on Kratzer's results:

- our account correctly predicts that reverse readings are only available when material in the *if*-clause is focused:
- . . . and then only for determiners that are focus-sensitive in the right way
  - we don't predict reverse readings for *all*-QICs
  - we *do* predict them for *many* and *few*, on the assumption that these involve a Romero-style 'parametrized determiner'

(33) Many kids used calculators if they had to do DIVISION.

Putative 'reverse' reading:
The number of calculator users among the division-kids was high as compared to the number of calculator users doing other problem types.

5.4 *If*-clauses vs regular restrictions

So far so good, but ...

- *most* doesn't allow the inverse reading when its restriction contains focus but no conditional: (34) only has the standard reading.

  (34) Most kids who had to do division$_{foc}$ asked for calculators.

- we suggest that the absence of a relative reading is due to an independently needed constraint on the relative reading of (English) -*est* (see also Romero, 2015b):

Constraint:
On a relative reading, the F-associate of -*est* cannot be internal to the DP where -*est* originates.

- we suggest that, even though *if*-clauses *end up* being interpreted in the restriction of *most*, they are not 'internal to the DP' headed by *most* in the relevant sense for this constraint
- this blocks relative readings for (34), but not for the corresponding QIC.

6 Summary and outlook

We have shown that ...

- the 'reverse' reading is not a insurmountable challenge for a restrictor solution to the QIC 'embarrassment'; this motivates pursuing it further
- (9) can be explained as an instance of the relative reading of appropriately focus-sensitive determiners (e.g. *most*), using a largely standard analysis of this reading (see Heim, 1999; Hackl, 2009)
- the resulting analysis ...
  - ... correctly predicts that reverse readings surface only with focus in the *if*-clause
  - ... correctly predicts the absence of reverse readings for focus-invariant quantifiers like *all* and *every*

Open issues:

- for many speakers, the relative reading of (bare) *most* in English is hard to access in many contexts (see Kotek et al., 2015, for discussion and experimental data)
  - do these speakers also have trouble with the reverse readings of *most*-QICs?
- there are alternative analyses of the relative reading of *(the) most* (Beaver and Coppock, 2014; Coppock and Josefson, 2014) which arguably account better for cross-linguistic data. Can our analysis be modified to fit this kind of account?
- Romero's implementation of *many* differs from these in that it treats *many* as a 'parametrized determiner', rather than an NP-modifier. Can we derive reverse readings without this assumption?

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