Quantifier Scope and Tensed Clauses

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1 Plan

i. The empirical generalization at the centre of our talk: that **non-existential quantifiers cannot scope out of tensed clauses:**[1]

(1) A woman believes that Sam beats every student.

a. ✓ 'there is a woman y such that y believes that every student x is such that Sam beats x'

b. ✗ 'for every student x, there is a woman y such that y believes Sam beats x'

Symmetrically, we want to account for the fact that such quantifiers can scope out of infinitival clauses:

(2) Every citizen tried to vote for half of the candidates.

a. ✓ For every citizen x, half of the candidates y are such that x tried to vote for y

b. ✓ Half of the candidates y are such that every citizen x tried to vote for y

ii. Focus: two approaches to scope ambiguities: Quantifier Raising (QR) and Argument Raising (AR).

iii. QR is a movement approach and is prone to overgeneration. AR is a type-shifting approach and faces the opposite problem: it is not always flexible enough to account for the empirical facts.

iv. We argue that unlike the QR approach, the AR approach has no problem to account for the generalization that non-existential quantifiers cannot scope out of tensed clauses, but faces another problem: it seems to be unable to handle complex sentences with infinitival clauses and adverbial modifiers.

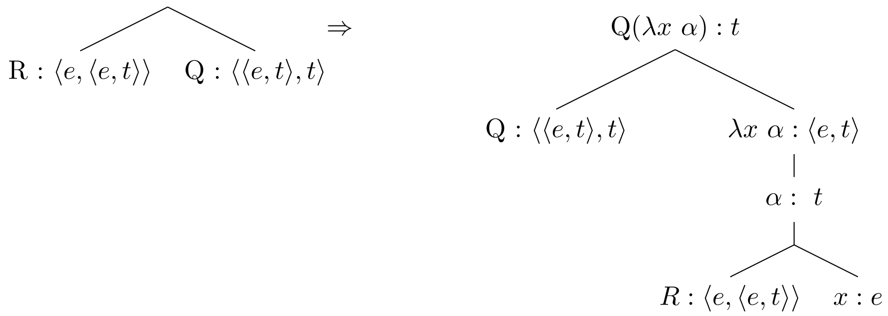
v. We propose a novel type-shifter that helps to solve this problem.

2 Quantifier Raising (QR)

A phrase Q of type $\langle\langle e,t\rangle,t\rangle$ can move to adjoin to a node N that c-commands it and has a denotation of type $\langle e,t\rangle$, leaving behind a trace of type e.

[1] We assume, following Reinhart, that 'existential' generalized quantifiers are choice functions and therefore not subject to the same scopal restrictions as other quantifiers.

(3)



Consider a simple two-quantifier sentence like (4). QR can generate the two scope possibilities.

(4) A man loves exactly three books.

a. S > O: ((a man)(λx((exactly three books)(λy((love y)x)))))

b. O > S: ((exactly three books)(λy((a man)(λx((love y)x)))))

3 Hendriks' Argument-Raising

In Argument Raising (AR) – pioneered by Hendriks (1993) – GQs remain in surface-syntax position and scopal facts are accounted for via a type-shift in the meaning of the transitive verb. One for each reading:

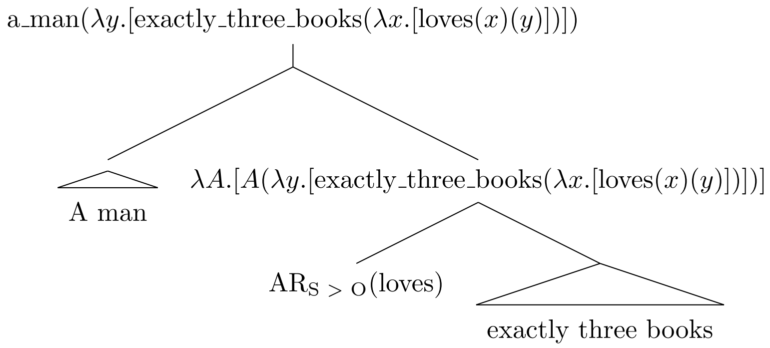
(5) a. $\text{AR}_{\text{S > O}}: \ \lambda x\lambda y.[P(x)(y)] \ \mapsto \ \lambda B.\lambda A.[A(\lambda y.[B(\lambda x.[P(x)(y)])])]$

b. $\text{AR}_{\text{O > S}}: \ \lambda x\lambda y.[P(x)(y)] \ \mapsto \ \lambda B.\lambda A.[B(\lambda x.[A(\lambda y.[P(x)(y)])])]$

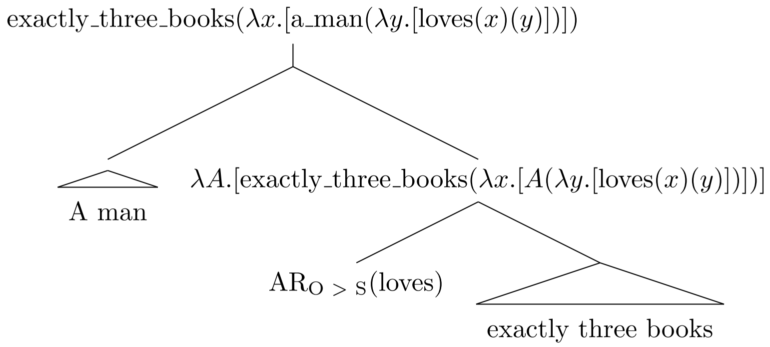
Consider a simple two-quantifier sentence like (4). AR can generate the two scope possibilities as demonstrated below.

(4) A man loves exactly three books.

a. Subject > Object:



b. Object > Subject:



4 The Puzzle

Non-existential quantifiers cannot scope out of tensed clauses:

(1) A woman believes that Sam beats every student.

a. ✓ 'there is a woman y such that y believes that every student x is such that Sam beats x'

b. X 'for every student x, there is a woman y such that y believes Sam beats x'

(6) A woman believes that most students like every kind of ice cream.

a. ✓ 'There is a woman who believes that there is some majority of students X such that that every x in X likes every kind of ice cream.'

b. ✓ 'There is a woman who believes that for every kind of ice cream y, there is some majority group of students X such that every x in X likes y.'

c. X 'For every kind of ice cream y, there is a woman w such that w believes that most students like y.'

d. X 'There is a majority of students X such that for every x there is a woman w who believes that x likes every kind of ice cream.'

But they can scope out of infinitival clauses:

(2) Every citizen tried to vote for half of the candidates.

a. ✓ For every citizen x, half of the candidates y are such that x tried to vote for y

b. ✓ Half of the candidates y are such that every citizen x tried to vote for y

5 How to Handle: QR

Support for QR comes partly from the hypothesis that QR involves the same movement operation that creates long-distance syntactic dependencies:

(7) A woman will be surprised if John eats every ice cream.

a. X every ice cream (λx a woman will be surprised if John eats t_x)

b. X Which ice cream will a woman be surprised if John eats t_x?

The parallel, however, breaks down once we turn to our tensed clause examples:

(6) A woman believes that most students like every kind of ice cream.

c. X 'For every kind of ice cream y, there is a woman w such that w believes that most students like y.'

e. ✓ Which ice cream did a woman believe that most students like?

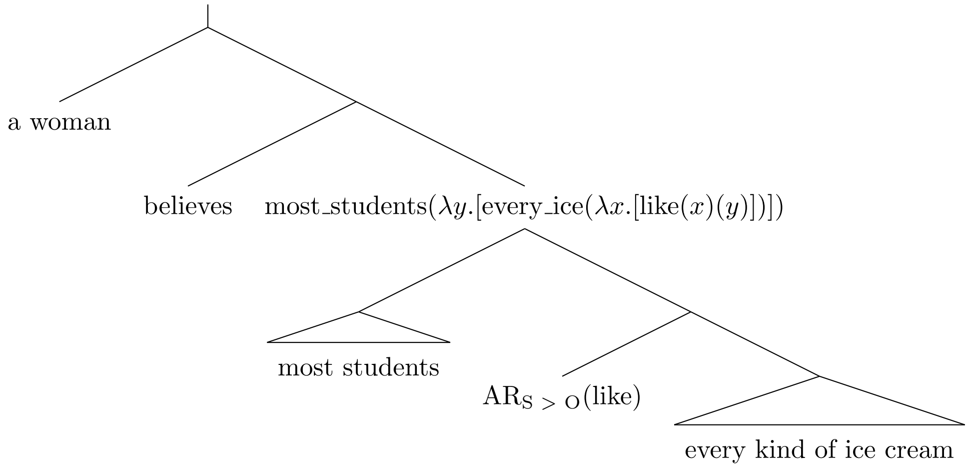
There are numerous proposals that try to cope with overgeneration problem, e.g. Fox (1995) proposes that (6c) and (6d) are ruled out because the QR required "would violate A-bar constraints" (p. 337). But really, no consensus in the area.

6 How to Handle: AR

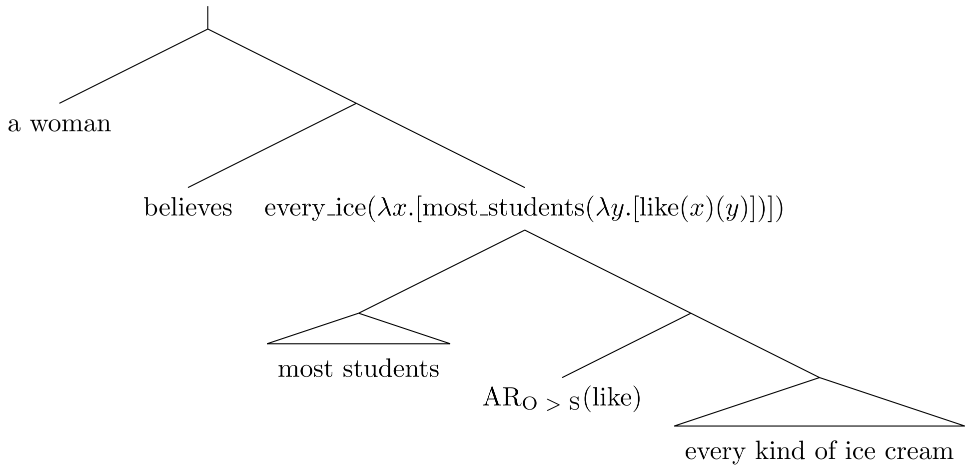
6.1 Tensed Clauses

The AR approach correctly precludes the readings corresponding to (6c) and and (6d). The type-shifted transitive verb always encounters the subject and object before any other GQ, so neither the subject nor the object can scope out of the minimal tensed clause containing them. So, in (6c), the type-shifted verb captures both of the GQs in the subordinate clause, and the matrix subject *a woman* necessarily takes scope over both. Thus, unlike QR, AR can account for the scopal facts associated with (6) with no need for constraints on the operation. (8) shows the only possible semantic structures for (6) under the AR approach.

(8) a. A woman believes that most students like every kind of ice cream.



b. A woman believes that most students like every kind of ice cream.



6.2 Infinitival Clauses

As it stands, however, AR does not allow for any scope ambiguity across claused boundaries, tensed or not. Thus, sentences like (2) and (9) are simply uninterpretable.

(2) Every citizen tried to vote for half of the candidates.

(9) Every citizen quickly voted for half of the candidates.

This is because both *try to* and *quickly* expect arguments of type $\langle e, t\rangle$ while an object-saturated AR'd transitive verb has type $\langle\langle\langle e, t\rangle, t\rangle, t\rangle$. This consideration alone motivates the introduction of the following type-shifter, which operates on functions of type $\langle\langle e, t\rangle, \langle e, t\rangle\rangle$:

(10) $T = \lambda M.\lambda N.\lambda Q.N\,(\lambda v.Q\,(Mv))$

where $M : \langle\langle e,t\rangle,\langle e,t\rangle\rangle$, $N : \langle\langle\langle e,t\rangle,t\rangle,t\rangle$, $Q : \langle\langle e,t\rangle,t\rangle$, and $v : \langle e,t\rangle$.[2]

Applying the type shifter in (10) to the meaning of *try to* in (2) and *quickly* in (9) renders those sentences interpretable, and allows for both scopal possibilities for each. For instance, here is a derivation of (2):

(2) Every citizen tried to vote for half of the candidates.[3]

$$\begin{aligned}
T\,(try_to) &= \lambda N.\lambda Q.N\,(\lambda v.Q\,(try_to(v)))\\
vote_for_{\mathrm{S>O}} &= \lambda B.\lambda A\,[A\,(\lambda y.B\,(\lambda x.vote_for\,(x,y)))]\\
vote_for_{\mathrm{S>O}}\,(half_cand) &= \lambda A\,[A\,(\lambda y.half_cand\,(\lambda x.vote_for\,(x,y)))]\\
T\,(try_to)\,(vote_for_{\mathrm{S>O}}\,(half_cand)) &= \lambda Q.\,((\lambda A\,[A\,(\lambda y.half_cand\,(\lambda x.vote_for\,(x,y)))])\,(\lambda v.Q\,(try_to(v))))\\
&= \lambda Q.\,([\lambda v.Q\,(try_to\,(v))]\,(\lambda y.half_cand\,(\lambda x.vote_for\,(x,y))))\\
&= \lambda Q.Q\,(try_to\,(\lambda y.half_cand\,(\lambda x.vote_for\,(x,y))))
\end{aligned}$$

Applying this to *every* (*citizen*), we get as the final denotation:

$$every\,(citizen)\,(try\_to\,(\lambda y.half\_cand\,(\lambda x.vote\_for\,(x,y))))$$

Substituting every instance of *try_to* with *quickly* in the derivation above gives the derivation for (9), and the Object > Subject reading of each sentence can be generated by starting instead with $\mathrm{AR}_{\mathrm{O>S}}$. Of course, this analysis can also account for scopal ambiguities in grammatical sentences with sequences of multiple adverbs and control verbs, like (11); all that is required is that T is applied to each such term.

(11) Every citizen boldly decided to try to quickly vote for half of the candidates.

7 Conclusion

i. Unlike the QR approach, the AR approach has no problem accounting for the generalization that non-existential quantifiers cannot scope out of tensed clauses.

ii. The type-shifter we proposed rescued the AR approach so that it can handle complex sentences with infinitival clauses and adverbial modifiers.

iii. Does the empirical generalization always hold?

(12) (ex.29 in Szabolcsi (2009)) That every boy was hungry surprised his mother.

a. ✗ 'for every boy, that he was hungry surprised his own mother'

Eric: at least some of the speakers think that the interpretation in (a) is a possible interpretation of (12).

[2] Here's a demonstration that this type-shifter behaves as desired. Consider an argument raising function $L : \langle\langle e,t\rangle,\langle\langle\langle e,t\rangle,t\rangle,t\rangle\rangle$ given by $L = \lambda v.\lambda Q.Qv$. We then have that

$$\begin{aligned}
(T\ M)\,(L\ v) &= \lambda Q.\,(\lambda P.Pv)\,(\lambda u.Q\,(Mu))\\
&= \lambda Q.\,(\lambda u.Q\,(Mu))\,v\\
&= \lambda Q.Q\,(Mv)\\
&= L\,(Mv)
\end{aligned}$$

which is the desired result.

[3] We use $vote\_for_{\mathrm{S>O}}$ as shorthand for $\mathrm{AR}_{\mathrm{S>O}}\,(vote\_for)$.

(13) (ex. (1c) in Reinhart) A doctor will make sure that we give every new patient a tranquilizer.

a. ✓ (?) For every patient x, there is a doctor who will make sure that we give x a tranquilizer.

(14) A teacher will make sure that we give every student an exam.

a. X (?) For every student x, there is a teacher who will make sure that we give x an exam.

Reinhart thinks that (13a) is an available interpretation. But the similar (14a) may suggest that the availability is a pragmatic effect based on common knowledge of medical practices.

References

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