Deconstructing quantifiers

Advanced Issues in Cognitive Science and Linguistics

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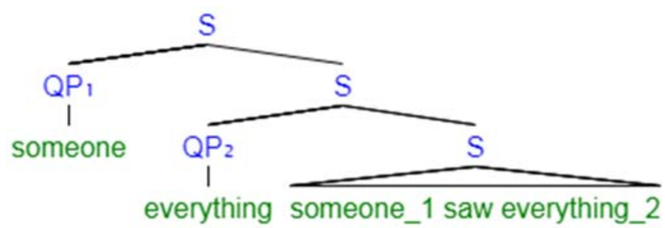
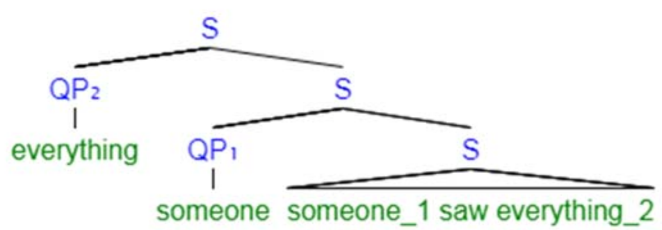
Anna Szabolcsi
New York University
annaszabolcsi.com

The plot

The standard theory of quantifier scope assignment has just one rule: Quantifier Raising (QR), which operates in Logical Form or at the level of interpretation (not in surface syntax). Consider a simple sentence with two quantifier phrases (QPs). Some details aside, QR grabs each QP and adjoins them to the top of the structure (S / TP). The QP that ends up higher is interpreted as having wider scope than the one that ends up lower:



`There is someone who saw everything' (direct scope, matches surface linear order)



`Everything is such that someone saw it' (inverse scope, does not match linear order)

This machinery reflects certain assumptions about quantifier phrases (QPs):

I. One rule is enough -- all QPs are alike and behave alike. (Monday)
II. The rule grabs the QP as a whole -- QPs do not have an internal structure that may come apart in the course of scope assignment. (Tuesday)

Further consequences of these assumptions:

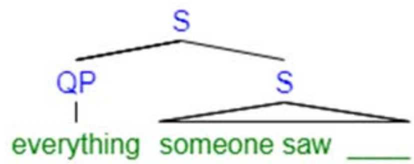
III. The quantifier words in the QP do not have parts that play interesting roles elsewhere. (Wednesday)
IV. We can take the semantic contribution of each quantifier at face value. For example, an existential is always an existential, it does not have universal force. (Thursday)

We'll show that these assumptions and consequences are wrong. Finally, we'll ask,

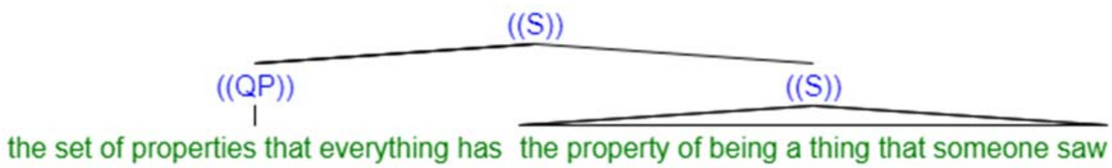
V. What may explain that certain properties of quantifiers, or quantifier inventories, are cross-linguistically prevalent and others are rare or non-existent? (Friday)

Background: The interpretation of Quantifier Raising (QR)

Here the QP *everything* has been extracted and adjoined to the rest of the sentence, its scope. How is the result interpreted?



Let ((QP)) and ((S)) be the denotations of those phrases.
The key assumption: ((QP)) is a set of properties, called a generalized quantifier.
Its scope denotes a property ((S)), which itself is a set of entities.
The combination says: property ((S)) **is an element of** the set of properties ((QP)).



In proper set theoretical notation or equivalent lambda notation,

((QP)) = the set of properties that everything has = {R: everything has R}
= $\lambda R[\forall y[\text{thing}(y) \rightarrow R(y)]]$

((S)) = the property of being a thing that someone saw =
the set of entities that someone saw = {e: someone saw e}
= $\lambda x[\exists z[\text{person}(z) \wedge \text{saw}(x)(z)]]$

((Q)) ° ((S)) = {e: someone saw e} $\in$ {R: everything has R}

$\lambda R[\forall y[\text{thing}(y) \rightarrow R(y)]]\ (\lambda x[\exists z[\text{person}(z) \wedge \text{saw}(x)(z)]]) =$
$= \forall y[\text{thing}(y) \rightarrow \lambda x[\exists z[\text{person}(z) \wedge \text{saw}(x)(z)]](y)] =$
$= \forall y[\text{thing}(y) \rightarrow \exists z[\text{person}(z) \wedge \text{saw}(y)(z)]]$

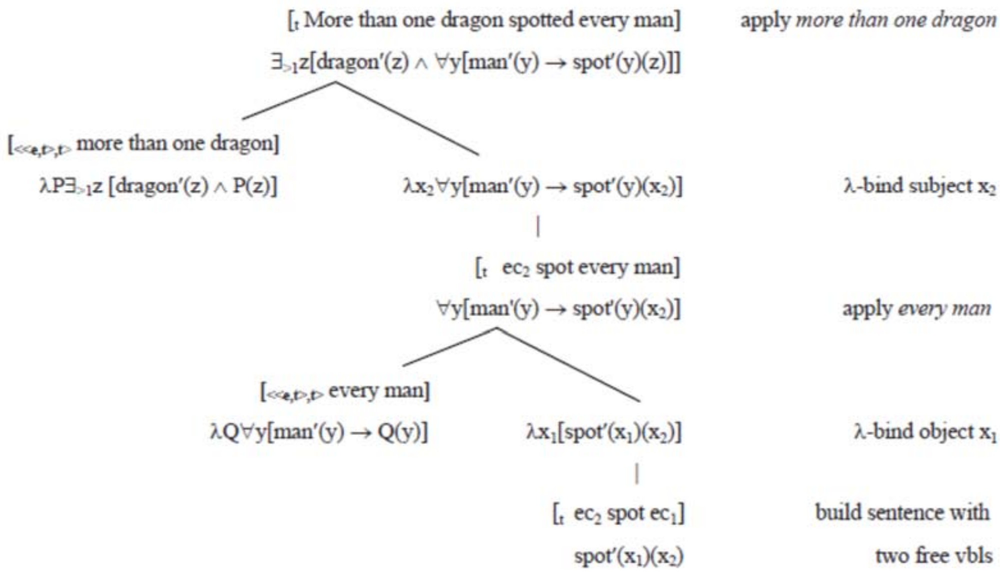
This is the general schema for interpreting a quantifier (here: *everything*) taking scope over a stretch of the sentence. In our case, that stretch contains another quantifier (*someone*). If *someone* stays there, it is part of the scope of *everything*. I.e. *everything* takes scope over *someone*. -- This is the O>S, object-wide-scope reading (inverse scope).

Alternatively, we could now extract *someone* and adjoin it to the S on top of *saw everything*. This step would be interpreted as saying that the property of being an entity that saw everything is an element of the set of properties that someone has. -- This is the S>O, subject-wide-scope reading (direct scope).

The next page spells out the two readings of *More than one dragon spotted every man* in the style of Montague (1972), from Szabolcsi, Quantification (2010: 13-14).

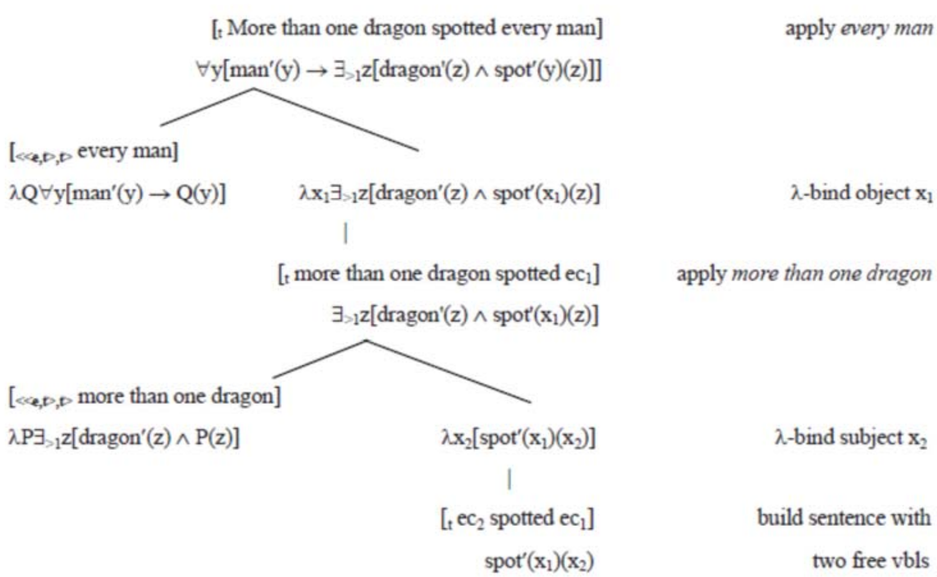
Read the trees bottom up! The last steps are spelled out in detail in (20) and (22).

(19) Subject > Object reading



(20) $$\lambda P\exists_{>1}z[dragon'(z) \wedge P(z)](\lambda x_2\forall y[man'(y) \to spot'(y)(x_2)]) =$$
$$\exists_{>1}z[dragon'(z) \wedge \lambda x_2\forall y[man'(y) \to spot'(y)(x_2)](z)] =$$
$$\exists_{>1}z[dragon'(z) \wedge \forall y[man'(y) \to spot'(y)(z)]]$$

(21) Object > Subject reading



(22) $$\lambda Q\forall y[man'(y) \to Q(y)](\lambda x_3\exists_{>1}z[dragon'(z) \wedge spot'(x_3)(z)]) =$$
$$\forall y[man'(y) \to \lambda x_3\exists_{>1}z[dragon'(z) \wedge spot'(x_3)(z)](y)] =$$
$$\forall y[man'(y) \to \exists_{>1}z[dragon'(z) \wedge spot'(y)(z)]]$$