The domain of quantifier raising

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Many years ago, when I was a student in Vienna, Josef taught a course on LF there. This was my first serious contact with scope and LF, and although I then couldn't imagine that I would once be working on such topics myself, Josef had instilled my interest in covert matters. After a semester of LF, Bengali, a trip to Venice, and lots of Ringsgwandl, Josef had become one of my mentors who wrote recommendation letters for grad school for me, and he remained that throughout the years. *Danke, Josef, und alles Gute zum 65er!*

Josef's and my linguistic interests have overlapped in several areas. Other than covert syntax, we both engaged extensively in restructuring and infinitives, and recently (for me), in the relation between syntax and parsing. This short note speculates about a possible new connection in these areas. In particular, building on Josef's experimental work (Bayer et al., 2005; Schmid et al., 2005) on restructuring infinitives in German where it is concluded that restructuring infinitives are preferentially parsed as mono-clausal configurations, I suggest that this is also the case in English (despite the different directionality), and that *quantifier raising* (QR) can be seen as an indicator of the processing load involved.

A standard claim about the locality of QR is that it is clause-bounded. Examples such as (1) are often considered to be unambiguous.

(1)   a.   #Someone said that every man is married to Sue. $^*\forall > \exists$ (Fox, 2000: 62)
        b.   #Someone said that Sue is married to every man. $^*\forall > \exists$ (Fox, 2000: 62)
        c.   I told someone you would visit everyone. $^*\forall > \exists$ (Johnson, 2000: 188)
        d.   A technician said that John inspected every plane. $^*\forall > \exists$ (Cecchetto, 2004: 350)

Clause-boundedness effects for QR have always been puzzling. At least three issues arise. First, such judgments are not absolute but gradient and relative, and, as often stated in footnotes, speakers do sometimes allow inverse scope across finite clauses. Second, as shown in (2a), (2b), QR crucially differs from overt A'-movement (*wh*-movement, topicalization) in that the latter can escape from finite clauses via successive cyclic movement, raising the question why covert movement obeys different locality constraints from overt movement. Third, when scope in *antecedent contained deletion* (ACD) contexts is considered, QR out of finite clauses appears to be generally possible. Since examples like (2c) allow a large ellipsis antecedent as indicated, assuming QR is required to resolve ACD, such examples must involve QR of *every committee* + the relative clause to a position above the matrix verb, thus across a finite clause boundary.

(2)   a.   It's Mary that I told someone __ you would visit __.   (Johnson, 2000: 188)
        b.   What did a technician say __ that John inspected __?   (Cecchetto, 2004: 350)

c. John said that you were on every committee that Bill did ~~say that you were on.~~
QP > [said that you were on [every committee that Bill did ~~say that you were on~~]]   (Wilder, 1992)

An even greater area of variation is found when QR out of infinitives is considered. While Hornstein (1994), Hornstein (1995), and Cecchetto (2004) state that QR is only possible out of restructuring infinitives, which are assumed to involve mono-clausal configurations, this claim is contested by Kennedy (1997), Moulton (2007), as well as most native speakers. Examples such as (3) (Kennedy, 1997: 674) allow inverse scope, although only *try* and *intend* would typically be considered as restructuring predicates. With respect to these examples, Kennedy writes: "although QR is in general clause-bounded, it can move quantified DPs out of nonfinite clauses (possibly as a marked option) [...] Each of these sentences has an interpretation in which the embedded quantifier has wide scope with respect to the indefinite subject of the matrix clause."

(3) a. At least two American tour groups **expect** to visit every European country this year. [41]
     b. Some agency **intends** to send aid to every Bosnian city this year. [42]
     c. At least four recreational vehicles **tried** to stop at most AAA approved campsites this year. [43]
     d. Some congressional aide **asked** to see every report. [44]
     e. More than two government officials are **obliged** to attend every state dinner. [45]
     f. A representative of each of the warring parties is **required** to sign every document. [46]
     g. At least one White House official is **expected** to attend most of the hearings. [47]

As in finite contexts, ACD with wide ellipsis resolution and resulting wide scope of the ACD containing QP is again possible for most speakers.

(4) a. Tim believes the students to know everything Joe does [~~believe the students to know~~].
     b. A middle school teacher claimed to be about to catch each problem student John did [~~claim to be about to catch~~]. $^?\forall > \exists$ (Cecchetto, 2004: 388, ex. 93)

The existing accounts of the clause-boundedness of QR derive the effect from Scope Economy.

(5) Scope-shifting operations (SSOs) cannot be semantically vacuous (Fox, 2000: 3).

Assuming that each step of QR must be motivated semantically, successive-cyclic movement through Spec,CP (required to meet locality) is excluded since that step violates *Scope Economy*. To allow QR in ACD contexts, Cecchetto (2004) defines semantic motivation as: (i) scope over another QNP, (ii) resolving a type mismatch, (iii) solving an infinite regress problem in an ACD configuration. This approach thus derives the difference between (1) and (2), with the exception of the speaker variation. As for infinitives, the situation is not so clear. Restructuring infinitives are assumed to lack a clausal domain (in particular a CP), whereas non-restructuring infinitives involve a CP. The lack of clause-boundedness effects in

restructuring thus follows, but the behavior of non-restructuring infinitives is unaccounted for. Theoretically, the analysis raises the question of why semantic motivation includes ACD resolution, but not, for instance, scope over an intensional verb.

I therefore speculate about a different approach to the clause-boundedness puzzle here. The basic idea is that clause-boundedness effects are only apparent and the ACD contexts reflect this. More specifically, there is no Scope Economy restriction and successive-cyclic QR across finite and non-restructuring clause boundaries is allowed syntactically. Instead the difficulty associated with constructing non-clause-bound inverse scope interpretations is attributed to increased processing costs calculated based on the complexity of the structure, similar to Anderson's (2004) Processing Scope Economy.

Some interesting evidence for this view comes from scope differences in infinitives. Based on the results of two pen-and-paper questionnaires (which follow an experimental design used by Anderson, 2004), Moulton (2007) shows that QR out of non-restructuring infinitives is possible, but more difficult than QR out of restructuring infinitives (*try*). Crucially, the latter is also significantly more difficult than QR in simple predicates, giving rise to the following scale:

(6)   easy … simple predicates > restructuring *inf* > non restructuring *inf* >finite… hard

I propose that this scale of difficulty tracks the complexity of the structures involved, in particular, the number of steps that are required for QR under the assumption that QR, like other A'-movement, applies successive-cyclically. An illustration is given in (7), with a hint of the syntax proposed for different types of infinitives in other works (Wurmbrand, 2014; Wurmbrand, to appear). In contrast to overt movement, QR involves a retrospective search in parsing, which incurs the higher processing cost for QR than for overt successive-cyclic movement.

(7)   a.   [$_{vP}$ QP …[$_{VP}$ …Q̶P̶…]] simple predicate
        b.   [$_{vP}$ QP [$_{VP}$ …V [$_{vP}$ Q̶P̶ … [$_{VP}$ …Q̶P̶…]]]] restructuring
        c.   [$_{vP}$ QP [$_{VP}$ …V [$_{XP}$ Q̶P̶ … [$_{vP}$ Q̶P̶ … [$_{VP}$ …Q̶P̶…]]]]] non-restructuring
        d.   [$_{vP}$ QP [$_{VP}$ …V [$_{CP}$ Q̶P̶ … [$_{XP}$ Q̶P̶ … [$_{vP}$ Q̶P̶… [$_{VP}$ …Q̶P̶…]]]]]] finite

Lastly, the improvements noted for ACD can be related to the fact that the simpler syntactic derivation (small ellipsis resolution) is disfavored by the aux mismatch in ACD contexts (see Cecchetto, 2004, for the same claim for Italian). As shown in Syrett & Lidz (2011), in contexts without an aux mismatch, ACD does also pose significant difficulties.

(8)   a.   A middle school teacher claimed to be about to catch each problem student John
              did [c̶l̶a̶i̶m̶ ̶t̶o̶ ̶b̶e̶ ̶a̶b̶o̶u̶t̶ ̶t̶o̶ ̶c̶a̶t̶c̶h̶]. $^{?}\forall > \exists$ (Cecchetto, 2004: 388, ex. 93)
        b.   ACD high antecedent:
              For every problem student x, such that John [$_{VP2}$ claimed to be about to catch the problem student x], a middle school teacher claimed to be about to catch the problem student.
        c.   *ACD low antecedent:
              A middle school teacher claimed to be about to catch each problem student John
              was [a̶b̶o̶u̶t̶ ̶t̶o̶ ̶c̶a̶t̶c̶h̶]

Attributing the distribution of QR across different clausal domains to processing difficulties rather than 'hard' syntactic constraints captures the availability of QR as diagnosed by ACD, the variability in judgments, the gradient difficulty of QR, and allows a uniform approach to the locality of A'-movement including QR.

Lots of details have obviously been left open here. Perhaps one of the most relevant questions related to the works on infinitives in German is the question of whether the scale in (6) also exists in German, not just for QR but for any of the restructuring properties that have been investigated. Restructuring infinitives are typically treated as mono-clausal configurations in the sense that they lack CPs and TPs. However, there is disagreement regarding the question of whether restructuring involves a configuration which is essentially identical to a simple predicate (a truly complex V predicate) or a slightly larger embedding configuration as, for instance, given in (7b). The ideas and new direction presented in this short note may allow us to develop further tests to probe this question.

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