Asymmetries in the Scope Behavior of Quantifiers

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Introduction. Beghelli & Stowell (BS) (1997) observe that $\forall$-quantifiers in object position are able to take scope over subject quantifiers (ex. (3a)) but are unable to take scope over clausal negation (ex. (3b)). In contrast, $\exists$-quantifiers, such as *more than 2*, are unable to scope over either subject quantifiers (ex. (3c)) or negation[1] (ex. (3d)). BS model this and related data by positing a complex series of functional projections in the syntax, where different classes of quantifiers have different features that are checked by different FPs. Additionally, the different quantifiers must also be able to reconstruct in various ways. Unfortunately, the theory has empirical problems and its cross-linguistic justifications have been questioned (Suranyi 2004)[2]. In this talk, I will explore a semantically-oriented approach to these contrasts, as an alternative to BS's syntax-centered approach[3]. Specifically, I will show that two general principles can account for the data in (3) and extensions thereof. First, I assume that classes of quantifiers differ in the flexibility of their derivationally-constructed syntax-semantics mapping. Secondly, I assume that interpretive possibilities can be made unavailable because of competition from alternative derivations that provide the same interpretation, but are more simply derived.

Analysis. I implement these principles in synchronous tree adjoining grammar (Sheiber & Schabes, 1990), a version of TAG where the derivation of semantic trees parallels the syntactic derivation. Independently, TAGs have been shown to be an elegant model of natural language syntax (Kroch 1987; Frank, 2002). The derivation of (3c), depicted in figure 1, provides an example of the formalism's mechanics: The object-tree (*more than 2 books*) first combines with the verb-tree (*read*) (step 1) via the substitution operation. In the semantic derivation, the scope tree and the argument tree of the quantifier combine into the verb tree (step 1) via substitution and adjoining respectively[4]. Then, the subject-tree (*every student*) substitutes into the verb-tree (step 2). In the semantic derivation, the scopal tree and the argument tree combine into the verb-tree (step 2) again via substitution and adjoining. The properties of multiple adjunction (Sheiber & Schabes 1990) force the subject scope tree to combine above the scope tree for the object quantifier. This produces only the desired surface scope reading. To explain why only this reading is available, we have to limit the availability of inverse scope, which could have been derived if steps 1 and 2 of the derivation had been reversed. I propose the following restriction on the ordering of the derivation (which is traditionally thought to be unordered):

(1)   PROMINENCE RESTRICTION ON DERIVATION (PROD): If node a in syntactic tree T is targeted prior to node b in T, then a must not irreflexively dominate or asymmetrically c-command b.

By PRoD, one could not substitute into the subject position before the object position, and hence only the derivation in Figure 1 is possible. But given PRoD, inverse scope should be unavailable generally (contrary to what we see in (3a)). To handle cases of inverse scope, I propose that a tree set can specify derivational restrictions on its use during a derivation. I assume that the substitution of the variable trees in the semantic derivation must take place at the time of the substitution of the syntactic NPs, following the hierarchical order. The scopal portion of the semantic tree set may follow one of the following regimens: (1) **Simultaneous combination (SC)**: the integration of the trees within a tree-set must take a single point in a derivation (SC is the assumed method of derivation in most TAG analyses.). (2) **Delayed combination (DC)**: the integration of the trees within a tree-set may take place at different points during the derivation. I argue that the different classes of quantifiers differ along the SC/DC dimension: the tree-set of $\forall$-quantifiers are DC, while the other QP classes are SC. So, in order to get inverse scope in cases like (3a), the DC property of the $\forall$-quantifier tree is exploited. The scope portion of the $\forall$-quantifier is not adjoined immediately. Instead, the derivation proceeds through the integration of the subject quantifier, including its scope, and then the scope of the object quantifier is finally adjoined. This yields wide scope for the object quantifier.

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[1]I put aside here other existential quantifiers like Bare numerals, which are able to scope over a subject quantifier or negation. I assume that these types of quantifiers acquire scope via a pragmatic mechanism, following Schwarzchild(1999).

[2]A few empirical problems include the prediction that inverse scope is available for sentences like *Exactly three students read less than five books* and wide scope negation is not available for *Every student didn't whine*.

[3]Mayr & Spector(2010) present a simple semantic constraint on quantifier movement in order to account for the same data. They argue that a covert scope shifting operator cannot apply if the resulting meaning is equivalent to or entails the meaning without the operator shift applying. This theory also has empirical problems, as it is unable to derive (5) given that the intended reading entails the surface scope reading.

[4]Note here that lexical items can be represented by more than one tree. In this case quantifiers are represented by two trees: one for the argument and one for the scope. Lexical items that represent more than one tree do not increase the formal power of TAG in this case.
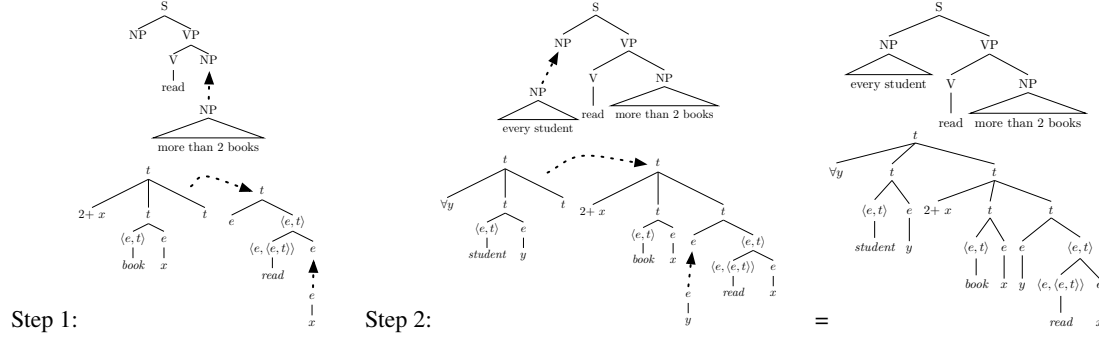
Figure 1: Derivation for *Every student read more than two books*.

At this point it seems puzzling that object ∀-quantifiers are unable to scope over clausal negation when they are DC. Notice that the examples in (4) are logically equivalent to the unavailable reading in (3b), as ∀¬ is equivalent to ¬∃. The examples in (4) are more simply derived than (3b) in that they take fewer steps and do not involve DC. I propose:

(2)   DERIVATIONAL COMPLEXITY CONSTRAINT ON SEMANTIC INTERPRETATION (DCCSI)
       A derivation *d* producing meaning *m* is ruled out if another shorter derivation *d'* also produces *m*.

Additional evidence for this constraint stems from the availability of the ∀∃¬ reading for (5). This reading would be surprising under an account in which the universal is simply unable to scope outside of negation. However, it is predicted on this analysis because there is no other "simpler" derivation competing with it. The DCCSI makes use of the potentially powerful mechanism of comparison of derivations. In the talk, I will discuss how DCCSI can be understood as a local constraint on TAG derivations, allowing only interpretations that can be derived via the combination of elementary trees to be compared. We will also see how this limited kind of comparison, which retains the computational restrictiveness of the TAG formalism, allows us to account for the patterns in (6), (7), and (8).

(3)   (a) A student read every paper $(\forall > \exists, \exists > \forall)$
      (b) John didn't read every/each paper. $(\forall \not> \neg, \neg > \forall)$
      (c) Every student read more than 2 papers. $(\forall > 2+, 2+ \not> \forall)$
      (d) John didn't read more that 2 papers. $(2+ \not> \neg, \neg > 2+)$

(4)   John didn't read a/any book(s). $(\neg > \exists)$

(5)   Someone didn't read every book. $(\forall > \exists > \neg)$

(6)   (a) John gave a book to more than three friends $(3+ > \exists, \exists > 3+)$
      (b) John gave a friend more than three books. $(3+ \not> \exists, \exists > 3+)$

(7)   (a) Every student didn't read the book $(\forall > \neg, \neg \not> \forall)$.
      (b) No student read the book. $(\neg > \forall)$

(8)   (a) A student didn't come to my office hours. $(\exists > \neg, \neg \not> \exists)$ (from MS)
      (b) No student came to my office hours. $(\exists \not> \neg, \neg > \exists)$

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