

Two Puzzles about Infinitivals with *Too*

Jon Nissenbaum and Bernhard Schwarz

McGill University

1. Introduction

As illustrated in (1), the degree operator *too* optionally combines with an infinitival clause and this infinitival clause can contain a non-subject gap.

- (1) a. John is too rich [for the monastery to hire him].
b. John is too rich [for the monastery to hire ___].

Reading the object pronoun *him* in (1a) as anaphoric to *John*, (1a) and (1b) are synonymous. Two related questions arise: what makes it possible for infinitivals with *too* to contain a non-subject gap? And how do sentences like those in (1) get to be synonymous?

Chomsky (1977) argued for an approach to the first question in which the non-subject gap in an infinitival with *too* is a trace left behind by a phonetically null operator that has moved to the edge of its clause to form a predicate of individuals. While Chomsky did not address the second question, he did assume that the infinitival is a complement of *too*. Under this assumption, a straightforward extension of Chomsky's proposal would posit two homophonous degree operators *too*, one that takes a propositional infinitival clause as its complement and one that takes a property-denoting infinitival.

In this paper we will spell out such an analysis, but then present two types of surprising observations that it fails to predict, both having to do with the interpretation of *too* when it appears under intensional verbs. We argue that the first of these appears to be a restriction on the logical scope of the degree operator, while the second appears to be a restriction on the binding of world variables.

2. Letting *too* Fill the Gap

Based on common assumptions about gradable adjectives, we will formulate a semantics for *too* with non-gapped infinitivals that essentially follows Heim (2001). Extending this account, we then spell out the Chomskyan analysis of *too* with gapped infinitivals.

We take gradable adjectives to relate degrees and individuals (Cresswell 1976, Bierwisch 1989, von Stechow 1984, Heim 2001). Specifically, we assign gradable adjectives denotations of type $d(et)$. This is illustrated in the lexical entry in (2), where $RICH_w(x)$ refers to x 's net worth in the possible world w .

- (2) $\llbracket \text{rich} \rrbracket^w = \lambda d_d. \lambda x_e. RICH_w(x) \geq d$

According to (2), *rich* relates a degree to an individual just in case the individual's net worth is at least d . So we take *rich* to relate a given individual x not only to x 's net worth itself, but also to every degree on the scale of wealth below x 's net worth (von Stechow 1984, Bierwisch 1989, Gawron 1995, Heim 2001).

The degree operator *too* has a modal component. Sentence (1a), repeated in (3), has the truth conditions in (4), which says that in no accessible world where John is as rich as he actually is does the monastery hire him.

- (3) John is too rich [for the monastery to hire him].
(4) $\exists d[RICH_w(j) \geq d \ \& \ \sim \exists w'[w' \in Acc_w \ \& \ RICH_{w'}(j) \geq d \ \& \ m \text{ hires } j \text{ in } w']]$

What worlds count as accessible in general depends on context. In the example at hand, the accessible worlds could be those worlds where the monastery's actual hiring policy is obeyed. (4) then says that in no such world where John is as rich as he actually is does the monastery hire him. This is true, for example, if John is a millionaire and the monastery's policy is not to hire anyone whose net worth exceeds a half a million dollars. Note also that (3) is understood to entail that the monastery will not hire John. This can be credited to the assumption that accessibility relation in question is realistic, which entails that the monastery respects its hiring policy in the actual world.

Suppose (3) has a logical form like (5), where *too* and its infinitival form a degree phrase that has undergone covert movement to the edge of the clause. The trace of this degree phrase is interpreted as a variable ranging over degrees. The truth conditions in (4) can be derived by assigning *too* the lexical entry in (6), assuming composition via *Intensional Function Application* (Heim and Kratzer 1998).

- (5) [too [for the monastery to hire him]] λd [John is *d* rich]
 (6) $\llbracket \text{too} \rrbracket^w = \lambda p_{st} . \lambda f_{s(dt)} . \exists d [f(d)(w) \ \& \ \sim \exists w' [w' \in \text{Acc}_w \ \& \ f(w')(d) \ \& \ p(w')]]$

Recall now that sentence (1b), repeated in (7), is judged to share with (3) the truth conditions in (4). To derive this, we can posit (8) as the logical form of (7) as well as the lexical entry in (9).

- (7) John is too rich [for the monastery to hire ___].
 (8) John is [too' λx [for the monastery to hire *x*]] rich
 (9) $\llbracket \text{too}' \rrbracket^w = \lambda P_{s(et)} . \lambda F_{s(d(et))} . \lambda x_e . \exists d [F(w)(d)(x) \ \& \ \sim \exists w' [w' \in \text{Acc}_w \ \& \ F(w')(d)(x) \ \& \ P(w')(x)]]$

In (8), the degree phrase remains in situ, hence below the subject, and it is headed by a *too'*, a type shifted homophone of *too*. The lexical entry in (9) lets *too'* feed the subject denotation in (8) as an input to the property denoted by the gapped infinitival (as well as to the degree relation in the scope of the degree phrase). This ensures that the gap in the infinitival is anaphoric to the subject. It thereby ensures that (8) is indeed assigned the intended truth conditions in (4).

So this analysis, a straightforward extension of the proposal in Chomsky (1977), derives the equivalence of (3) and (7). However, we will now show that *too* plus gapped infinitival is subject to restrictions that the analysis does not lead one to expect.

3. The First Puzzle: Gaps Force *too* to Remain *In Situ*

Heim (2001) observes that under (certain) intensional verbs, degree phrases with *too* participate in an ambiguity that can be analyzed as an ambiguity of logical scope. To illustrate, consider sentence (10), where the degree phrase headed by *too* is embedded under *want*.

- (10) John wants to be too rich [for the monastery to hire him].

Consider the logical form for (10) shown in (11), where the degree phrase takes scope within the embedded clause. Assuming that PRO refers to John, the truth conditions assigned to this logical form are those shown in (12). (12) conveys that in all of John's desire worlds he is too rich for the monastery to hire. In this predicted reading, then, the sentence entails that John wants not to be hired.

- (11) John wants [[too [for the monastery to hire him]] λd [PRO be *d* rich]]
 (12) $\forall w'' [w'' \in \text{Bu}_{w'}(j) \rightarrow \exists d [RICH_{w''}(j) \geq d \ \& \ \sim \exists w' [w' \in \text{Acc}_{w''} \ \& \ RICH_{w'}(j) \geq d \ \& \ m \text{ hires } j \text{ in } w']]]$

To be sure, sentence (10) can indeed be understood in this way. However, the sentence also has another reading, one that is consistent with John having no objection to being hired by the monastery and that could even be true if John wants them to hire him. The relevant reading of the sentence would be salient in a scenario where the monastery's hiring policy makes reference to applicants' desired wealth, rather than their actual wealth, excluding every candidate whose desired net worth is above a certain limit. Sentence (10) could then be understood as conveying that John's desired net worth is above that limit. In other words, (10) seems to have a reading with the truth conditions in (13).

- (13) $\exists d [\forall w'' [w'' \in \text{Bu}l_w(j) \rightarrow \text{RICH}_{w''}(j) \geq d] \ \& \ \sim \exists w' [w' \in \text{Acc}_w \ \& \ \forall w'' [w'' \in \text{Bu}l_{w'}(j) \rightarrow \text{RICH}_{w''}(j) \geq d] \ \& \ m \ \text{hires } j \ \text{in } w']]]$

The availability of such a reading is precisely what one expects if, as Heim (2001) argues, degree phrases with *too* can take inverse scope over (certain) intensional verbs. That is, the truth conditions in (13) can be credited to the logical form (14), where the degree phrase covertly moves from the embedded clause to take widest scope.

- (14) [too [for the monastery to hire him]] λd [John wants [PRO be *d* rich]]

3.1. The Frozen Scope of *too* with Gapped Infinitivals

Consider now sentence (15) below, which minimally differs from (10) in that the object pronoun in the infinitival clause accompanying *too* is omitted. The relevant observation, previously unnoticed, is that (15) does not share with (10) the ambiguity described above. While the sentence allows for the reading in (12), it is judged to lack the one in (13). So in contrast to (10), sentence (15) unambiguously entails that John does not want to be hired.

- (15) John wants to be too rich [for the monastery to hire ___].

Under the analysis given above, the availability of reading (12) indicates that it is possible for the degree phrase headed by *too'* to be interpreted *in situ*, in the scope of *want*, but evidently this degree phrase cannot take inverse scope over *want*. That is, intuitions on (15) indicate that while the logical form (16) is available, the one in (17) is not.

- (16) John wants [PRO be [too' λx [for the monastery to hire *x*]] rich]
 (17) John [too' λx [for the monastery to hire *x*]] λd [wants [PRO be *d* rich]]

It is the unavailability of (17) that comes as a surprise. What is it that keeps a degree phrases with *too* from taking inverse scope if it combines with a gapped infinitival clause?

We begin to address this question in the next section by introducing additional relevant data. These data illustrate another type of restriction on *too* plus gapped infinitival, first proposed in Faraci (1973). The restriction in question does not concern the relative scope of the degree phrase and another operator, but the possible antecedents of non-subject gaps in infinitivals with *too*.

3.2. Faraci's Generalization

Faraci (1974, 188–9) observed that the distribution of gapped infinitivals with *too* is much more restricted than that of gapless infinitivals. For example, Faraci judges each of the examples in (18) to be unacceptable.

- (18)a. *Mary runs too fast [for me to keep up with ___].
 b. *Homer eats too much [for Jim to keep up with ___].

Faraci notes that the unacceptability of these cases is indeed tied to the presence of the gap. He reports that the sentences in (19), where the gaps are filled with overt pronouns anaphoric to the matrix subject, are fully grammatical.

- (19)a. Mary runs too fast [for me to keep up with her].
 b. Homer eats too much [for Jim to keep up with him].

Faraci takes these observations to show that a non-subject gap in an infinitival with *too* can only be anaphoric to the subject argument of the adjective that *too* combines with. This captures the fact that (18a-b) cannot mean what (19a-b) mean, since in (19a-b) the final pronoun is understood to be

anaphoric to the subject of the main predicate (*run* or *eats*) rather than the adjective combining with *too* (*fast* or *much*). Moreover, since the adjectives in question do not predicate subjects, at least none that could conceivably antecede the gap in the infinitival, Faraci's generalization correctly excludes the examples in (18) as unacceptable.

Faraci's generalization also applies correctly to cases where the adjective combining with *too* is the main predicate, but has an internal argument. In the grammatical (20), for example, the gap can be understood anaphoric to John, the subject argument of *angry*, but not to its complement *Mary*.

(20) John is too angry at Mary [for us to invite ___].

Under the assumption we have introduced above, Faraci's generalization comes as a surprise. Assuming that degree phrases with *too*' can move covertly just as the gapless variants with *too* can, one expects (18a-b) to have the logical forms in (21a-b), where in each case the degree phrase has landed just below the matrix subject and which would derive the very readings expressed by the non-gapped examples in (19a-b).

- (21)a. Mary [too' λx [for me to keep up with x]] λd [runs d fast]
 b. Homer [too' λx [for Jim to keep up with x]] λd [eats d much]

Similarly, an unattested reading of (20) could be derived from the logical form in (22), where *Mary* has covertly moved to the edge of the clause and the *too*' degree phrase has moved right below it, ensuring that *Mary* fills the gap in the infinitival.

(22) Mary [too' λx [for us to invite x]] $\lambda d \lambda y$ [John is d [angry at y]]

Each of the unavailable logical forms in (21) and (22) assumes that degree phrases with *too*' can move covertly. To account for Faraci's generalization, we would accordingly have to assume that degree phrases with *too*' are not in fact scopally mobile and instead must always be interpreted *in situ*.

It is apparent that this assumption would also derive the frozen scope observation presented in the previous section. If degree phrases with *too*' cannot move covertly, then in particular they cannot take inverse scope over higher operators at logical form.

It turns out, however, that Faraci's Generalization is actually not correct as it stands and needs to be refined.¹ We demonstrate this in the next section.

4. Interlude: But Sometimes There is Movement After All

4.1. Exceptions to Faraci's Generalization

While Faraci's generalization applies correctly to the data presented above, the generalization turns out to have systematic, previously unnoticed, exceptions. A first illustration of this are the examples in (23), which differ from Faraci's examples in (18) only in that the matrix subject has been questioned.

- (23)a. Tell me [which girl ___ runs too fast [for me to keep up with ___]].
 b. Tell me [which girl ___ eats too much [for Jim to keep up with ___]].

These examples are acceptable, with the gap in the infinitival understood anaphoric to the matrix subject. The gap in the infinitival is bound by the subject wh-phrase, just like an overt pronoun can be bound by the wh-phrase in the examples in (24).

¹ An *in situ* restriction on *too* with a gapped infinitival cannot be seen as a more general restriction on degree phrases which, like *too*' degree phrases, take an individual argument after taking a denotation of the type of gradable adjectives. Apart from hypothetical *too*', the only degree operators we are aware of that might have to be analyzed as projecting degree phrases of such a semantic type are superlatives (Heim 1999, 2001) and reciprocal equatives (as in *equally rich*, Schwarz 2007). Neither type of degree phrase is constrained in the way *too* plus gapped infinitival is. In particular, the works cited here show that both can take inverse scope over (certain) intensional verbs.

- (24) a. Tell me [which girl __ runs too fast [for me to keep up with her]].
 b. Tell me [which girl __ eats too much [for Jim to keep up with her]].

The examples in (23), then, are clear exceptions to Faraci's generalization. The same is true for the examples in (25), where the matrix subject has been relativized rather than questioned. Again, these sentences are acceptable and the gap in the infinitival is understood as bound by the matrix subject.

- (25) a. Mary, [who __ runs too fast [for me to keep up with __]]
 b. Homer, [who __ eats too much [for Jim to keep up with __]]

These data suggest that it is generally possible for a non-subject gap in an infinitival with *too* to take as its antecedent an expression that has undergone overt wh-movement, irrespective of its place in argument structure. Apparently, it is only in the absence of overt wh-movement that Faraci's Generalization applies.

This characterization of the data receives further support from the examples in (26), as contrasted with (20) above. In (26a-b), it is the internal argument of *angry* that has undergone wh-movement and, as expected, it is possible to read the gap in the infinitival as bound by the moved wh-phrase.

- (26) a. Tell me [who John is too angry at __ [for us to invite __]]
 b. Mary, [who John is too angry at __ [for us to invite __]]

In the terms of our current analysis, the exceptions to Faraci's Generalization indicate that a degree phrase headed by *too'*, while ordinarily frozen *in situ*, can move covertly to adjoin to predicates of individuals derived through overt wh-movement. For example, the relative clauses in (25) have surface structures where overt movement has derived a predicate of individuals to the right of *who*. The acceptability of the examples in (25) indicate that it is possible for the *too'* degree phrase to covertly raise and attach to this predicate, yielding the logical forms in (27), which derive the readings described above.

- (27) a. who [too' λx [for me to keep up with x]] $\lambda d \lambda y$ [y runs d fast]
 b. who [too' λx [for Jim to keep up with x]] $\lambda d \lambda y$ [y eats d much]

Similarly, the relevant reading of the sentences in (26) would be due to a logical form like (28), where again the *too'* degree phrase has targeted a predicate of individuals derived by overt wh-movement.

- (28) who [too' λx [for us to invite x]] $\lambda d \lambda y$ [John is d [angry at y]]

Moreover, the exceptional pattern seen in wh-movement environments turns out to generalize to the apparent restriction on scope that we have described above. We show this in the next subsection.

4.2. Exceptions to the Frozen Scope Generalization

Recall our suggestion that the frozen scope requirement described in section 3 above is a consequence of the assumption, motivated by Faraci's Generalization, that degree phrase with *too'* must be interpreted *in situ*. If frozen scope and Faraci's Generalization are indeed so related, we should expect exceptions to frozen scope to arise in just those environments where exceptions to Faraci's Generalization arise. Remarkably, this expectation is correct. Consider (29):

- (29) Mary, who [my mother wants me to be too [angry at __]] [for me to (actually) dislike __]

In its only sensible interpretation (29) conveys that what is incompatible with my disliking Mary is my mother's wanting me to be angry at Mary to the degree that she actually wants me to be angry at her. This is the reading expressed by the logical form (30), where the *too'* degree phrase scopes over *want*.

(30) Mary, who [too' λx [for me to dislike x]] $\lambda d \lambda y$ [my mother wants me to be [d angry at y]]

So the frozen scope observation described above is not in fact due to a restriction on the scope of *too'* plus gapped infinitival relative to other operators. Instead, it is due to a restriction on possible landing sites of the relevant degree phrases. Nothing in principle prevents *too'* plus gapped infinitival from taking inverse scope over an intensional verb. The relevant degree phrases can move past an intensional verb provided they can target a position next to a predicate derived by overt wh-movement.

To summarize, under the current account of *too* with gapped infinitivals, restrictions on scope and possible antecedents suggest that *too'* degree phrases must remain *in situ* at logical form unless they can move to target a predicate of individuals derived by overt wh-movement. The obvious question is whether it is possible to explain why *too'* degree phrases should be restricted in this way. We will not address this question here for reasons of space; we have argued elsewhere for a more principled approach to the observation (see Nissenbaum and Schwarz, in press), but here we will simply continue to assume an additional *in situ* restriction on the stipulated homophone *too'*.

5. The Second Puzzle: Transparent Readings

5.1. Degree Phrases with *too* in Noun Phrase Modifiers

We have so far confined attention to *too* degree phrases in predicative position. Unsurprisingly, as (31) shows, gapped infinitivals with *too* can also occur with adjectives in attributive position.

(31) John married too rich a woman [for the monastery to hire __]

The account we gave above, based on our extension of Chomsky's proposal about the structure of degree phrases, applies to such cases straightforwardly. (31) can get the logical form in (32). The latter has the truth conditions in (33), which asserts the existence of a woman who John married and whose net worth is incompatible with the monastery's hiring her. These truth conditions seem adequate.

(32) John married a [[too' λx [for the monastery to hire x] rich] woman

(33) $\exists x[x \text{ is a woman in } w \ \& \ j \text{ marries } x \text{ in } w \ \& \ \exists d[\text{RICH}_w(x) \geq d \ \& \ \sim \exists w' [w' \in \text{Acc}_w \ \& \ \text{RICH}_{w'}(x) \geq d \ \& \ m \text{ hires } x \text{ in } w']]]]$

5.2. A Transparent Reading

When a sentence like (31) is embedded under an intensional verb, it should not give rise to scope ambiguity of the sort that we were concerned with above; we expect the scope of *too* to be frozen due to the presence of the gap. Confining attention to a *de dicto* construal of the indefinite containing *too*, one might accordingly expect that (34) can only have the logical form (35), hence the truth conditions in (36), unambiguously entailing that John wants his future wife not to be hired by the monastery.

(34) John wants to marry too rich a woman [for the monastery to hire __]

(35) John wants [PRO to marry a [[too' λx [for the monastery to hire x] rich] woman]

(36) $\forall w'' [w'' \in \text{Bu}_w(j) \rightarrow \exists x[x \text{ is a woman in } w'' \ \& \ j \text{ marries } x \text{ in } w'' \ \& \ \exists d[\text{RICH}_{w''}(x) \geq d \ \& \ \sim \exists w' [w' \in \text{Acc}_{w''} \ \& \ \text{RICH}_{w'}(x) \geq d \ \& \ m \text{ hires } x \text{ in } w']]]]$

Interestingly, however, (34) is ambiguous after all. Apart from the expected reading (36), it also has a reading that does not entail that John wants his future wife not to be hired by the monastery. In this reading, (34) could be true even if John doesn't even know there is a monastery. Specifically, it could be judged true if John wants to marry a millionaire, and the monastery's policy, unbeknownst to John, is to not hire millionaires.

While the reading in question is not the one expressed by the logical form with surface scope in (35), it is also not expressed by the one with inverse scope in (37), either. (37) is not what is needed here because it makes the gap anaphoric to *John*, and also because it expresses an incompatibility between the monastery's hiring policy and desired wealth, rather than actual wealth.

(37) John [too' λx [for the monastery to hire x] λd [wanted [PRO to marry a [d rich] woman]]

It appears instead that the truth conditions of the reading in question can be given as in (38), which differs from (36) only in that the accessibility function *ACC* is indexed with the actual world, rather than the variable ranging over John's desire worlds. We will refer to this as a *transparent* reading.

(38) $\forall w''[w'' \in \text{Bu}_{w'}(j) \rightarrow \exists x[x \text{ is a woman in } w'' \ \& \ j \text{ marries } x \text{ in } w'' \ \& \ \exists d[\text{RICH}_{w''}(x) \geq d \ \& \ \sim \exists w'[w' \in \text{ACC}_w \ \& \ \text{RICH}_{w'}(x) \geq d \ \& \ m \text{ hires } x \text{ in } w']]]]$

5.3. Explicit World Variables

To derive the transparent reading, we could assume logical forms with explicit variables ranging over possible worlds, as proposed in Percus (2000) (and references given there). Lexical entries would need to be adjusted accordingly. In particular, in a Chomsky-style account of the sort we developed above, we could have the following adjusted entries for *too* and *too'* (cf. (6) and (9) above).

(39) a. $\llbracket \text{too} \rrbracket = \lambda w. \lambda w'. \lambda p_{st}. \lambda f_{s(dt)}. \exists d[f(w)(d) \ \& \ \sim \exists w''[w'' \in \text{Acc}_{w'} \ \& \ f(w'')(d) \ \& \ p(w'')]]]$
 b. $\llbracket \text{too}' \rrbracket = \lambda w. \lambda w'. \lambda P_{s(et)}. \lambda F_{s(d(et))}. \lambda x_e. \exists d[F(w)(d)(x) \ \& \ \sim \exists w''[w'' \in \text{Acc}_{w'} \ \& \ F(w'')(d)(x) \ \& \ P(w'')(x)]]$

Notice that according to these entries, *too* and *too'* take two world arguments. One of these will be fed as an input to the degree property, while the other fixes the world from which accessibility will be determined. To illustrate this with a simple case, the logical form in (5) is now to be replaced with the one in (40), which also derives the intended truth conditions in (4).

(40) $\lambda w[\text{too}_{w,w} \ \lambda w'[\text{for the monastery}_{w'} \text{ to hire}_{w'} \text{ him}]] \ \lambda w'' \lambda d[\text{John is } d \text{ rich}_{w''}]$

Moving on to the attributive case we are interested in, the logical form in (35) above is to be replaced with (41), which derives the same truth conditions as (35), that is, the truth conditions in (36).

(41) $\lambda w[\text{John wants}_{w'} \ \lambda w''[\text{PRO to marry}_{w'} \text{ a } [[\text{too}'_{w',w'} \ \lambda w'' \lambda x[\text{for the monastery}_{w''} \text{ to hire}_{w''} \ x]] \text{ rich }] \text{ woman}_{w'}]]$

To derive the transparent reading in (38), it is now enough to revise the logical form (40) minimally by letting the second world argument of *too* be bound non-locally by the highest lambda, hence by ultimately considering accessibility from the actual world.

(42) $\lambda w[\text{John wants}_{w'} \ \lambda w''[\text{PRO to marry}_{w'} \text{ a } [[\text{too}'_{w',w'} \ \lambda w'' \lambda x[\text{for the monastery}_{w''} \text{ to hire}_{w''} \ x]] \text{ rich }] \text{ woman}_{w'}]]$

Assuming explicit representation of world variables, then, the transparent reading is straightforwardly captured. In particular, it is consistent with the assumption that *too'* degree phrases must remain *in situ*. After all, our constraint on scope is evidently compatible with non-local binding of world variables.

This is not to say that the binding of world variables is unconstrained. Percus (2000) posits a pair of relevant constraints as a first step toward a complete binding theory for world variables. The observations reported here suggest that such a theory will have to allow for the world variable determining accessibility associated with *too* to be bound non-locally.

5.4. No Transparent Readings with Predicative Adjectives?

The reader might wonder why we have chosen gapped attributive cases to illustrate transparent readings with *too*. Strikingly, transparent readings appear to be unavailable when the adjective appears in non-NP-modifying position. Consider (43):

(43) John wants the woman he marries to be too rich [for the monastery to hire ___].

This sentence allows a close paraphrase of the attributive example (34), but uses a predicative adjective instead. However, the paraphrase is limited to the reading in (36). In stark contrast to (34), (43) unambiguously entails that John wants his future wife not to be hired by the monastery. In short, sentence (43) does not seem to allow for the transparent reading in (46) any more than it does for an inverse scope reading.

We are forced to conclude, then, that the logical form in (44), where the second world index on *too'* is bound non-locally, is not available as an input to the semantics.

(44) $\lambda w[\text{John wants}_w$
 $\lambda w'[\text{the woman he marries}_{w'} [\text{too}'_{w',w} \lambda w[\text{for the monastery}_w \text{ to hire}_w \text{ him}] \text{ rich}]]]$

From one point of view, the unavailability of (44) comes as a surprise, given the possibility of non-local binding in example (34). It is not clear why gapped infinitivals ever block non-local world binding, or why predicative and attributive cases should differ in this respect.

On the other hand, if the generalization were simply a matter of transparent readings being limited to *too* with attributive adjectives, one might suspect a different culprit: namely the quantificational DP in which the attributive adjective is embedded. After all, quantificational DPs are known to behave exceptionally in allowing non-local binding of world variables internal to their restrictor (see Percus 2000, as well as Keshet, *in press* and this volume, and the references cited there). The analysis offered above does not establish such a connection.

However, we will not pursue that possibility. It turns out that the phenomenon of transparent readings can be observed with simpler cases not involving quantificational DPs.

5.5. A Puzzle Upon a Puzzle: Transparent Readings with Gapless Cases

Consider our gapless predicative example in (10), repeated below as (45).

(45) John wants to be too rich [for the monastery to hire him].

It seems that the two readings of (45) discussed above do not exhaust the range of possible interpretations of the sentence. Speaker intuitions suggest that in addition to (12) and (13), the sentence can have the reading in (46), expressed by the logical form in (47).

(46) $\forall w''[w'' \in \text{Bu}_w(j) \rightarrow \exists d[\text{RICH}_{w''}(j) \geq d \ \& \ \sim \exists w'[w' \in \text{ACC}_w \ \& \ \text{RICH}_w(j) \geq d \ \& \ m \text{ hires } j \text{ in } w']]]]$

(47) $\lambda w[\text{John wants}_w$
 $\lambda w''[[\text{too}_{w'',w} \lambda w'[\text{for the monastery}_{w'} \text{ to hire}_{w'} \text{ him}] \ \lambda w''' \lambda d \text{ PRO be } d \text{ rich}_{w''}]]]]$

That is, the sentence could be judged true even if John doesn't know the monastery exists (parallel to (34)), as long as the monastery's policy is to not hire millionaires (as opposed to those who want to be millionaires) and John wants to be a millionaire, but isn't one. This third reading of sentence (45) is another instance of a transparent reading: in (46), the accessibility function *ACC* is indexed with the actual world and, correspondingly, the second world index of *too* in (47) is bound non-locally.

We might at this point simply stipulate yet another difference between *too* and its postulated homophone *too'*: only the former allows non-local binding of its second world argument. But as unsatisfactory as this seems, we would still be left without an explanation for the difference between attributive and predicative environments for gapped degree phrases.

6. Summary

We started by asking about a puzzling alternation involving degree phrases with optional non-subject gaps. We sketched an obvious account of this alternation, based on Chomsky's (1977) conclusion that

the gap arises from movement of an empty operator to the edge of the degree operator's complement, forming a derived predicate.

But we showed that, while current approaches to degree operators provide a reasonable way to understand *too* phrases without gaps, and make correct predictions about scope ambiguities in which they participate, the extension to the gapped versions based on Chomsky's proposal runs into unexpected difficulties. We identified two puzzles for such an approach. First, we demonstrated that the gapped versions of degree phrases are much more restricted than their gapless counterparts in scopally ambiguous sentences: they must remain *in situ* unless they can target a predicate derived by overt *wh*-movement. We noted that this puzzling restriction is parallel to Faraci's observed restriction on the choice of antecedent for the gap. And we showed that Faraci's restriction is lifted in exactly the same environments that our observed scope restriction is lifted. Second, we showed that even when they remain *in situ*, gapped degree phrases can get an additional reading — the transparent reading — but only when they appear with adjectives in NP-modifying positions.

The two puzzles appear to be independent of one another. We have argued elsewhere (Nissenbaum and Schwarz, in press) that the optional gap in a degree phrase is, perhaps surprisingly, an instance of a parasitic gap, based in part on the striking parallel between that construction and the environments where the frozen scope of gapped degree phrases is lifted. Our conclusion in that work is that the null operator raises *past* the infinitival clause (contra Chomsky) to target the edge of the degree phrase itself, forming a derived function which is then interpreted compositionally in the same way as parasitic gaps (Nissenbaum 2000) — either *in situ* or in a canonical parasitic gap environment. If that is correct, puzzle one would be explained. Moreover it would be explained in a way that eliminates the need for a homophonous operator *too'* that must remain *in situ* by stipulation.

However, note that if this is the right solution for puzzle one, then puzzle two becomes more puzzling, not less. If there is only one *too*, with the presence of a gap determined compositionally, it is hard to see how we could even stipulate the restriction on world-variable binding in a coherent way. We therefore leave our two puzzles unsolved, as an empirical challenge that future work on the topic will have to meet.

References

- Bierwisch, Manfred: 1989, 'Semantik der Graduierung', in M. Bierwisch and E. Lang (eds.), *Grammatische und konzeptuelle Aspekte von Dimensions-adjektiven*, Akademie-Verlag, Berlin.
- Chomsky, Noam: 1977, 'On Wh-Movement', in P. Culicover, T. Wasow and A. Akmajian (eds.), *Formal Syntax*, Academic Press, New York.
- Cresswell, M. J.: 1976, 'The Semantics of Degree', in Barbara Partee (ed.), *Montague Grammar*, Academic Press, New York, pp. 261-292.
- Faraci, Robert: 1974, *Aspects of the Grammar of Infinitives and for-phrases*, Doctoral dissertation, MIT, MITWPL.
- Gawron, Jean Mark: 1995, 'Comparatives, Superlatives and Resolution', *Linguistics and Philosophy* **18**, 333-380.
- Heim, Irene: 1999, 'Notes on Superlatives', ms., MIT.
- Heim, Irene: 2001, 'Degree Operators and Scope', in C. Féry and W. Sternefeld (eds.), *Audiat Vox Sapientiae*, Akademie-Verlag, Berlin.
- Heim, Irene, and Angelika Kratzer: 1998: *Interpretation in Generative Grammar*, Blackwell, Cambridge.
- Keshet, Ezra: in press, 'Only the strong: restricting situation variables', in Tova Friedman and Satoshi Ito (eds.), *Proceedings of Semantics and Linguistic Theory XVIII*.
- Keshet, Ezra: this volume, 'Situation economy'.
- Nissenbaum, Jon: 2000, *Investigations of Covert Phrase Movement*, Doctoral Dissertation, MIT, MITWPL.
- Nissenbaum, Jon and Bernhard Schwarz: in press, 'Infinitivals with *too*: Degree operator scope and parasitic gaps', in Tova Friedman and Satoshi Ito (eds.), *Proceedings of Semantics and Linguistic Theory XVIII*.
- Percus, Orin: 2000, 'Constraints on Some Other Variables in Syntax', *Natural Language Semantics* **8**, 173-229.
- Schwarz, Bernhard: 2007, 'Reciprocal Equatives', in E. Puig-Waldmüller (ed.), *Proceedings of Sinn und Bedeutung* **11**, Universität Pompeu Fabra, Barcelona, pp. 568-582.
- Stechow, Arnim von: 1984, 'Comparing Semantic Theories of Comparison', *Journal of Semantics* **3**, 1-177.

Proceedings of the 27th West Coast Conference on Formal Linguistics

edited by Natasha Abner
and Jason Bishop

Cascadilla Proceedings Project Somerville, MA 2008

Copyright information

Proceedings of the 27th West Coast Conference on Formal Linguistics
© 2008 Cascadilla Proceedings Project, Somerville, MA. All rights reserved

ISBN 978-1-57473-428-7 library binding

A copyright notice for each paper is located at the bottom of the first page of the paper.
Reprints for course packs can be authorized by Cascadilla Proceedings Project.

Ordering information

Orders for the library binding edition are handled by Cascadilla Press.
To place an order, go to www.lingref.com or contact:

Cascadilla Press, P.O. Box 440355, Somerville, MA 02144, USA
phone: 1-617-776-2370, fax: 1-617-776-2271, e-mail: sales@cascadilla.com

Web access and citation information

This entire proceedings can also be viewed on the web at www.lingref.com. Each paper has a unique document # which can be added to citations to facilitate access. The document # should not replace the full citation.

This paper can be cited as:

Nissenbaum, Jon and Bernhard Schwarz. 2008. Two Puzzles about Infinitivals with *Too*. In *Proceedings of the 27th West Coast Conference on Formal Linguistics*, ed. Natasha Abner and Jason Bishop, 344-352. Somerville, MA: Cascadilla Proceedings Project.

or:

Nissenbaum, Jon and Bernhard Schwarz. 2008. Two Puzzles about Infinitivals with *Too*. In *Proceedings of the 27th West Coast Conference on Formal Linguistics*, ed. Natasha Abner and Jason Bishop, 344-352. Somerville, MA: Cascadilla Proceedings Project. www.lingref.com, document #1849.