Quantificational and Modal Interveners in Degree Constructions

SZ93 and H01 independently note identical scopal restrictions on universal quantifiers in amount *wh*-questions and comparatives, respectively. SZ93's proposal explains the restrictions on quantifier scope in degree constructions, but seems to predict wrongly that strong modals should also be restricted. I argue that (1) recent proposals on which modals are scalar operators rather than quantifiers explain why they are not affected by SZ93's constraints; and (2) this explains a puzzling difference between strong modals and mid-strength modals (*should, ought, want*) — the former show ambiguities but the latter apparently do not. The scalar theory predicts different truth-conditions for the two LFs with strong modals, but equivalent truth-conditions with mid-strength modals.

SZ93 point out that standard assumptions predict two readings for amount comparatives with *every*, but one of these readings is not attested. However, this reading does arise with certain modals.

(1) How far did everyone run? (how far$_i$ > *everyone* > t_i)
"For what d: everyone ran at least d-far (i.e. how far did the person who ran **least** run)?"

(2) How far do we have to (must we, are we required to) run? (how far$_i$ > *have to* > t_i)
✓ "For what d: we run ≥ d-far in all accessible w (i.e., what is the **minimum** requirement)?"

Independently, H01 makes the same point for comparatives: (4) is a possible reading but (3) is not.

(3) Jim ran 5 miles. Everyone else ran exactly 1 mile farther than that. (CC$_i$ > *everyone* > t_i)
"The person who ran the **least** ran 6 miles (but some ran farther)."

(4) Jim ran 5 miles. We have to run exactly 1 mile farther than that. (CC$_i$ > *required* > t_i)
✓ "The max d s.t. we run ≥ d-far in all acc. w is 6 miles (we must run **at least** that far)"

H01 proposes to explain (3)-(4) using an LF-constraint banning quantificational DPs from taking scope between a degree operator and its trace. The constraint does not, however, explain *why* modals and quantifiers should behave differently in this respect if modals are indeed quantifiers over worlds. It also does not account for a counterexample involving indefinites noted by H01 herself (fn. 11): by the proposed constraint, the only reading of (5) should have the existentials taking wide scope.

(5) Jaffrey is closer to an airport than it is to a train station. (CC$_i$ > *an airport* > t_i)
"The closest airport is closer than the closest train station"

SZ93 give a theory which predicts the contrast between (1)/(3) and (5). Their general claim is that intervention constraints are due to restrictions on which operations are available in various semantic domains. In the case of degree expressions, SZ93 argue that the relevant restriction applies specifically to expressions which make use of the operations *meet* (≈ intersection) and *complement*. This predicts that universal quantification, negation, conjunction, etc. should not be able to appear directly below a degree operator, as for example in (1)/(3). However, existential quantifiers, which do not make use of the meet operation, are predicted to be acceptable in this position, as in (5).

As SZ93 point out, this account does not at first glance illuminate the difference between modal and quantificational interveners: *have to* and the like are usually treated as universal quantifiers over accessible worlds, and so the constraint should apply equally here. SZ93 suggest briefly that the solution is that "the scopal properties of these verbs are not Boolean in nature"; this amounts to proposing that these verbs do not have a quantificational semantics. In fact, non-quantificational semantics for modals and intensional verbs has been proposed recently by a number of authors [G96,vR99,Le03,Y10,La11] in order to account for the fact that many modals are gradable and various other puzzles. On the most general version of this account, modals, like gradable adjectives, are scalar expressions which relate propositions to their degrees of likelihood/goodness/etc., or (in the positive form) compare them to a threshold. For example, La11 proposes that *must/have to* ϕ is true iff (a) ϕ receives a very high value on a deontic scale, and (b) all relevant ways of realizing $\neg\phi$ have to a low value. I'll summarize this (roughly) as "$good(\phi) > \theta_H \wedge good(\neg\phi) < \theta_L$", where *good* relates propositions to deontic degrees and θ_H/θ_L are the relevant High and Low thresholds. This predicts the LFs in (6), which express the "precise" and "minimum requirement" readings of (4).

(6) a. $good(\mathbf{max}[\lambda d(\text{we run} \geq d \text{ mi.})] = 6) > \theta_H \wedge good(\mathbf{max}[\lambda d(\text{we run} \geq d \text{ mi.})] \neq 6) < \theta_L$
≈ "It's great if we run exactly 6, and terrible if more or less" (*required* > $\text{CC}_i > t_i$)

b. $\mathbf{max}(\lambda d[good(\text{we run} \geq d \text{ mi.}) > \theta_H \wedge good(\text{we run} < d \text{ mi.}) < \theta_L]) = 6$
≈ "It's great if we run 6 or more, and terrible if less" (CC_i > *required* > t_i)

Crucially, neither scoping makes use of the meet operation in the form of universal quantification or otherwise, and so the ambiguity is generated in a way compatible with SZ93's theory of intervention constraints. This is our first result: an independently motivated proposal explains the acceptability of (2) and (4) as due to the fact that *have to* is a scalar expression rather than a universal quantifier.

An important puzzle remains: *should, ought, want,* and *supposed to* do not seem to have intervention readings. (Epistemics don't either, but this is probably an ECP effect [H01, cf. vFI03]).

(7) Jim ran 5 miles. We should/ought to/want to run exactly 1 mile farther than that.

(7) has a "precise desire/obligation" reading, but no "minimum" reading. Glossing over some details, G96 and La11 argue essentially that *should* ϕ is true iff ϕ is significantly better than its negation: $good(\phi) >_s good(\neg\phi)$, and similarly for *ought* and *want*. This predicts for (7):

(8) a. $good(\mathbf{max}[\lambda d(\text{we run} \geq d \text{ mi.})] = 6) >_s good(\mathbf{max}[\lambda d(\text{we run} \geq d \text{ mi.})] \neq 6)$
≈ "Running 6 miles exactly is better than another distance" (*should* > $\text{CC}_i > t_i$)

b. $\mathbf{max}(\lambda d[good(\text{we run} \geq d \text{ mi.}) >_s good(\text{we run} < d \text{ mi.})]) = 6$
≈ "≥ 6 is better than < 6 and, for no $d > 6$, $\geq d$ is better than $< d$" (CC_i > *should* > t_i)

(8a) expresses a preference for 6 miles precisely, while (8b) says essentially the same thing in a more complicated way: running ≥ 6 is better than < 6, but when $d > 6$ running $\geq d$ miles is not better than $< d$. Given the overall theory of deontic scales in [G96,L11], these clauses taken together boil down to a requirement that 6 is good and more than 6 is fairly undesirable; that is, that the preference is for 6 and no more. As a result the LFs are equivalent and there is no detectable ambiguity.

In sum, SZ93's theory of weak islands accounts for scope restrictions in comparatives and — together with a recent scalar semantics for modals — explains why modals are able to intervene and why a coherent class of modals exemplified by *ought, should* and *want* do not show overt ambiguities.

References [vFI03] von Fintel & Iatridou, Epistemic Containment, *LI*. [G96] Goble, Utilitarian deontic logic, *Phil. Studies*. [H01] Heim, Degree operators & scope. [La11] Lassiter, *Measurement & Modality*, NYU diss. [Le03] Levinson, Probabilistic model-theoretic semantics for *want*, *SALT 13*. [vR99] van Rooij, Some analyses of *pro*-attitudes. [SZ93] Szabolcsi & Zwarts, Weak islands and an algebraic semantics for scope taking, *NLS*. [Y10] Yalcin, Probability operators, *Phil. Comp.*