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Constraining (shifting) types at the interface

A longstanding problem in semantics is that natural language only makes use of a small subset of the possible types generated by the standard recursive definition of semantic types (e, t are types; if σ, τ are types, then $\langle \sigma, \tau \rangle$ is a type). What restricts the actively used types in this manner? This paper provides a novel argument for the hypothesis that while types are in principle unconstrained in the semantics, one way that they are constrained is at the syntax–semantics interface because syntactic operations only ever result in λ-abstractions over individual types, e.g. e and d (Chierchia 1984; Landman 2006). While existing research shows that movement does not create λ-abstractions over generalized quantifiers (Romero 1998; Fox 1999), this paper shows that movement also does not create λ-abstractions over properties and that traces cannot be shifted into property meanings.

Data: Postal (1994) observes that there are environments in English that can be targeted by only some types of A′-movement. For example, in existentials, *wh*-movement can target the post-verbal position (1b), but topicalization cannot (1c). For space, only four of the environments are given here: existentials (1), change-of-color verbs (2), predicate nominals (3), and naming verbs (4). (The paper includes discussion of several purported counterexamples for topicalization, e.g. *Pat may be a good administrator, but* ***a good teacher****, he is not*; not discussed here for space.)

(1) a. There is **a book** on the table.
 b. ✓**What**$_1$ is there t_1 on the table?
 c. ***A book**$_1$, there is t_1 on the table.

(2) a. Sue painted the house **blue**.
 b. ✓**What color**$_1$ did Sue paint the house t_1?
 c. ***Blue**$_1$, Sue painted the house t_1.

(3) a. Pat was **a teacher**.
 b. ✓**What kind of teacher**$_1$ was Pat t_1?
 c. ***A math teacher**$_1$, Pat was t_1.

(4) a. Helen called the cat **Garfield**.
 b. ✓**What name**$_1$ did Helen call the cat t_1?
 c. ***Garfield**$_1$, Helen called the cat t_1.

We discover three novel empirical generalizations about these A′-asymmetries: **[Generalization I: Properties]** The apparently heterogeneous syntactic environments that exhibit the asymmetry are environments where the DP denotes a *property*, i.e. type $\langle e, t \rangle$. To support this characterization, we appeal to independently-motivated arguments in the literature for each of the environments: existentials (Heim 1987; McNally 1997, 1998), change-of-color verbs (Kratzer 2005), predicate nominals (Williams 1983; Partee 1986), and naming verbs (Matushansky 2008). We refer to these environments as **Π-positions**. **[Generalization II: Scope]** Movement cannot target a Π-position iff that movement shifts the scope of the moved DP. Some movement types, e.g. topicalization, can be shown to shift scope obligatorily (5). For this reason, they can never target a Π-position.

(5) a. *Everyone* likes **a (different) TV show**. ✓every ≫ a; ✓a ≫ every
 b. **A (#different) TV show**$_1$, *everyone* likes t_1. *every ≫ a; ✓a ≫ every

However, other movement types, e.g. *wh*-movement, can be shown to shift scope optionally (6). Crucially, these movement types can only target Π-positions when they do not shift scope (7).

(6) **How many books**$_1$ should Nina read t_1? ✓how many ≫ should; ✓should ≫ how many
 a. *Wide:* For what n: There are n-many particular books x such that Nina should read x.
 b. *Narrow:* For what n: It is necessary for there to be n-many books x such that Nina reads x.

(7) a. **How many books**$_1$ should there be t_1 on the table? *h.m. ≫ should; ✓should ≫ h.m.
 b. **How many colors**$_1$ should Nina paint the house t_1? *h.m. ≫ should; ✓should ≫ h.m.

c. **How many kinds of teacher**$_1$ should Nina become t_1? *h.m. ≫ should; ✓should ≫ h.m.

d. **How many nicknames**$_1$ should Nina call the cat t_1? *h.m. ≫ should; ✓should ≫ h.m.

This generalization is further supported by Π-positions prohibiting QR over the subject or negation:

(8) a. There are*n't* **two books** on the table. ✓not ≫ two; *two ≫ not

b. *A (#different) contractor* painted the house **every color**. ✓a ≫ every; *every ≫ a

c. *A (#different) student* became **every kind of teacher**. ✓a ≫ every; *every ≫ a

d. *A (#different) child* called the cat **every dumb name**. ✓a ≫ every; *every ≫ a

[Generalization III: Weak definites] Definites in Π-positions cannot be anaphoric, as shown in (9) where quantificational covariance with an indefinite is impossible from a Π-position. Thus, definites in Π-positions are always *weak definites*, and never strong definites (in the sense of Schwarz 2009).

(9) Every time Irene picks out *a new color* for the bathroom, { #Helen has to paint the room [**the color**]$_{\Pi\text{-pos}}$ / ✓Helen complains that **the color** is too bright }.

Analysis: Scope-shifting movement is incompatible with Π-positions because it must leave a trace of type *e* in order to shift scope. An *e*-type trace is incompatible with the property-type requirement of a Π-position, thereby yielding a type mismatch and hence ungrammaticality (10). Movement that does not shift scope instead reconstructs syntactically. Therefore, if a DP would not ordinarily violate the property-type requirement of a Π-position, it will not under reconstruction either (11).

(10) *[$\text{DP}_1\ \lambda x_e \ldots [\ldots [\ x_e\ ]_{\Pi\text{-pos}} \ldots]]$
type *e* trace

(11) ✓[$\_\__1 \ldots [\ldots [\ \text{DP}_1\ ]_{\Pi\text{-pos}} \ldots]]$
reconstruct

When seemingly type-*e* DPs occur in a Π-position (e.g. *I painted the house the darker shade of green*), a property-type denotation is achieved via nominal type shifting (Partee 1986), in particular using $\mathcal{BE}$, which shifts from the generalized-quantifier domain into the property domain. A ban on type shifting traces prevents type shifting in (10). We will propose that this ban derives from the complementarity of nominal type shifting and Trace Conversion (TC), the LF rule that interprets traces wherein the lower copy of a chain is converted into an anaphoric definite description (Fox 2002). Under Schwarz's (2009) weak–strong definite distinction, TC crucially requires the strong definite determiner because it has access to an index that can be bound by the higher λ-abstraction created by movement (13). We propose that the complementarity is *syntactic*: (i) *the*$_{\text{STRONG}}$ occupies D^0, (ii), nominal type shifters occupy D^0 as well, and (iii) *the*$_{\text{WEAK}}$ occupies some lower functional head, say n^0; this is schematized in (14). The result is that (i) TC and type shifting cannot apply to the same nominal and (ii) type-shifted definites in Π-positions are always weak definites (see 9).

(12) $[\![\text{the}_{\text{WEAK}}]\!] = \lambda s\, \lambda P\, .\, \iota x[P(x)(s)]$

(13) $[\![\text{the}_{\text{STRONG}}]\!] = \lambda s\, \lambda P\, \lambda y\, .\, \iota x[P(x)(s) \wedge x = y]$

(14) $[\ \text{D}^0\ [\ n^0\ \text{NP}\ ]]$ (where *the*$_{\text{STRONG}}$ and type shifters are in D^0 and *the*$_{\text{WEAK}}$ is in n^0)

Implications: First, Π-positions show that movement cannot create λ-abstractions over properties. Otherwise, scope-shifting movement would be able to target Π-positions. Π-positions thus provide a novel argument for the hypothesis that syntactic operations only ever create λ-abstractions over individual types. Second, the three novel generalizations show that the Π-position asymmetry is not an arbitrary distinction between movement types, but reduces to scope. This recharacterization leads to an analysis that preserves the syntactic uniformity of A′-movement, contra Postal (1994). Third, since quantificational elements can occur in Π-positions but only with in-situ scope, there must be some mechanism for interpreting quantifiers (over properties) in-situ in English.