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# Type logic served by co-Merge, Merge and Move: an account for sluicing and questions of “common European” and Japanese types

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## Type logic served by co-MERGE, MERGE and MOVE: an account for sluicing and questions of “common European” and Japanese types (March 23, 2007)

We explore the power of type-logical grammar as a linguistic theory, specifically, of a new tentative development inside the framework—a “symmetricized” Lambek Calculus, due to [Moortgat2005]. The basis for our discussion is an account we give for constructions involving questions and—in particular—involving sluicing; it seeks to solve puzzles these constructions have been setting for linguistic theory. Two things in the organization of grammar are of interest here: first, a uniform system joining structures from the surface side (syntactic) and structures from the “mind side” (discourse)—we call MERGE and co-MERGE the relations by which the former and the latter structures are arranged; second, a view on the circumstances of performing MOVE (by Syntax) from the type-logical perspective. As it is usual for type-logical grammars, the theory is conscious of semantics.

**Questions and sluicing.** We consider (embedded) special questions (1),(2), sluicing (3) (underlined; note: an indefinite (framed) is a prerequisite for the construction)—described in [Ross1969], “sluicing-based NPs” (4)—discussed in [Bylinina&Testeleets2004] (the Japanese one is strange in its absence of overt material).

- (1) *Taro-wa*  $[[dare\text{-}ga\ katta]\ mochi]\text{-}o$  *tabemasita ka?* (JAPANESE)  
Taro-TOP  $[[who\text{-}NOM\ bought]\ rice.cake]\text{-}ACC$  ate Q [Shimoyama2006, (4a)]  
‘Who<sub>x</sub> did Taro eat rice cakes that *x* bought?’
- (2) *I don’t know what John ate.* (ENGLISH)
- (3) *Taro-ga*  $[\underline{nani\text{-}ka\text{-}o}]$  *tabeta rasii ga,...* *boku-wa*  $\underline{nani\text{-}o}$   $(\underline{da})$   $\underline{ka}$  *wakara-nai* (JAPANESE)  
Taro-NOM what-KA-ACC ate seem but I-TOP what-ACC (COP) Q know-not [Hiraiwa&Ishihara2002, (40)]  
‘It seems that Taro ate  $[\underline{something}]$ , but... I don’t know what.’ (ENGLISH)
- (4) *Dare-kara-(da)-ka* *henna tegami-ga todoita.* (JAPANESE)  
who-from-(COP)-KA strange letter-NOM arrived [Shimoyama2006, p. 10, (iii)]  
‘A strange letter came from God knows who.’ (ENGLISH)

Some theoretical puzzles they present: the syntactic properties of WH-items (they move; they cause pied-piping), the semantic non-compositionality/non-locality of WH-in-situ constructions, the role of Syntax and Discourse in sluicing (copy+delete or anaphoric link?), the apparent change of category in (4) (sentence  $\rightsquigarrow$  NP or PP), the (quasi-)grammaticalization of the sluicing-based NPs, the semantics of WH-items and the connection to other kinds of pronouns; and differences between languages.

**Type-logical grammars** (categorial grammars+Montague-style semantics; refer to [Moortgat1997] for a presentation) are based on the primitive, allegedly indispensable formal laws (“*logic*”) of combination, which happen to act at the Syntax–Semantics–Discourse interface. These laws reflect inherent universal properties of computation (it’s semantic composition that is a computation: the computation of the semantic value). The laws are formulated in terms of *types* (or *categories*)—abstractions of semantic values and syntactic properties of linguistic objects. The language-specific part of the grammar in this approach are the assignments of types (and underlying semantic values) to lexical items.

In our considerations, we adopt a new tentative development inside the framework—“symmetricized” Non-associative Lambek Calculus, due to [Moortgat2005]. The aim is to gain descriptive power but preserve the predictive stringency as a linguistic theory.

<i>Direct</i> composition laws (structures arranged by $\otimes$ (MERGE) are taken from Syntax): $A \rightarrow C/B \iff A \otimes B \rightarrow C \iff B \rightarrow A \setminus C,$ $(A \rightarrow C \text{ and } B \rightarrow D) \implies A \otimes B \rightarrow C \otimes D,$	<i>Dual</i> composition laws (structures arranged by $\oplus$ (co-MERGE) are given to Discourse): $C \oslash B \rightarrow A \iff C \rightarrow A \oplus B \iff A \oslash C \rightarrow B,$ $(A \rightarrow C \text{ and } B \rightarrow D) \implies A \oplus B \rightarrow C \oplus D,$
<i>Interaction</i> laws: $(A \oslash B) \otimes C \rightarrow A \oslash (B \otimes C)$ and $B \otimes (A \oslash C) \rightarrow A \oslash (B \otimes C),$ and similarly for $\oslash.$	

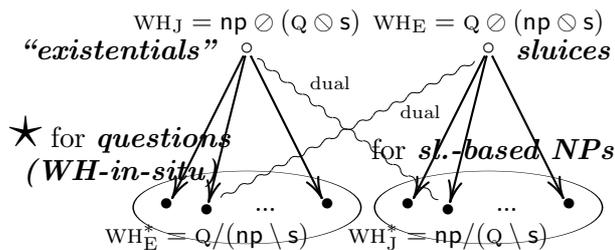
This calculus of types is in accordance with a suitable theory of semantics (in “continuation passing style” [Barker2002]). Derivability between types (“ $\rightarrow$ ”) is to be understood as the ability (for an item of a corresponding type) to expose a certain behavior.

The descriptive gain is the coverage of long-distance & discourse-linked phenomena (examples: analyses below), and possibly, a grip on (some of) the conditions of movement. The explanatory strength is due to a “minimalism” in the architecture of the system: • just the few (motivated) primitives make up the system; • the single system spans several “levels” of Language; • lexical peculiarities must be semantically justified. (Cf. the methodological arguments of Chomsky’s minimalism.) No extra stipulations should be admitted.

**Composition in MERGE- & CO-MERGE-structures. Analysis of questions and sluicing.** In the analysis of indefinites, we follow the ideas developed in [Heim1982; Kamp1981; Muskens1994; Dekker2000; Jäger2005]; type assignment:  $someone \vdash np \otimes np$ ; by the interaction and direct composition laws, “Someone came” derives  $(np \otimes s)$ —the type of a complete sentence with a link to an object of type  $np$  in the discourse (the indefinite). Sluicing is analyzed similarly: the type reflects a discourse anaphoric link leading to the antecedent sentence (like in [Jäger2005]). Our analysis of WH-in-situ follows [Moortgat2005]; it involves also the dual composition laws in the derivation of a complete question phrase.

We formally explore the derivability relations between the involved types; the results are presented by the diagram. It explains the patterns of questions and sluicing, hints at solutions to the mentioned puzzles and supplies predictions as to which language types are (im)possible w.r.t. such constructions. The summary of our view is as follows:

We admit an extra stipulation (which is bad!): lexical items come in two “dual” variants.



Japanese: WH-extraction is impossible in Syntax, but **questions** are a necessary language function (★). So, the WH-item must be assigned a type  $(WH_J)$  suitable for **WH-in-situ question** formation. Consequences: **sluicing** is not available for  $WH_J$  (so, it’s done by Syntax and is subject to syntactic restrictions); there are **sluicing-based NPs** (realized by the dual WH-item  $WH_J^*$ ; subject

to strong syntactic restrictions—that’s why (4) is so defective); other—discourse-linked—uses of *nani...-ka* are predicted by our scheme: these are the “**existentials**” (framed in (3))! (Previously, they have commonly been assumed to be unrelated to questions.)

The “common European” type (English, Russian, ...) is symmetric: WH-extraction is possible, **questions** are formed using a “weak” type  $(WH_E^*)$ , able only to directly combine with sentences with gaps), which is related by duality to the type for anaphoric **sluicing**  $(WH_E)$ ; not sensitive to syntactic restrictions); **sluicing-based NPs** are easily formed; the WH-item can’t realize **existentials** (they are realized by other indefinite pronouns; note: Russian bare WH-items present a problem for this prediction).

So, our analysis shows how a single type assignment can explain the connection between several language phenomena where a lexical item participates in either discourse relations, or long-distance relations within a sentence, or just in direct combination (this kind of ambiguity of certain lexical items has been noticed to be systematic); and how the alternation in type explains the typology. This is a success of the Symmetric Lambek Calculus. Further work is required: a more thorough study of the data (and extension to related constructions, such as relative clauses, indefinite pronouns), understanding the formalisms, and coping with the extra stipulation we made. Here is how to do the last: **Low-level syntax: circumstances of MOVE.** We shall maintain a view where the grammar is organized in a complementary way: the “high-level” type-logical module is served by a “lower-level” Syntax module, which performs MERGE and MOVE under its own restrictions. We shall discuss the reasons the type logic gives for movement.

The cases where our theoretically unwanted “duality assumption” is used (“common European” WH-question formation, Japanese sluicing-based NPs) are also the cases involving movement: the “weak”  $WH_E^*$  and  $WH_J^*$  combine with sentences with gaps. We suggest to substitute the “duality stipulation” by a theory of MOVE. Informally, the idea is as follows. Consider (2). At the place of the gap, a syntactic object is merged which has a hypothesis of type  $s/Q$  inside and as a whole is of type  $np$  (a sluicing-based NP): *John ate*  $[\emptyset_{s/Q} \text{ what}]_{np}$ ; MOVE is performed to cancel the hypothesis: the object must be re-merged into a position where it “directly” takes the value for the hypothesis from the enclosing sentence (“*I don’t know*” for  $\emptyset_{s/Q}$ ).

In the presented framework, **pied-piping** (in sluicing-based NPs and by WH-extraction) is to be treated by assigning “stronger” types to WH-items, e.g. for WH inside NP in “common European”:  $np \otimes (WH_E \otimes np)$ ,  $np \otimes (WH_E^* \otimes np)$ . Note: they can also behave as the normal  $WH_E$ ,  $WH_E^*$ , respectively. The 2nd case would have been a problem for our original theory (a further complication of the “duality stipulation”) unless we reduced the treatment of WH-extraction to sluicing-based NPs.

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