



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&Tستهlets2004] (the Japanese one is strange in its absence of overt material).

- (1) *Taro-wa* [[*dare-ga katta*] *mochi*]-*o* *tabemasita ka?* (JAPANESE)
 Taro-TOP [[who-NOM bought] rice.cake]-ACC ate Q [Shimoyama2006, (4a)]
 ‘Who_x did Taro eat rice cakes that *x* bought?’
- (2) *I don't know* *what John ate*. (ENGLISH)
- (3) *Taro-ga* [*nani-ka-o*] *tabeta rasii ga...* *boku-wa* *nani-o* (*da*) *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 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.

<p><i>Direct</i> composition laws (structures arranged by \otimes (MERGE) are taken from Syntax):</p> $A \rightarrow C/B \iff A \otimes B \rightarrow C \iff B \rightarrow A \setminus C,$ $(A \rightarrow C \text{ and } B \rightarrow D) \implies A \otimes B \rightarrow C \otimes D,$ <p><i>Interaction</i> laws: $(A \otimes B) \otimes C \rightarrow A \otimes (B \otimes C)$ and $B \otimes (A \otimes C) \rightarrow A \otimes (B \otimes C)$, and similarly for \oslash.</p>	<p><i>Dual</i> composition laws (structures arranged by \oplus (co-MERGE) are given to Discourse):</p> $C \oslash B \rightarrow A \iff C \rightarrow A \oplus B \iff A \oslash C \rightarrow B,$ $(A \rightarrow C \text{ and } B \rightarrow D) \implies A \oplus B \rightarrow C \oplus D,$
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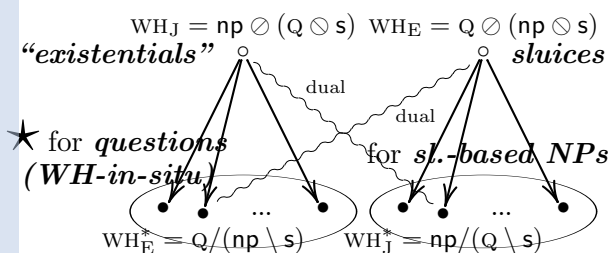
This calculus of types is in accordance with a suitable theory of semantics (in “continuation passing style” [Barker2002]). Derivability between types (“ \rightarrow ”) is to be understood as the ability (for an item of a corresponding type) to expose a certain behavior.

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.

References

- Barker, C. (2002). Continuations and the nature of quantification. *Natural Language Semantics*, 10(3):211–242.
- Bernardi, R. and Moortgat, M. (in progr.). A CPS semantics for LG. <http://grail.let.uu.nl/~mjm/Tarragona/CGDocs/lgterms.pdf>; also see the ESSLLI 2007 course “Symmetric Categorical Grammar” <https://www.cs.tcd.ie/esslli2007/content/courses/id75.html>.
- Bylinina, L. and Testelets, Y. (2004). On sluicing-based indefinites. In *Proceedings of FASL 13*.
- Dekker, P. (2000). Grounding dynamic semantics. Manuscript.
- Heim, I. (1982). *The semantics of definite and indefinite noun phrases*. PhD thesis, University of Massachusetts, Amherst.
- Hiraiwa, K. and Ishihara, S. (2002). Missing links: Cleft, sluicing, and *no da* construction in Japanese. In *Proceedings of HUMIT 2001*, volume 43 of *MIT Working Papers in Linguistics*, pages 35–54.
- Jäger, G. (2005). *Anaphora and Type Logical Grammar*, volume 24 of *Trends in Logic*. Springer.
- Kamp, H. (1981). A theory of truth and semantic representation. In Groenendijk, J., Janssen, T., and Stokhof, M., editors, *Formal Methods in the Study of Language, Part 1*, volume 135, pages 277–322. Mathematical Centre Tracts, Amsterdam. Reprinted in Jeroen Groenendijk, Theo Janssen and Martin Stokhof (eds), 1984, *Truth, Interpretation, and Information; Selected Papers from the Third Amsterdam Colloquium*, Foris, Dordrecht, pp. 1–41.
- Moortgat, M. (1997). Categorical type logics. In van Benthem, J. and ter Meulen, A., editors, *Handbook of Logic and Language*, chapter 2, pages 93–177. Elsevier, MIT Press, Amsterdam.
- Moortgat, M. (2005). Grammatical invariants. Presented at the *workshop “Proof theory at the syntax-semantics interface”*, LSA Institute 2005, MIT/Harvard. Slides at the workshop site on <http://web.mit.edu/lsa2005/>.
- Muskens, R. (1994). Categorical grammar and discourse representation theory. In *Proceedings of the 15th conference on Computational linguistics*, pages 508–514, Morristown, NJ, USA. Association for Computational Linguistics.
- Ross, J. R. (1969). *Guess who?* In Binnick, R. I., Davidson, A., Green, G. M., and Morgan, J. L., editors, *Papers from the Fifth Regional Meeting of the Chicago Linguistic Society*, pages 252–286. University of Chicago.
- Shimoyama, J. (2006). Indeterminate phrase quantification in Japanese. *Natural Language Semantics*, 14(2):139–173.
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