Quantifier Particles and Compositionality

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Abstract

In many languages, the same particles build quantifier words and serve as connectives, additive and scalar particles, question markers, existential verbs, and so on. Do the roles of each particle form a natural class with a stable semantics? Are the particles aided by additional elements, overt or covert, in fulfilling their varied roles? I propose a unified analysis, according to which the particles impose partial ordering requirements (glb and lub) on the interpretations of their hosts and the immediate larger contexts, but do not embody algebraic operations themselves.

1 The compositionality question

Formal semanticists often treat even multi-morphemic words as compositional primitives. This paper examines a domain of data in which extending compositionality below the word level seems especially rewarding.

English *some, or, whether, every, both, and, even, too*, and *also* look like a motley crew. But in many other languages, the same particles build quantifier words and serve as connectives, additive and scalar particles, question markers, existential verbs, and so on. It is natural to ask if they are really "the same" across their varied environments.

Consider the following samples. Hungarian *ki* and Japanese *dare*, usually translated as 'who', are indeterminate pronouns in the terminology of Kuroda 1965. *Ki* and *dare* form 'someone' and 'everyone' with the aid of morphemes whose more general distribution is exemplified below. The joint distribution of Hungarian *vala/vagy* and etymologically unrelated *-e* corresponds, roughly, to that of Japanese *-ka.* The joint distribution of *mind* and *is* corresponds to that of *-mo* (see further in Szabolcsi, Whang & Zu 2013, Szabolcsi 2013).

Slavic languages, Malayalam, Sinhala, and many others exhibit similar patterns. I will use upper-case KA and MO as generic cross-linguistic representatives.

(1)	*Hungarian*	*Japanese*	*Gloss*
a.	**vala**-ki	dare-**ka**	'someone'
b.	A **vagy** B	A-**ka** B(-**ka**)	'A or B'
c.	**vagy** száz	hyaku-nin-to-**ka**	'some 100 = approx. 100'
d.	**val-, vagy-**	–	'be' participial & finite stems
e.	–	dare-ga VP-**ka**	'Who is VP-ing?'
f.	[S-**e**]	S-**ka**	'whether S'

(2)	*Hungarian*	*Japanese*	*Gloss*
a.	**mind**-en-ki	dare-**mo**	'everyone/anyone'
b.	**mind** A **mind** B [A **is** (és) B **is**]	A-**mo** B-**mo**	'A as well as B, both A and B'
c.	[A **is**]	A-**mo**	'also/even A'

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2 A promising perspective: join and meet

There is a beautiful generalization that caught the eyes of many linguists working with these data (Gil 2008, Haspelmath 1997, Jayaseelan 2001, 2011, among others; see Szabolcsi 2010: Ch 12). In one way or another, the roles of KA involve existential quantification or disjunction, and the roles of MO involve universal quantification or conjunction. Generalizing,

(3) KA is lattice-theoretic join ($\cup$), MO is a lattice-theoretic meet ($\cap$).

Alternative Semantics has thrown a new light on the signature environments of KA. Hamblin 1973, Kratzer & Shimoyama 2002, Alonso-Ovalle 2006, Aloni 2007, AnderBois 2012, and others proposed that not only polar and wh-questions but also declaratives with indefinite pronouns or disjunctions contribute sets of multiple classical propositions to interpretation. They contrast with declaratives that are atomic or whose main operations are negation, conjunction, or universal quantification, and contribute singleton sets of classical propositions. If the universe consists of Kate, Mary, and Joe, we have,

(4) a. Who dances?, Someone dances, Kate or Mary or Joe dances
$\{\{w : \mathsf{dance}_w(k)\}, \{w : \mathsf{dance}_w(m)\}, \{w : \mathsf{dance}_w(j)\}\}$

b. whether Joe dances
$\{\{w : \mathsf{dance}_w(j)\}, \{w : \neg\mathsf{dance}_w(j)\}\}$

(5) a. Joe dances
$\{\{w : \mathsf{dance}_w(j)\}\}$

b. Everyone dances
$\{\{w : \mathsf{dance}_w(k) \,\&\, \mathsf{dance}_w(m) \,\&\, \mathsf{dance}_w(j)\}\}$

Inquisitive Semantics (say, Ciardelli et al. 2012) develops a notion of propositions as non-empty, downward closed sets of information states. The sentences in (4) and (5) are recognized as inquisitive and non-inquisitive propositions, respectively; disjunction and conjunction re-emerge as Heyting-algebraic join and meet.

The upshot is that the Alternative/Inquisitive Semantic perspective offers an even more interesting way to unify KA's environments, and maintains the possibility to treat KA as a join and MO as a meet operator, although in a slightly modified algebraic setting. In other words, it looks like the core roles of KA and MO can be assigned a stable semantics, and a simple one at that.

3 Mismatches: Too few arguments, too many operators

There are two general problems with this beautiful approach. The first problem is that both KA and MO may have just one argument. Schematically,

(6) Hungarian (KA = *vagy*, MO = *is*), Russian (MO = *i*), Japanese (MO = *mo*):

10-KA boys ran.	'Approximately/at least ten boys ran'
John-MO ran.	'Also/even John ran'

The flip-side problem is that in some cases KA and MO occur on all their alleged arguments. In Sinhala, both inclusive disjunction *hari* and alternative question forming disjunction *də* attach to each disjunct, as illustrated in (7). Japanese *mo*, Russian *i*, and Hungarian *mind* as well as *is* all attach to each conjunct in the distributive construction illustrated in (8).

(7) Sinhala (KA = *hari* / *də*):

John-KA Mary-KA ran.	'John or Mary ran'
John-KA Mary-KA ran?	'Did John run, or did Mary?'

(8) Japanese (MO = *mo*), Russian (MO = *i*), Hungarian (MO = *mind* / *is*)

John-MO Mary-MO ran 'John as well as Mary ran'

Russian *li* and Hungarian *-e*, the morphemes that mark alternative questions alternate with 'or not' in glorious justification of the Hamblin/Karttunen analysis of *whether*. But, embarrassingly, they also co-occur with 'or not' – which is in fact equally possible in the case of *whether*.

(9) Russian (KA = *li*), Hungarian (KA = *-e*)
... John ran-KA
... John ran or not 'whether (or not) John ran'
... John ran-KA or not

The first problem might be explained away by assuming that the single argument represents or evokes a set of alternatives, to which join and meet can sensibly apply. But it is not clear how that assumption would explain the cases where KA and MO attach to each of the dis/conjuncts, i.e. where we have too many actors for one role.

I conclude that KA is not join, and MO is not meet. But, in solving the problems I would like to preserve the insight that KA and MO occur precisely in contexts that are the least upper bound / greatest lower bound of the contribution of the host of KA/MO and something else.

4 The gist of the solution: KA/MO impose semantic requirements on the context

There are three basic strategies for solving the mismatch problems:

(10) a. KA and MO are meaningful, but their mission in the compositional process is not directly related to $\cup$ and $\cap$.

b. KA and MO are meaningless syntactic elements that point to (possibly silent) meaningful $\cup$ and $\cap$ operators. Compare $\pm$ interpretable features.

c. KA and MO are meaningful elements that point to least upper bounds (join) and greatest lower bounds (meet) in a semantic way. Compare presuppositions.

The analysis of KA in Hagstrom 1998, Yatsushiro 2009, Cable 2010, and Slade 2011 can be seen to represent option (a). On this view, KA is a choice-function variable that eliminates alternatives. I will not pursue this analysis here, because it inherits the problems of choice-functional analyses of indefinites, it offers no parallel insight for MO's role, it assumes that alternatives (in general, sets as opposed to individuals) are bad for you, and it does not help with the "too many actors" problem.

Variants of option (b) have been proposed in Carlson 1983, 2006 for all functional categories, in Ladusaw 1992 for negative concord, in Beghelli & Stowell 1997 for *every/each*, and in Kratzer 2005 for *ka*, *mo*, and more concord phenomena. Taking KA and MO to be meaningless syntactic pointers could be viable. But I'm going to argue that the semantic route is also viable and interesting.

Option (c) says that KA and MO are meaningful elements that point to joins and meets in a semantic way. This is what I am going to pursue. My approach draws from Kobuchi-Philip 2009 and Slade 2011, works that took seriously some problems that other literature glossed over, and provided important elements of the solutions.[1]

MO is a good starting point, because the standard analysis of *too* easily extends to MO in *John-MO ran* 'John, too, ran' (I put scalar 'even' aside). *John-MO ran* is thought to assert that John ran and to presuppose that a salient individual distinct from John ran. So MO can be seen as a "semantic pointer" — it points to a fact not mentioned in the sentence, and ensures that the context is such that both John and another individual ran. Kobuchi-Philip's insight is that in *John-MO Mary-MO ran* 'John as well as Mary ran', both MO's can be seen as doing the same thing. John's running and Mary's running mutually satisfy the requirements of the two MOs. Similarly for *Person-MO ran* 'Everyone ran', with generalized conjunction.

The mutual satisfaction of requirements is reminiscent of presupposition projection, and so a small amendment is called for. Presupposition projection works left-to-right, at least when it is effortless (Chemla & Schlenker 2012). If so, the symmetrical character of these constructions is a problem. I reclassify these definedness conditions as postsuppositions in the sense of Brasoveanu 2013: tests that are delayed and checked simultaneously after the at-issue content is established. This is utilized in *John-MO Mary-MO ran.* In contrast, if nothing in the at-issue content satisfies the test, it is imposed on the input context and emerges as a presupposition. The traditional analysis of *John-MO ran* is reproduced. For details see Brasoveanu & Szabolcsi 2013.

Below, I will use the neutral term "requirement" instead of pre- or postsupposition. I assume that the same reasoning carries over to KA, whose semantics will be detailed in Section 6.

5 Ingredients of the analysis: Greatest lower bound / least upper bound requirements, pair formation, silent meet and join, defaults

To summarize, the "mismatch cases" offer the best insight into the working of the particles. The particles do not embody algebraic operations, as examples of the form *A Particle B* would lead us to believe. Instead, I suggest, the particles require that interpretations of their hosts and of the immediately larger contexts stand in particular partial ordering relations. The core of the proposal is this. For simplicity, I pretend that the hosts of KA and MO are propositions.

(11)

```
        Y
      /   \
    ...   X-KA / MO
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[1] In particular, Kobuchi-Philip 2009 proposed a unified analysis of Japanese *mo* that I follow with minor modifications. Slade 2011 was the first to take up the challenge posed by the multiple occurrences of KA-style particles and to invoke den Dikken's 2006 Junction; see Section 5. Also, Slade 2011 is my source for Sinhala.

(12) a. MO requires that another proposition parallel to $[\![X]\!]$ hold in $[\![Y]\!]$. MO's requirement is trivially satisfied if $[\![Y]\!]$ is the meet (glb) of $[\![X]\!]$ and something else.

b. KA requires that the alternatives in $[\![X]\!]$ be preserved and boosted in $[\![Y]\!]$. KA's requirement is trivially satisfied if $[\![Y]\!]$ is the join (lub) of $[\![X]\!]$ and something else.

But MO and KA do not perform meet and join operations. Who does, then?

Winter (1995, 1998: Ch 8) argued that the word *and* in *A and B* is not conjunction; it merely forms pairs:

(13) $A \,\text{and}\, B = A \bullet B = \langle A, B\rangle$

Pairs grow pointwise, much like Hamblinian alternatives. At some point silent meet ($\cap$) applies, creating the illusion that *and* scopes there. The pair-former can be silent (asyndetic conjunction); in many languages it is always silent. In contrast, *or* is cross-linguistically almost never silent (no asyndetic disjunction). I adopt the decomposition of conjunction into pair-formation and silent meet, with the following modifications:

(14) a. Identify the pair-former, whether overt or silent, with the syntactic Junction (J) head that den Dikken 2006 detected in *either* ... *or* ... disjunctions.

b. Delimit the pointwise growth of pairs to avoid scopal overgeneration.

c. Replace Winter's plain Boolean $\cap$ with Dekker's 2012 order-sensitive $\cap$, which interprets the 2nd conjunct strictly in the context of the 1st (cf. anaphora).

d. Recognize silent order-sensitive $\cap$ as the default propositional operation.

Canonizing order-sensitive $\cap$ as the default will be important in regulating the use of KA, but it has independent motivation. All languages use silent order-sensitive $\cap$ for text-level sequencing. Bumford 2013 even shows that the definition of universal quantifiers involves the iteration of order-sensitive $\cap$.

To wrap up the emergent analysis of *A-MO B-MO* 'A as well as B,' it contains a pair-forming $\bullet$, overt or silent, silent $\cap$, and the MOs, which impose postsuppositional requirements on the context and make the construction irrevocably distributive in the process.

Compare the following Hungarian examples. In both, *és* 'and' is the pair-former Junction, and silent $\cap$ applies. The collective reading of (15) is due to a shift, as in Winter 1998, 2002. The collective shift is bled by the MO-particles, as in (16).

(15) *Kati és Mari felemelte az asztalt.*
Kate and Mary up-lifted the table-ACC

'Kate and Mary lifted up the table, individually or together'

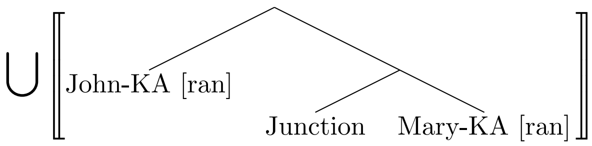
(16) *Kati is (és) Mari is felemelte az asztalt.*
Kate MO (and) Mary MO up-lifted the table-acc

'Kate as well as Mary lifted up the table, individually'

See Mitrović & Sauerland 2013 for connectives that incorporate both Junction and MO or KA, among them Latin *at-que* 'and, nevertheless' and Russian *i-li* 'or'.

We now turn to KA. I take the iterated KA of Sinhala to be paradigmatic, cf. (7), and add silent join ($\cup$) to the inventory. Winter assumed that conjunctions and disjunctions have completely different structures. I assume that they have the same structure, with silent $\cap$ versus silent $\cup$.

(17) John or Mary ran:



The significant fact, I suggest, is that cross-linguistically, KA is only mandated in disjunctions (A B never means 'A or B'), but not in wh-questions or in indefinites. German offers good examples of the absence of any KA-style particle from the latter contexts (Haida 2007):

(18) *Wer MAG was?*
who likes what
'Who likes something?'

KA must be present in disjunctions, because the default operation on pairs is meet, $\cap$. KA's semantic requirement forces the pair to be fed to join, $\cup$.

In contrast, when join is the default, KA's presence is subject to variation. One reason for non-disjunctive KA to be present can be to signal that join composes with another operator, as in the various flavors of epistemic indefinites.

Why KA/MO is sometimes present on each "junct" and sometimes on just one requires further morpho-syntactic research. But, my assumption is that there is no "completely silent" KA/MO. If there is not a single overt copy in the construction, KA/MO is not there, and the construction is interpreted via semantic defaults.

6 Alternatives in KA's host must be preserved and boosted

In line with (12b), KA imposes the following requirement:

(19) KA requires that $[\![X]\!]$, the alternatives introduced by its host X, be preserved and boosted in $[\![Y]\!]$, the interpretation of the immediately larger context: $[\![X]\!] < [\![Y]\!]$. This ensures that $[\![Y]\!]$ is the least upper bound of $[\![X]\!]$ and something else.

Let us first see how things pan out with linguistic data beyond plain disjunctions. The core indefinite and wh-question examples reproduce (4a):

(20)

Hungarian	*Japanese*	*Gloss*	*Meaning*
-ki táncol	dare- odorimasu		$\{\{w : \mathsf{dance}_w(x)\} : \mathsf{person}(x)\}$
Vala-ki táncol	dare-ka odorimasu	'Someone dances'	$\bigcup\{\{w : \mathsf{dance}_w(x)\} : \mathsf{person}(x)\}$
Ki táncol?	dare-ga odorimasu-ka	'Who dances?'	

Krifka 2001, arguing for structured meanings for questions, distinguishes polarity questions, which can be answered by plain *Yes* or *No*, from alternative questions, which require repeating one of the alternatives, possibly accompanied by *Yes* or *No*. (He notes that Karttunen 1977 considers polarity questions a subclass of alternative questions.) Let us look at Hungarian data. $\uparrow$ indicates final rising intonation, and $\downarrow$ falling, declarative intonation. (No such distinction exists in complements.) I consider the *-e* suffix on the finite verb a KA-particle, although it is etymologically unrelated to *vala/vagy*:

(21)	a. Alszik? ↑	'Is he asleep?'	**compl:**	*. . . alszik.
	b. Alszik vagy nem?	'Is he asleep or not?'		. . . alszik vagy nem.
	c. Alszik-e? ↓	'Is he asleep-KA?'		. . . alszik-e.
	d. Alszik-e vagy nem?	'Is he asleep-KA or not?'		. . . alszik-e vagy nem.

I propose that only *Alszik?* ↑ is a Krifkean polarity question and that polarity questions are a main-clause phenomenon, interpreted via the Inquisitive Semantic ? operator (non-informative closure). Alternative questions, being disjunctions, always contain either one KA (*-e* or *vagy*) or two (*-e* and *vagy*). The KA-particle *-e* requires $[\![X]\!] < [\![Y]\!]$, as in (19). In (21c) the only possible exclusive alternative is "accommodated" — in (21d) it is spelled out.

The approximate-number constructions in (1c) corroborate the existence of "unary KA" alongside "unary MO". *Hyaku-nin-to-ka-*, *vagy száz*, and *some one hundred* mean, '100 or another number in the vicinity of 100.' Dutch *een* (M. den Dikken, p.c.) and Hebrew *eyze* (D. Farkas, p.c., with reference to Kagan & Spector 2008) also attach to full arguments:

(22) a. Neem een Chomsky.
'Take for example Chomky' = 'Take Chomsky or someone like him'

b. Kxi eyze tapuax!
'Take an apple or something' = 'Take an apple or some other fruit'

Let us now make the interpretation more precise. Switching from Alternative Semantics to Inquisitive Semantics does not have a major effect on the linguistic analysis of KA, but it gives access to well-defined algebraic tools, and to the ? and ! operators (non-informative and non-inquisitive closure, resp.). I assume some basic definitions in Ciardelli et al. 2012.[2]

An Inquisitive Semantic definition of $[\![X]\!] < [\![Y]\!]$ must ensure that the alternatives of KA's host X are "preserved" and "boosted". It must approve $[\![Y]\!] = \bigcup([\![X]\!], [\![Z]\!])$ and possibly also $[\![Y]\!] = ((\bigcup([\![X]\!], [\![Z]\!]))^*)^*$ i.e. one-fell-swoop non-inquisitive join, as satisfiers of KA. It must exclude shrinking, $[\![Y]\!] = \bigcap([\![X]\!], [\![Z]\!])$ and what I dub endogamy, $[\![Y]\!] = (([\![X]\!])^*)^*$, as satisfiers of KA. The following definition will do; other definitions are imaginable if we abandon downward closure.

(23) $[\![X]\!] < [\![Y]\!]$ iff every possibility in $[\![X]\!]$ is a possibility in $[\![Y]\!]$, and $[\![Y]\!]$ contains a possibility that is excluded in $[\![X]\!]$.

(24)-(25) examine the effect from the perspective of just one KA, which suffices for the formal demonstration. Both (24a) and (24b) preserve all possibilities in [\![Mary runs]\!], and add a possibility excluded in [\![Mary runs]\!], e.g. $\{k \neg m\}$ = only Kate runs. KA is happy.

(24) a.
$$\begin{aligned}[\![Y]\!] &= \bigcup([\![\text{KA(Mary runs)}]\!], [\![\text{Kate runs}]\!]) \\ &= \wp\{w : \mathsf{run}_w(m)\} \cup \wp\{w : \mathsf{run}_w(k)\} \\ &= \{\emptyset, \{m \neg k\}, \{mk\}, \{m \neg k, mk\}, \{k \neg m\}, \{k \neg m, mk\}\}\end{aligned}$$

[2] A **proposition** is a non-empty, downward closed set of possibilities. A **possibility** is a set of worlds. $[\phi] = [\![\text{John runs}]\!] = \wp\{w : \mathsf{run}_w(j)\}$. The informative content of ϕ, **info**$(\phi) = \cup[\phi]$. **Meet**: $A \cap B$. **Join** = $A \cup B$. **Pseudo-comp**: $A* = \{\beta : \textbf{disjoint}(\beta, \cup A)\}$. $A \cap A* = \bot$, but $A \cup A*$ may or may not be $\top$. ϕ is **informative** iff info$(\phi) \neq W$; ϕ excludes something in W. ϕ is **inquisitive** iff info$(\phi) \notin [\phi]$; ϕ has > 1 maximal possibility. An **alternative** is a maximal possibility. Non-inquisitive closure $[\mathbf{!}\phi] = ([\phi]^*)^* = \wp(\text{info}(\phi))$. Non-informative closure $[\mathbf{?}\phi] = [\phi] \cup [\phi]*$.

b. $[\![\mathrm{Y}]\!] = ((\bigcup([\![\mathrm{KA(Mary\ runs)}]\!], [\![\mathrm{Kate\ runs}]\!]))^*)^*$
$= \wp\{w : \mathsf{run}_w(m) \vee \mathsf{run}_w(k)\}$
$= \left\{ \begin{array}{l} \emptyset, \{m\,\neg k\}, \{mk\}, \{m\,\neg k, mk\}, \\ \quad \{k\,\neg m\}, \{k\,\neg m, mk\}, \{m\,\neg k, k\,\neg m\}, \{m\,\neg k, k\,\neg m, mk\} \end{array} \right\}$

(25) a. $[\![\mathrm{Y}]\!] = \bigcap([\![\mathrm{KA(Mary\ runs)}]\!], [\![\mathrm{Kate\ runs}]\!])$
$= \wp\{w : \mathsf{run}_w(m) \wedge \mathsf{run}_w(k)\} = \{\emptyset, \{mk\}\}$
\# KA: $\cap$ eliminates $\{m\,\neg k\}$ from $[\![\mathrm{Mary\ runs}]\!]$; possibilities are shrinking.

b. $[\![\mathrm{Y}]\!] = (([\![\mathrm{KA(Mary\ runs\ or\ Kate\ runs)}]\!])^*)^*$
$= ((\wp\{w : \mathsf{run}_w(m)\} \cup \wp\{w : \mathsf{run}_w(k)\})^*)^*$
$= \left\{ \begin{array}{l} \emptyset, \{m\,\neg k\}, \{mk\}, \{m\,\neg k, mk\}, \{k\,\neg m\}, \\ \quad \{k\,\neg m, mk\}, \{m\,\neg k, k\,\neg m\}, \{m\,\neg k, k\,\neg m, mk\} \end{array} \right\}$
\# KA in this position: ! preserves the possibilities in inquisitive $[\![\mathrm{Mary\ or\ Kate\ runs}]\!]$, but the new possibilities are all joins of old possibilities; endogamy.

It is important to have ! in interpreting indefinites and disjunctions. Generally, ! attaches to the scopes of externally static operators (27a), although not to all clause-boundaries (27b):

(26) Bill saw Joe or some girl, but I forget who/which
'whether Bill saw Joe or Bill saw some girl'
won't suffice: $[\phi_{\mathrm{joe}}] \cup [\phi_{\mathrm{kate}}] \cup [\phi_{\mathrm{mary}}]$ — needed: $[\phi_{\mathrm{joe}}] \cup (([\phi_{\mathrm{kate}}] \cup [\phi_{\mathrm{mary}}])^*)^*$

(27) a. Bill didn't invite Kate or Mary, but I forget which
\# 'didn't invite !(Kate or Mary)'
'didn't invite Kate or didn't invite Mary'

b. Bill thinks that they hired Kate or Mary, but I forget which
'whether Bill thinks that they hired Kate or he thinks that they hired Mary'

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