

# THE *WENN*/*OB*/*ODER* TRIANGLE

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## Abstract

In many languages across families, the connectives for conditionals, questions, and disjunctions partially converge: the language's conditional connective and its question particle are the same, or the question particle and the disjunction are. This article explores the patterns of lexical convergence in terms of the denotations of assertions, questions, and denials. It is argued that neither the partial convergence between the three connectives nor the lack of convergence between conditionals and disjunctions is accidental. To account for this, questioning is constructed as the pivot in a triangle of algebraic relations without a specified connection between disjunction and conditionalization.

## 1 Conditions, questions, and disjunctions can be marked lexically

Most languages have non-veridical lexical operators marking disjunctions, questions, and conditionals. In standard German, these operators differ lexically. Consider the triplet *wenn* 'if', *ob* 'whether', and *oder* 'or'.

- (1) *Wenn* du gewinnst, verliere ich.  
*if you win loose I*  
'If you win, I loose'
- (2) Ich fragte *ob* du gewonnen hast.  
*I asked whether you won have*  
'I asked whether you won'
- (3) Du gewinnst *oder* ich verliere.

‘You win or I loose’

In many languages, however, the three operators partially converge in the sense that one function word may fulfil two semantic roles. Where German has the triplet  $\langle c:wenn, q:ob, d:oder \rangle$  for the conditional, the question and the disjunction respectively, Dutch, for example, has  $\langle c:als, q:of, d:of \rangle$ , identifying the operators for questions and disjunctions, and French has  $\langle c:si, q:si, d:ou \rangle$ , identifying the operators for conditionals and questions. Both patterns of partial convergence – hitherto *wenn/oder/oder* for Dutch  $\langle c:x, q:y, d:y \rangle$  as well as *wenn/wenn/oder* for French  $\langle c:x, q:x, d:y \rangle$  – are frequent beyond chance. In this article, two conjectures are made regarding these patterns. Firstly, the partial convergence is facilitated by deep underlying similarities in the semantics of the sentences governed by conditionalization, questioning and disjunction, respectively. Secondly, it is unlikely that any language will identify the conditional and the disjunction while having a distinct question operator – hitherto, no *wenn/ob/wenn* language has turned up in my inquiries among scholars of language.

Both conjectures are based on comparison of the semantic triangle put up by assertions, questions, and denials to the triangle spanned by disjunction, question marker and conditional. The argument in favour of the conjectures is built in four steps:

- three non-veridical operators may converge lexically two-by-two
- sentences-in-use span a semantic triangle
- the three operators span a semantic triangle too
- those triangles show distinctly labelled edges.

## 2 Three non-veridical operators may coincide

The operators for conditionals, questions and disjunction illustrated above by their German lexicalizations form a natural class among the sentential connectives – they are *non-veridical* but not *anti-veridical* (see Zwarts 1995). Propositional arguments in their scope are neither entailed nor anti-entailed by the complex propositions they construct. Sentence (1), if true, neither entails the antecedent clause nor the consequent clause. The truth of the whole sentence is compatible with falsehood as well as truth of both the antecedent and the consequent. Sentence (2) neither presupposes nor entails positive or negative answers to the embedded question. Sentence (3) can only be true if one of the

disjuncts is true, but neither of those is entailed.

Among the languages of the world, these three non-veridical operators often coincide lexically – pairwise, that is. A table reflecting this convergence for a more or less randomly chosen collection of languages is given below. The operators are marked by German function words and by a symbol. Indo-European languages are indicated as such. Coinciding operators within a language are in boldface.

Table 1: *Wenn, ob and oder across languages*

IE-German	<i>wenn</i> →	<i>ob</i> ?	<i>oder</i> ∨
IE-Dutch	als	<b>of</b>	<b>of</b>
IE-English	<b>if</b>	<b>if</b>	or
IE-Homeric Greek	εἰ	<b>ἢ</b>	<b>ἢ</b>
IE-Iskashimi	agar	<b>-o</b>	<b>-o</b>
IE-Spanish	<b>si</b>	<b>si</b>	o
Turkish	eger	<b>mi</b>	<b>mi</b>
Tagalog	<b>kung</b>	<b>kung</b>	o
Swahili	<b>kama</b>	<b>kama</b>	au
IE-Yersekian	<b>a</b>	<b>of a</b>	<b>of</b>
IE-Russian	если	<b>ли</b>	<b>или</b>
<i>wenn</i> -pattern	<b>wenn</b>	<b>wenn</b>	oder
<i>oder</i> -pattern	wenn	<b>oder</b>	<b>oder</b>

[Iskashimi is an Iranian language from around the city of Ishkashim at the Tajik-Afghan border; Yersekian is the language of the Dutch city of Yerseke]

Clearly, Indo-European languages as well as languages from other families show partial convergence of the three non-veridical sentential operators. At the same time, within a language family the diversity is considerable: various patterns may occur, and closely related languages may differ in the pattern they realize. Besides, languages showing partial convergence may have one or more alternatives to lexical operators involved. Partial convergence just means that some operators act in more than one paradigm. Ambiguity in the sense that in a given sentence a function word may have different readings, I take to be exceptional.

In the same vein, partial convergence does not require similar syntax. For example, in the Indo-European *wenn/oder/oder* languages, the coinciding operators for question and disjunction are

subordinative and coordinative, respectively. These properties are syntactic rather than semantic, though. In propositional logic, the counterparts of natural language coordinators are the *symmetric* connectives for coordinative disjunction and conjunction; the *antisymmetric* implication corresponds to the embedding conditional *wenn*.

The patterns might be old - the *wenn/oder/oder* scheme already shows up in Homeric Greek. Hittite also featured signs of convergence. Modern Yersesian and Russian show that the operators may also be lexically *composed* of similar elements (cf. Table 1). As a matter of fact, in many Slavic languages the (-) *li* morpheme is persistent in conditions, questions and disjunctions. Strikingly, however, no language was found in which the conditional *wenn*- and the disjunctive *oder*-values were identical with the inquisitive *ob*-value being different, thus realizing a *wenn/ob/wenn* or *oder/ob/oder* pattern. The apparent absence of this scheme is reflected upon below.

### 3 The partial convergence between the connectives has hardly been discussed

The partial lexical convergence of conditionals, disjunctions and questions is hardly overexposed in the literature. The Dutch etymological lexicons, for example, recognize the convergence, but they consider it to be a phonological accident or even the result of confusion in dark ages. The *Vroegmiddelnederlands Woordenboek* ('Lexicon of Early Middle Dutch') suggests two *different* origins for the question particle and the disjunction, though both pronominal and dual – an early announcement of alternative semantics, as it seems. English etymology traces the counterpart *if* back to nouns of doubt – an early instance of non-veridicality.

In the academic study of Dutch, its *wenn/ob/ob* pattern has attracted little attention. Van Calcar (1973) has pleaded for a common derivation of the conditional and the disjunction, from a genuine generative-semantic perspective. He recognizes the fundamental similarity between questions and disjunctions; he claims that embedded questions can be reduced to exclusive disjunctions and that exclusive disjunctions are conditional in nature. His line of reasoning can be reconstructed as follows. Questioning *p* reduces to inquiring after *either p or not p*, as the exclusive disjunction is presupposed by the question. This exclusive disjunction *either p or q* embodies the conjunction of implications *if p then not q, and if q then not p*. Thus, the linkage between questions, disjunctions and conditionals is semantic, but Van Calcar's argument rests on paraphrasing meanings in a rigid manner.

Den Besten (1974), however, certainly has reason on his side arguing that neither syntax nor semantics is well served by an effort to unify essentially distinct syntactic configurations: subordinative embedding versus coordination. Here, Den Besten's and Van Calcar's concepts of grammar clash, and the issue has hardly come up since. Yet, both Larson (1985) and Han and Romero (2004) envisage syntactical relations between certain types of questions and certain types of disjunctions in English, Korean and Hindi.

Analysing Serbo-Croatian coordination, Arsenijevic (2011) suggests that disjunction can be seen as composed, rather than as a primitive. Izabela Jordanoska (p.c) described disjunction in Macedonian as a composition: *conjunction plus question yields disjunction*. These ideas about the morpho-semantic situation in Slavic languages testify to the need for reflection on the complex described above. A particular phenomenon in Dutch and German stresses this point. The finite verb occurring in leftmost position can serve both conditionalization and questioning:

- (4) Is ze geslaagd?  
*has she passed*  
 'Did she pass?'
- (5) Slaagt ze, gaat ze een jaar naar Tajikistan.  
*Passes she, goes she a year to Tajikistan*  
 'If she passes, she will go to Tajikistan for one year'

The composed nature of the connectives pointed out by Arsenijevic (2011), can also be conjectured from Dutch complementizers like *als-of* and – substandard but old – *als-dat*.

- (6) Het lijkt *als-of* het land stilstaat.  
*it looks if-whether the country stands still*  
 'It looks as if the country stands still'
- (7) Het was niet zeker *als-dat* hij zou komen.  
*It was not certain if that he would come*  
 'It was not certain that he would come'

The Dutch *Geïntegreerde Taalbank* and *Dynasand* (Instituut voor Nederlandse Lexicologie n.d.) offer a detailed account of the huge range of *als*-connectives. Moreover, Hinskens (2016) reports that

in the Dutch spoken by people originating from -the Antilles and Surinam, -the conditional *als* functions as a question particle. That is, their Dutch -shows a  $\langle c:x, q:x, d:y \rangle$  pattern, along with the standard Dutch  $\langle c:x, q:y, d:y \rangle$  pattern.

From a mainly syntactic and distributional perspective, Uegaki (2014) argues that in Japanese the particle *-ka* functions both as a question marker and as a disjunction, depending on its embedding and scope. This analysis reflects proposals in Szabolcsi (2014) on Japanese, Hungarian and other languages.

In general, relatively little attention has been paid to the grammatical status of the wide-spread partial convergence in the *wenn/ob/oder*-complex. All linguistics is to blame here. Descriptive linguistics rarely worries about functional words. Theoretical linguists tend to avoid digging in logical mud. Logicians do not tend to account for lexical particularities. Yet, their combined genius will be needed to reach solid ground.

## 4 Sentences represent higher order objects

### 4.1 Propositions are ordered by entailment

By now, it is standard practice in intensional semantics to assign to a proposition the set of situations in which it is true. Thus, two propositions are equivalent *iff* the same set of situations is assigned to them. The associations of a proposition and its negation are complementary, by definition. The assignment also works the other way around: a situation is fully described by the propositions that apply in that situation. So, given a model theory over situations  $s$  such that for every  $s$  a proposition  $p$  is computably true, false, or undefined in  $s$ , we define the meaning  $\llbracket p \rrbracket$  of  $p$  as  $\{s \mid p \text{ is true in } s\}$ .

A sentence is a proposition-in-action. Sentences come in at least three modes: assertion, question, and denial. Each of these modes can be defined in terms of propositions and entailment, as is shown below. In this set-up, entailment is the partial ordering on sets of situations, and therefore, a relation between propositions.

#### (8) *entailment*

$p$  entails  $q$  *iff*  $\llbracket p \rrbracket \subseteq \llbracket q \rrbracket$ .

Because this paper is on natural languages, I take the notion of entailment to be not purely logical, but subject to conceptual restrictions in the following sense. Only those entailment relations  $p$  entails  $q$  are considered in which  $q$  does not contain any non-functional or lexical concept that is not derivable from concepts in  $p$ , while observing their cardinality. Every lexical concept in the entailed proposition is derived from exactly one concept in the entailing proposition, and every lexical concept in the entailing proposition derives at most one concept in the entailed proposition. That is, entailment is taken to be a *resource sensitive* notion, applied conservatively (cf. Cremers, Hijzelendoorn and Reckman 2014 ch. 4). In short, the entailed proposition  $q$  is conceptually a sub-proposition of the entailing proposition  $p$ , and if  $p$  linguistically entails  $q$ , it does not linguistically entail  $q$  and  $q$ ,  $q$  or  $q$ , and  $q$  or  $r$ . Thus, for linguistic purposes, definition (8) is to be read as

- (9) *l-entailment* ( $p \prec q$ )  
 $p$  l-entails  $q$  iff  $\llbracket p \rrbracket \subseteq \llbracket q \rrbracket$  and  $q$  is a conceptual sub-proposition of  $p$ .

The restriction that the entailed proposition is conceptually subsumed under the entailing proposition qualifies l-entailment as anti-symmetric. In the spirit of Seuren (2006), it also prevents all kinds of truisms from being entailed, thus keeping the set of l-entailments to be finite. In the next section, the three different modes of sentences are defined in terms of l-entailment (9).

#### 4.2 Questions, assertions, and denials denote sets of propositions

The assertion of  $p$  – short:  $!p$  – in a certain context introduces the set of all propositions entailed by  $p$ . This is a standard, almost Aristotelian, approach to the context update brought about by an assertion. Each failure of any entailment of  $p$  weakens  $!p$  in an essential way, and as long as  $p$  is valid, *all* its entailments are valid, simultaneously.

- (10) *assertion*  
 $\llbracket !p \rrbracket = \{q \mid p \prec q\}$   
*The assertion of  $p$  invokes all its entailments*

The assertion of a sentence  $p$  brings all its semantic consequences into play.

Questioning  $p$  is inquiring whether some proposition that is at least as specific as  $p$  is the case. This generalizes the almost classical theory (Karttunen 1977) that a question can be identified with the set of sentences equivalent to the proposition that is questioned. As a matter of fact, a question was identified with the equivalence class induced by the questioned proposition. Once you have a notion of entailment in the restricted sense introduced above, however, you do not need equivalence in constructing the sets of propositions. (11)c is a positive answer to question (11)a, although it is much more specific than the sentence underlying the question (11)b. In fact, the positive answer entails that proposition. It *settles* the question, according to inquisitive semantics (Ciardell *et al.* 2013).

- (11) a. Who read the book?  
       b. Somebody read the book.  
       c. It is well known that the student that is always reading during your classes read the book several times when he was a kid.

Therefore, we can identify a question with the set of propositions entailing - and thus confirming - the questioned one.

- (12) *question*

$$\llbracket ?p \rrbracket = \{q \mid q \prec p\}$$

*A question on  $p$  is positively answered by any proposition entailing  $p$*

This analysis is typical for *wh*-question: some indefinite sentence is presupposed, and the set of positive answers *lives on* that sentence. For *why*-questions, however, the relation is considerably more complicated, since the ‘underlying sentence’ itself is not questioned, and an answer is an independent proposition. That is why the interpretation of *why* is not sensitive to negative islands - (13) is ambiguous in Dutch - and why *pourquoi* in French does not occur *in-situ*: there is no canonical site for reason in the sentence frame, as demonstrated by (14) versus (15).

- (13) Waarom denk je dat niemand protesteerde?

*why think you that nobody protested*

'Why do you think nobody protested'



- (14) Tu es venu quand?  
*you are come when*  
 'When did you come?'
- (15) \*? Tu es venu pourquoi?  
*you are come why*

Therefore, definition (12) does not cover *why*-questions, while being readily applicable other *wh*-questions and *yes/no*-questions.

Finally, denials of a proposition can be construed as a higher-order object too, and quite straightforwardly so. The denial of a proposition  $p$  is induced by every proposition that is more specific than the negation of  $p$ , and is therefore represented by the set of those propositions:

- (16) *denial*  
 $\llbracket Np \rrbracket = \{q \mid q \prec \neg p\}$   
*p is denied by any proposition entailing the negation of p*

Note that the denial of  $p$  differs from the assertion of  $\neg p$ . The assertion  $! \neg p$  refers to the set of all propositions entailed by  $\neg p$ . In this construal,  $Np$  and  $! \neg p$  relate to each other like  $?p$  and  $!p$ . Each of the operators  $N$ ,  $!$ , and  $?$  specifies an antisymmetric entailment relation between a 'given' proposition  $p$  and a derived proposition  $q$ :  $R(p, q)$ . The  $!$  operator identifies the first or left argument as the entailing proposition:  $!$  is *left entailing*. With  $N$  and  $?$ , the second or right argument is the entailing proposition; both are *right entailing*. The operators  $!$  and  $?$  are *conservative*, in maintaining the polarity of the entailed proposition.  $N$  reverses the polarity of the entailed proposition. Here is an overview of these properties.

Table 2: Polarity of sentential types

relation $R(p, q)$	entailing prop		polarity entailed prop		denotation base $p$
	left ( $p$ )	right ( $q$ )	conservative	reversive	
$!p$ <i>assertion</i>	+		+		$\{q \mid p \prec q\}$
$Np$ <i>denial</i>		+		+	$\{q \mid q \prec \neg p\}$
$?p$ <i>question</i>		+	+		$\{q \mid q \prec p\}$

$\{p \text{ irony}\}$	+			+	$\{q p \prec \neg q\}$
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The scheme suggests the existence of a fourth operator that reverses the polarity of the entailed proposition while being left entailing. Such a structure would best be qualified as *irony*: the speech act that entails the opposite of what an assertion would. In the present set-up, however, it makes little sense to consider anti-veridical dimensions of language use. While the other relations are well-defined by their position in the scheme, irony's position there hardly exhausts its impact and reason-for-being, which seem pragmatic rather than semantic.

## 5 Questions, assertions, and denials are distinct and specific

The algebraic objects coming with asserting, questioning, and denying  $p$  are distinct: they do not share any proposition. By the definition of entailment in terms of sets of situations, the following lemma has at least four ways of expression; the literal  $U$  stands for the universe of situations.

### (17) *distinction*

$$\llbracket !p \rrbracket \cap \llbracket ?p \rrbracket \cap \llbracket Np \rrbracket = \emptyset$$

$$\{q|p \prec q\} \cap \{q|q \prec p\} \cap \{q|q \prec \neg p\} = \emptyset$$

$$\{\llbracket q \rrbracket \llbracket p \rrbracket \subseteq \llbracket q \rrbracket\} \cap \{\llbracket q \rrbracket \llbracket q \rrbracket \subseteq \llbracket p \rrbracket\} \cap \{\llbracket q \rrbracket \llbracket q \rrbracket \subseteq (U - \llbracket p \rrbracket)\} = \emptyset$$

*No proposition is both entailed by  $p$  and a positive or negative answer to it*

Still, the triad *<assertion, question, denial>* does not cover the universe of situations for any given proposition  $p$ , for the simple reason that entailment and subset impose just a partial order; not every proposition is involved in it. Consequently, for a given  $p$ , the union of its assertion, a question on it, and its denial is unique.

### (18) *non-triviality*

$$\llbracket !p \rrbracket \cup \llbracket ?p \rrbracket \cup \llbracket Np \rrbracket \subset U$$

$$(\llbracket !p \rrbracket \cup \llbracket ?p \rrbracket \cup \llbracket Np \rrbracket) = (\llbracket !q \rrbracket \cup \llbracket ?q \rrbracket \cup \llbracket Nq \rrbracket) \text{ if and only if } \llbracket p \rrbracket = \llbracket q \rrbracket$$

*Some propositions neither follow from  $p$  nor do they confirm or deny it;*

*the set of propositions that are entailed by it or confirm or deny it, is unique*

Comparing the three sets of propositions, one can easily deduce some structural properties.

Firstly, each set has its unique generator, in that membership of the set is determined by entertaining a relation to one specific proposition. That relation is, of course, *entailment*. The generators of assertion, question and denial are  $p$ , again  $p$  and  $\neg p$  respectively. Since entailment is antisymmetric, its role in generation may lead to different algebraic structures, depending on whether the generator is entailed or is entailing.

(19) *unique generator*

$\llbracket !p \rrbracket$  stems from applying the Boolean function *is entailed by*  $p$  or  $\lambda q. p \prec q$  to the set of propositions; it is a *ring* generated by  $p$ , to wit  $\{q / p \prec q\}$ .

$\llbracket ?p \rrbracket$  stems from applying the Boolean function *entails*  $p$  or  $\lambda q. q \prec p$  to the set of propositions; it is a *filter* generated by  $p$ , to wit  $\{q / q \prec p\}$ .

$\llbracket Np \rrbracket$  stems from applying the Boolean function *entails*  $\neg p$  or  $\lambda q. q \prec \neg p$  to the set of propositions; it is a *filter* generated by  $\neg p$ , to wit  $\{q / q \prec \neg p\}$ .

Secondly, all three sets are closed under conjunction and disjunction of propositions:  $q$  and  $q'$  and  $q$  or  $q'$  are in the set if both  $q$  and  $q'$  are. Only for the assertion, the opposite direction is valid too:  $q$  and  $q'$  are in the set if  $q$  and  $q'$  is. Thus, the assertion is upward entailing. Both denial and question, however, are downward entailing in the standard sense of entailment (8).

(20) *conjunction*

$q$  and  $q' \in \llbracket !p \rrbracket$  if and only if  $q \in \llbracket !p \rrbracket$  and  $q' \in \llbracket !p \rrbracket$

$q$  and  $q' \in \llbracket ?p \rrbracket$  if  $q \in \llbracket ?p \rrbracket$  and  $q' \in \llbracket ?p \rrbracket$

$q$  and  $q' \in \llbracket Np \rrbracket$  if  $q \in \llbracket Np \rrbracket$  and  $q' \in \llbracket Np \rrbracket$ .

As for disjunction or union, the sentential types of assertion, question, and denial show a similar pattern:

(21) *disjunction*

$q$  or  $q' \in \llbracket !p \rrbracket$  if  $q \in \llbracket !p \rrbracket$  or  $q' \in \llbracket !p \rrbracket$

$$q \text{ or } q' \in \llbracket ?p \rrbracket \text{ if } q \in \llbracket ?p \rrbracket \text{ or } q' \in \llbracket ?p \rrbracket$$

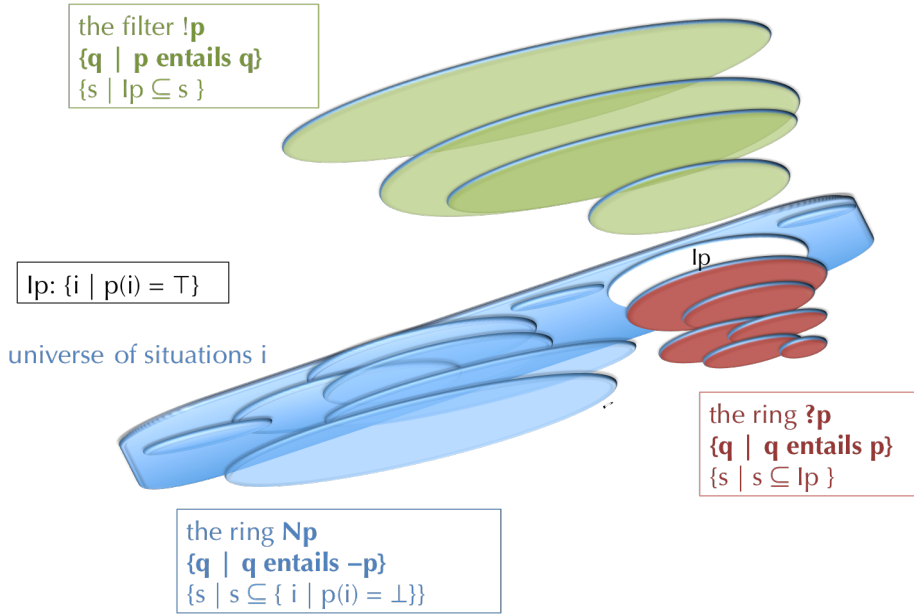
$$q \text{ or } q' \in \llbracket Np \rrbracket \text{ if } q \in \llbracket Np \rrbracket \text{ or } q' \in \llbracket Np \rrbracket.$$

Clearly, none of these sets is closed under complementation, *i.e.* propositional negation, and none of them contains both  $q$  and  $\neg q$ .

## 6 Assertions, questions, and denials put up a triangle

It is tempting to *draw* the members of the propositional field with respect to a universe of situations. In Figure 1, the elliptic spaces represent propositions denoting subsets of situations. The plane of

Figure 1: Objects introduced by assertions, questions and denials

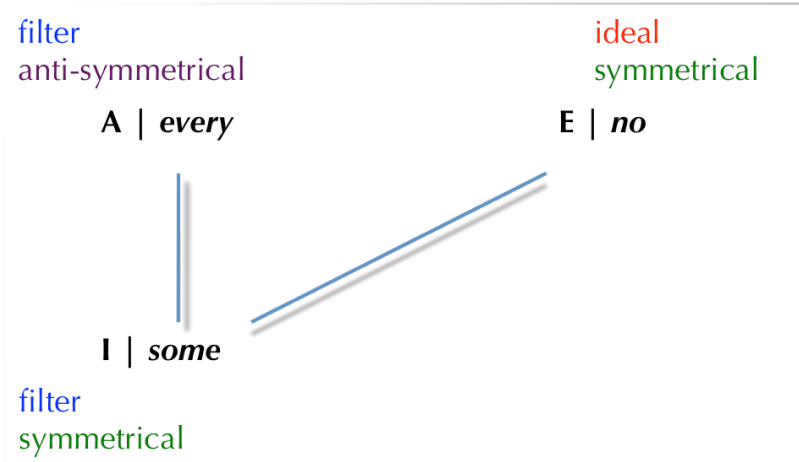


situations is represented as a rectangular in perspective from below. The set of situations selected by the base proposition  $p$  is marked as an open space in the intensional universe. A *ring* is an object that looks like the powerset of the generator, and like the collection of all of the generator's well-defined

proper parts: it is upward bounded, complete, closed under relative complementation, and with a maximal element. A filter, on the other hand, is a set of supersets of the generator, and is almost the opposite of a powerset: it is closed under union but not closed under subsets nor under relative complementation, and it is downward bounded, with a minimal element.

Equally tempting is the possibility of organizing the three sentential algebras in a manner similar to the *triangle of quantification* – the medieval quadrant of quantification tracing back to Boethius,

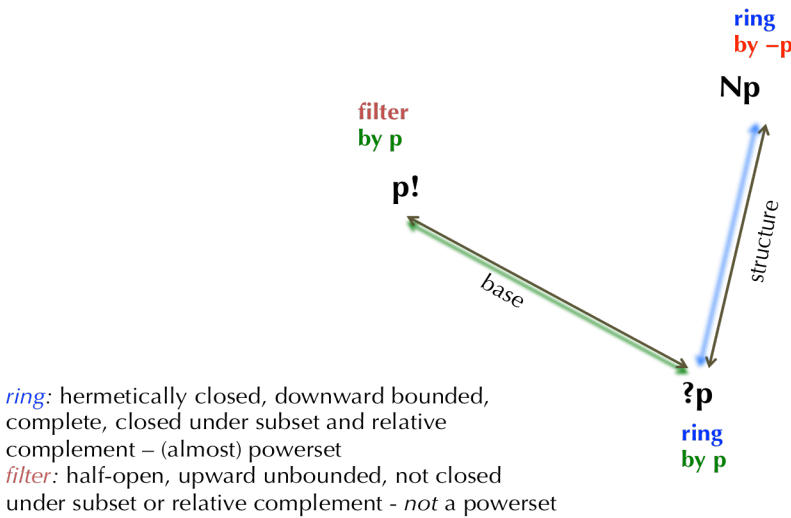
Figure 2: Triangle of quantification



minus the O-angle – *not every* (see Jaspers 2005 and Figure 2). The latter angle is missing because it is *derived*: it is not definable by any elementary specification of the *intersection* of the quantifier's arguments, to wit, the nominal and verbal predicates. Jaspers explains why this angle is never lexicalized in

any language. In this organisation, each triangle has a *pivot*. For quantification, the existential quantifier I is the triangle's pivot. For sentences, this pivot is the question,  $?p$ . The existential quantifier shares the property of being a filter generated by the noun phrase with the universal quantifier A. E, the negated universal, and the existential quantifier have symmetry in common: the nominal and the verbal predicate

Figure 3: Triangle of sentence denotations



can switch *salve veritate*. As pictured in Figure 3, the question  $?p$  shares the property of being generated by  $p$  with the assertion, and the property of being a filter with  $Np$ .  $!p$  and  $Np$  do not have any structural property in common. This makes the triangles A-I-E and  $!p-?p-Np$  analogue, though not congruent, structures.

## 7 The non-veridical sentential operators put up a triangle too

Given the algebraic triangle of questions, assertions, and denials, it should be possible to cast the interpretation of the question particle *ob*, the disjunction *oder* and the conditional *wenn* in terms of the triangle's vertices.

Each of the natural language connectives can be seen as a two-place operator. For the disjunction and the conditional, this is evident. The question particle is inquisitive, however, in the sense of Ciardelli, Groenendijk and Roelofsen (2013); we can easily interpret it as introducing a disjunction between the question and its negative counterpart. Furthermore, in natural language disjunction is taken to be persistently Boolean: every disjunction can be written as a disjunction of propositions (Hoeksema 1988, Payne 1995).

Under these assumptions, the semantic space for each connective can be construed as a union of arguments representing the three sentence types.

(22) *interpretation of connectives*

disjunction:	$\llbracket \text{oder}(p, q) \rrbracket$	$\equiv$	$!p \cup !q$
question:	$\llbracket \text{ob}(p) \rrbracket$	$\equiv$	$?p \cup ?(\neg p) \equiv ?p \cup Np$
conditional:	$\llbracket \text{wenn}(p, q) \rrbracket$	$\equiv$	$Np \cup q!$

As said before, none of the connectives is veridical or anti-veridical. This property is anchored in the interpretations of the structure introduced by each connective being a *union* of interpretations of the arguments. That is, for the structure headed by the connective to express truth, it is insufficient to valuate a single argument. The connectives are truth functional in each argument.

Although the three operators are interpreted as connectives, for each connective, a characteristic sentence type can be identified, indicated above with the literal *p*. For disjunction, this is the assertion, by definition. For the question marker, it is the question, again, by definition. For the asymmetric conditional, it is the denial of the antecedent. This complies with the traditional logical insight that denial of the implication's antecedent is sufficient for the condition to be true.

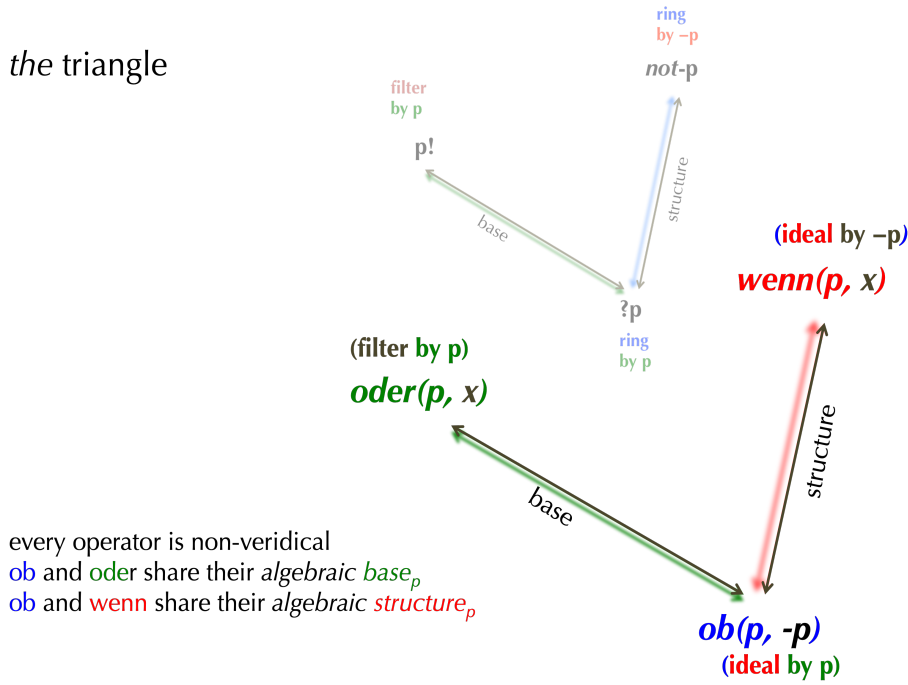
(23) *characteristic sentence type*

disjunction	<i>oder</i> :	assertion
question	<i>ob</i> :	question
conditional	<i>wenn</i> :	denial

Consequently, the three connectives put up a triangle, too. The triangle is congruent to the one erected by the sentence operators. This congruency, suggested in Figure 4, is the main argument of this paper.

Figure 4: Triangle of non-veridical connectives

the triangle



The congruency of the two triangles may explain the lexicalization strategies in the wenn/ob/oder complex hinted at in section 1. It shows that the three connectives are related in an asymmetric way.

Languages appear to differ in whether they take a shared algebraic aspect as a sufficient

condition for identification, and if they do, as to which aspect dominates. Modern German does not identify vertices of the triangle. Dutch and Homeric Greek, following the oder-pattern as defined in Table 1<sub>2</sub> by identifying the disjunction and the question particle, focus on the algebraic base, the generator of the higher-order object these connectives represent. English and the roman languages appear to lexicalize along the line of the connectives' algebraic structure, thus identifying the question particle and the conditional. Other languages show lexicalizations along both lines. Apart from languages that make this double strategy explicit, like Russian (and Esperanto!?), it is, for example, attractive to view the alternative English triplet <c:if, q:whether, d:or> as an opaque, etymologically flavoured instance of the <c:x, q:y, d:y> pattern. Below you find Table 1 again, now with lexicalization strategies made explicit.

Table 3: Qualifications of wenn/ob/oder patterns across languages

(IE-German)	<i>wenn</i> →	<i>ob</i> ?	<i>oder</i> ✓	<i>base vs. structure lexicalization</i>
IE-Dutch	als	of	of	base
IE-English	if (if	if whether	or or)	structure (base)
IE-Homeric Greek	εἰ	ἤ	ἤ	base
IE-Iskahami	agar	-o	-o	base
IE-Spanish	si	si	o	structure
Turkish	eger	mi	mi	base
Tagalog	kung	kung	o	structure
Swahili	kama	kama	au	base
IE-Yersekian	a	of a	of	base + structure
IE-Russian	если	ли	или	base + structure
Esperanto	se se	se cu	cu cu	structure base
<i>wenn</i> -pattern	wenn	wenn	oder	structure
<i>oder</i> -pattern	wenn	oder	oder	base

The relevant triangles of sentence types and connectives are antisymmetric: no vertex has the same edges as another. Thus, the triangle conjectures that languages are encouraged to identify the conditional and the disjunction without also covering the question particle - there is no independent semantic relation between these to trigger the identification.

This leads to the following conjecture, worded in two ways.

(24) *conjecture on lexicalization of condition, question, and disjunction*

a. the probability that a language expressing questions applies that expression to the disjunction or condition –  $\langle c:\mathbf{x}, q:\mathbf{x}, d:\mathbf{y} \rangle$  or  $\langle c:\mathbf{x}, q:\mathbf{y}, d:\mathbf{y} \rangle$  – largely supersedes the probability that a language expressing conditionality applies that same expression to disjunction, without applying it to questions –  $\langle c:\mathbf{x}, q:\mathbf{y}, d:\mathbf{x} \rangle$ .

b. for identifying the question operator with the conditional operator or the disjunction, a



semantic anchor can be found; no such anchor is available for identifying the conditional operator and the disjunction.

As it seems, the windmills of the lexicon may run on algebra-light.

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