

# On *Of*

A corpus study on  
the interpretation of *of*  
in spoken Dutch

Bachelor Thesis

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## Index

<b>1. Introduction</b>	3
<b>2. The pragmatist/lexicalist discussion</b>	3
2.1 Pragmatist view	4
2.2 Lexicalist view	5
<b>3. Empirical studies on the default meaning and interpretation of <i>or</i></b>	5
<b>4. Goals and hypotheses of this study</b>	6
4.1 Identifying factors in the interpretation of <i>of</i>	6
4.3 Evaluating the sentences used as stimuli in experimental research	7
4.3 Adding to the pragmatist/lexicalist discussion	9
4.4 Possible perks and pitfalls of a corpus study on <i>of</i>	9
<b>5. Method</b>	10
5.1 Assembling the corpus	10
5.2 First annotation: interpreting <i>of</i>	10
5.3 Second annotation: factors	12
5.4 Statistical analysis	12
<b>6. Results</b>	13
6.1 Control variables	13
6.2 Interpreting <i>of</i>	13
6.3 Factors influencing the interpretation of <i>of</i>	13
<b>7. Discussion and Conclusions</b>	16
<b>References</b>	18
<b>Appendix</b>	

## 1. Introduction

Of all words, the word *or* may be one of the most thoroughly investigated words. Although there is consensus that the word *or* in natural language relates in some way to the disjunction in logic, they are surely not identical - and that is where the discussion is. The logical disjunction may be paraphrased as 'A and/or B', whereas *or* in natural language can also mean 'either A or B, but not both'. The 'and/or'-interpretation of *or* is known as the inclusive reading of *or*, whereas the 'either/or, but not both' interpretation is called the exclusive reading. Anyone who has ever followed an introductory course in logic will remember struggling with the inclusive meaning of *or* being the logical disjunction. Somehow, the exclusive meaning seems more intuitive. However, much theoretical and experimental evidence indicates that in fact the inclusive reading is the basic meaning, from which the exclusive interpretation is derived in some way or other. The exact manner of derivation is currently subject of heavy debate among language philosophers, semanticists, pragmaticians and psycholinguists and subject of theoretical and experimental study.

So far, no attempt has been made at a corpus study of *or*. However, there are several reasons why a corpus study would be a valuable addition. The type of sentences found in experimental studies may be quite different from the sentences in which *or* is used in daily life. Exploring these sentences may help understand the results of experimental studies. Studying *or* in its natural habitat may also shed light in a theoretical discussion known as the 'pragmatist/lexicalist discussion'. The current study is designed to add evidence from spoken Dutch to this discussion, using data from the Corpus Gesproken Nederlands (Nederlandse Taalunie, 2004).

## 2. The pragmatist/lexicalist discussion

Classic theories about the meaning of *or* state that the basic meaning of *or* is the inclusive reading, from which the exclusive reading can be derived through a Scalar Implicature (SI; but see e.g. Zimmermann, 2001 and Sauerland, 2012 for explanations that do not incorporate SI's). The derivation of the exclusive reading arises roughly in this manner: the speaker *could* have said *and* instead of *or*, which would have been more informative; based on the assumption that the speaker is trying to be as informative as he can without stating anything he lacks evidence for, this must mean the speaker does not have enough evidence to say both disjuncts are true and thus he believes only one of them is true, but can not say which. This is called a Scalar Implicature because it is based on the assumption that *or* and *and* form a scale, just like *all* and *some*. Sentence 1a will typically be interpreted as John having eaten *some*, but *not all* of the cookies; because if John had eaten *all* of the cookies, then why would the speaker have used *some* instead of *all*? A similar line of reasoning, which will be described more thoroughly below, leads to the interpretation of sentence 1b as John having eaten *either* a chocolate chip cookie *or* a strawberry cookie, *but not both*.

1a. *John ate some of the cookies.*

1b. *John ate a chocolate chip cookie or a strawberry cookie.*

Although SI's are mostly accepted to be involved in the interpretation of *or*, there is yet much debate about how, in which contexts and at which stage of mental processing SI's arise. It is in the discussion about these first two questions I hope to add evidence. These questions are widely investigated mostly by philosophers, logicians and (psycho-)linguists. This has led to a wide variety of explanations and several discussions, and attempting to provide a full

overview would be outside the scope of this article. I will therefore only discuss the two main views in the discussion I am hoping to add evidence to, the pragmatist view and the lexicalist view.

## 2.2 *Pragmatist view*

Pragmatist accounts explain the derivation of the exclusive reading by the application of pragmatic reasoning as proposed by Grice (1975). Although Grice has not explicitly proposed this reasoning to be applicable to ‘or’, authors like Pelletier (1975) have proposed the exclusive reading is arrived at by reasoning based on the Gricean Conversational Maxims (Grice 1975). This reasoning goes as follows:

1. *The speaker used or.*
2. *The speaker could have used and instead, which would have been more informative.*
3. *Obeying the Maxim of Quantity, the speaker is trying to be as informative as possible.*
4. *Obeying the Maxim of Quality, the speaker does not say anything he does not have evidence for.*
5. *Apparently, the speaker does not have evidence for the sentence with and to be true, therefore uses or in order to obey the Maxim of Quality.*
6. *The speaker is well informed.*
7. *Since 5 and 6, the speaker is likely to believe the sentence with and is false.*

A major objection to pragmatic accounts of the interpretation of *or* is known as the ‘Speaker Expertise Paradox’ (SEP). This means that in order to arrive at the scalar implicature, one needs to assume that the speaker knows what he is talking about (see step 5 in the reasoning above), yet the very use of *or* seems to express doubt about the situation. Using *or* implicates one is not sure whether disjunct A is true, nor is the speaker sure that disjunct B is true. These implications are often referred to as Uncertainty Implicatures. In order for a Scalar Implicature to arise, one would need to assume that the speaker does know that one of the disjuncts is true, but does not know which. It seems contradictory to assume somebody does not know the truth value of A and neither does he know the truth value of B, but he does know one of them is true. Such a situation is nevertheless possible. Imagine the cookies in sentence 1b were in identical wrappers. You know you had one strawberry cookie and one chocolate chip cookie and you left them in the kitchen. John went into the kitchen and came out some time later, with a somewhat guilty look in his eyes. When you go in the kitchen, you see one wrapped cookie and one empty wrapper. You now know John ate one cookie, and no more than one, but you do not know which. In this situation, you may utter sentence 1b, and the SEP is avoided in the interpretation. However, it is a very specific situation. Also, and more importantly, it seems the exclusive reading of *or* also arose when we first encountered the sentence and had not yet thought of such a specific situation.

Van Rooij & Schultz (2004) and Sauerland (2004) have provided elegant solutions to the SEP. However, as Zondervan (2010) explains, both make an extra assumption that does not follow from the reasoning up to then (unfortunately to fully elaborate this matter here is outside the scope of this article, so please be referred to Zondervan’s explanation starting p. 223). Both Van Rooij & Schultz and Sauerland need to resort to steps of reasoning taken by default that can not be derived by Gricean reasoning, and are therefore not truly Gricean solutions. In my opinion, the SEP still stands for simple Gricean accounts.

The assumption made in step 6 may prove to be even more problematic when considering occurrences of *or* in natural conversation. As I will explain further in the next section, what makes *or* the weaker option in logic, may in fact be its strength in natural language. *Or* may very well be predominantly used in sentences in which the speaker is in

some way incompetent. Not because speakers like to state facts about which they are poorly informed, but rather because *or* allows for asking questions, proposing several options, and performing other speech acts that require the speaker to be uncertain to some extent. Since step 6 is crucial to arrive at an exclusive reading of *or*, according to the simple Gricean view, no SI's should arise in any of these sentences. Therefore, only inclusive readings of *or* should occur.

Gricean reasoning only occurs on the utterance level. This means implicatures can only be derived from the matrix sentence, and not from embedded sentences. This also applies to SI's - they can only arise on the level of the matrix sentence. No SI's should arise in embedded sentences. Therefore, according to the pragmatist view, all occurrences of *or* in embedded sentences should get an inclusive interpretation.

## 2.2 *Lexicalist view*

Lexical accounts propose implicatures are not computed on-line, but rather are part of the lexical meaning of the scalar term. They are therefore *generalized* conversational implicatures. In Grice's *Logic and Conversation* (Grice 1975), 'generalized conversational implicatures' are already mentioned. However, Grice does not take terms like *and*, *or*, and *some* to give rise to generalized implicatures. Levinson proposes these terms to give rise to generalized implicatures in his *Presumptive meanings* (Levinson 2000). In the case of *or*, the lexical meaning is not just 'or' but is completed to 'either \_ or \_, but not both'. Although the scalar implicature is constructed based on the same reasoning as the pragmatic account presumes, this reasoning is not done on-line, rather the outcome of the reasoning is lexically stored as a general property of the scalar term.

In order to account for interpretations that are not the result of a SI (such as an inclusive reading of *or*) the SI-property of the lexical term is presumed to be marked as cancellable. This is also why Levinson still speaks of 'implicatures'; they meet the cancellability-requirement of implicatures. Since the reasoning need not be done on-the-go, scalar implicatures also arise when some of the assumptions of the pragmatic account are broken. Generalised scalar implicatures may therefore also arise when the speaker competence assumption is broken and in embedded sentences.

## 3. **Empirical studies on the default meaning and interpretation of 'or'**

The subject of the default interpretation of *or* in natural language has been thoroughly investigated. Although overall, the inclusive reading being the basic reading seems to be more generally supported, the evidence is certainly equivocal. As Pelletier (1975) has pointed out, there is only one way to test whether the basic meaning of *or* is exclusive or inclusive, that is, to imagine a situation in which both disjuncts are true and see whether that situation falsifies the sentence. Some early studies in developmental psychology have worked in this way: participants were presented with a sentence with *or* and a situation in which both disjuncts were true, and asked participants whether they thought the sentence was false or not. Although these studies were originally done to assess the development of logical reasoning in children, they also provide us with interesting information of the interpretation of disjunctions by adults, as adults were included as well as children. Paris (1973) has shown that the majority of (adult) participants did not find inclusive readings of *or* to be false. 75% of the participants found these sentences applicable, and 67% still found an inclusive reading applicable when the sentence was formulated as 'either A or B'. Braine and Romain (1981) on the other hand, using a slightly different method that required the participant to reason with

the given sentence, showed that more participants had a preference for the exclusive reading over the inclusive reading (41%) than the other way around (32%).

More recently, several articles have been published that study the actual process of the derivation of exclusive reading from the inclusive reading, using psycholinguistic methods. Some examples are the study of Chevallier et. al. (2008), investigating in which contexts SI's are computed, and the study by Storto & Tanenhaus (2005), using an elegant eye-tracking paradigm to map the temporal window of the interpretation of *or*. The exact research questions investigated by these experiments are much more refined than their ancestors from the 1970's, and therefore are unfortunately outside the scope of this article. What is important for now is a property that all experimental studies share: the type of stimuli they use. Chevallier et. al. (2008) and Storto & Tanenhaus (2005) and many other studies use sentences with *or* and provide a situation in which both disjuncts are true. I believe this use of *or* is very atypical and this atypicality may have consequences for the interpretation of studies that use this stimuli.

Both processing evidence and truth value judgements are analysed to explore the interpretation of *or*. Studies that work with truth value judgements have led to equivocal results (see Pelletier, 1975 and Braine & Rumaine, 1981), whereas studies that work with reaction times have shown that the computation of scalar implicatures requires effort (Chevallier 2008). Now, may there be another explanation for this equivocality and the effort required to interpret these sentences? I think the explanation may lie in the stimuli used. The typical target sentence in experimental research describes a current or past situation. A situation is provided in which both disjuncts are true. Both the speaker as well as the listener (participant) are fully informed. Now, in life outside the experiment booth, would a well-informed speaker really use *or* to describe a situation in which he knows both disjuncts occur? According to Grice's Maxim of Manner, 'Be perspicuous', a speaker should 'avoid obscurity of expression' (Grice 1975). Using *or* when one could have used 'and' is clearly a violation of this Maxim. I believe a speaker will not use *or* in natural conversation in the situations in which it is used in experimental research. In this study, we will try to find such sentences in spoken Dutch. If we do not find *of* (the Dutch word for *or*) in sentences that are comparable to the experimental sentences, the equivocality and the extra effort required in the interpretation of *or* in such inclusive contexts may in fact be due to the stimulus-sentences' abnormality, rather than the computation of scalar implicatures.

#### 4. Goals and hypotheses of this study

This study has three main goals. The first goal is to identify factors that influence the interpretation of *of*. The second goal is to establish whether the type of sentences used as stimuli in experimental studies can be found in natural language. The third goal is to add evidence from corpus material to the pragmatist-lexicalist discussion. I will now discuss the hypotheses and annotated factors (capitalized and printed in bold) in this study.

##### 4.1 *Identifying factors in the interpretation of of*

Both the lexicalist view and the pragmatic view as sketched above state the inclusive reading of *of* is the basic meaning, from which the exclusive reading is derived. However, the exclusive reading is generally considered more intuitive by language users. This may indicate that although the inclusive reading is the basic lexical meaning of *or*, the exclusive reading of *of* is most frequent in spoken language. We will annotate what **Interpretation** *of* gets in each sentence. Since the exclusive reading is often felt to be more intuitive, this is the first hypothesis:

*Hypothesis 1: The exclusive interpretation of ‘of’ is most frequent.*

The first goal of this study is to identify factors that influence the interpretation of *of*. In the discussion of the other two goals we will come across many factors that may or may not influence the interpretation of *of*. Their (in)significance is important for the other two goals of this study as well. I will therefore discuss those factors in relation to the implications they may have for the other two goals of this study. One factor that is accepted by all as influencing the interpretation of *of*, is negation. Whereas *of* may normally get either an inclusive or an exclusive reading, and the exclusive reading is felt to be more intuitive, *of* in negative contexts is likely to receive an inclusive reading. Table 1 shows the truth conditions for inclusive and exclusive or, and the negation of both these disjunctions.

*Table 1. Truth conditions for disjunctions and their negation*

<b>p</b>	<b>q</b>	<b>p inclusive or q</b>	<b>p exclusive or q</b>	<b>¬(p inclusive or q)</b>	<b>¬(p exclusive or q)</b>
0	0	0	0	1	1
0	1	1	1	0	0
1	0	1	1	0	0
1	1	1	0	0	1

As can be seen from Table 1, in order for an exclusive reading of a negated disjunction to be true, either none of the disjuncts should be true or both should be true. This means that if John has both a cat and a dog, sentence 2 would be true according to the exclusive reading. This is not our intuition when we read the sentence. Our intuition is that John has neither a cat nor a dog. This is in accordance with the inclusive reading of a negated disjunction.

*2. John does not have a cat or a dog.*

Since we expect negation to influence the interpretation of *of*, we will annotate for **Negation**. Since negation is, by my knowledge at least, never questioned as a factor influencing the interpretation of *of*, incorporating it in our study can also be seen as a test of our method. If not even the effect of negation can be found, then certainly our method is not working. Our hypothesis is:

*Hypothesis 2: Of will receive an inclusive reading when under negation.*

#### **4.2 Evaluating the sentences used as stimuli in experimental research**

The second goal of this study is to re-evaluate the outcome of various experimental studies and the conclusions that have been drawn from them. As I have argued in section 3, using *or* in a situation such as is presented in experimental research, would be a violation of Grice’s Maxim of Manner. I believe a speaker will not use *or* in such a context as is provided in experimental research, as it would only sabotage the communication. I think a speaker will use *or* only in situations in which he or she does *not* know which options are true. Leaving the Speaker Expertise Paradox and its several possible solutions alone, as Zondervan (2010) states, the very use of *or* implicates some measure of insecurity. This may make *or* a very powerful ingredient for all sorts of speech acts that require the expression of some form of speaker incompetence, such as asking questions or proposing several options. Exactly that which makes the disjunction less informative in logic may be its strength in natural language. This leads us to Hypothesis 3.

*Hypothesis 3: Of will predominantly occur in sentences in which speaker competence is violated.*

In order to evaluate Hypothesis 3, we need factors indicating violations of speaker competence. One possible violation of speaker competence is the speaker explicitly stating that he or she does not exactly know what is going on. A speaker may for example add *maybe* or *I believe* to a sentence. If a statement like that is made, an annotation will be made in the category **Explicit violation of speaker competence**. Another factor that may violate speaker competence is **Speech act**. Uttering a sentence can have several goals. A sentence may have been uttered because the speaker wanted to provide information, because he or she wanted to convince the conversational partner to do something, or because the speaker is asking for information. If the speaker asks a question or makes a request, the speaker is not fully informed. In the case of questions, this shows from the fact that he is asking for information. When a speaker is making a request, the situation described is hypothetical. We will annotate for speech act, distinguishing between informative sentences, questions and directives (including requests, demands, prohibitions and everything in between). The **Time** in which a described action takes place may also have consequences for speaker competence; any action that takes place in the future is hypothetical to a certain extent. We will annotate whether the sentence describes an event or situation in the past, present or whether it describes a in future or a hypothetical situation or action.

Apart from the difference in speaker competence, the episodic nature of the sentences in experimental studies should also be considered. Sentences used as stimuli are usually episodic, whereas in natural speech sentences may describe a general rule or property. Although I am not familiar with any literature on the influence of genericity on the interpretation of *or* in natural language, I believe genericity may well influence the interpretation of *or*. A generic sentence describes multiple situations at once. Using *or* may provide the necessary variation to make a generalisation work for a larger scope of situations. Sentences 3a and 3b are much alike, except for their genericity. I think sentence 3a will only get an exclusive reading, whereas 3b is more likely to get an inclusive reading of *of*. In 3a, one assumes the kids were either painting or drawing, whereas in 3b, they are likely to have been doing both - though maybe not at the same time.

*3a. The kids were drawing or painting.*

*3b. The kids were always drawing or painting.*

This leads us to state hypothesis 4:

*Hypothesis 4: Of in generic sentences is more likely to be interpreted inclusively than of in particular sentences.*

In order to test this hypothesis, we will annotate for **Genericity**.

To prove our point that sentences used in experimental research are unnatural, we should be unable to find any sentences that are informative, particular, handle about the present or past, show no indication of an uninformed user (other than the very use of *of*) and get an inclusive reading.

*Hypothesis 5: Inclusive of will not occur in particular sentences in which speaker expertise is intact.*

### 4.3 Adding to the pragmatist/lexicalist discussion

The third goal of our study is to add evidence to the pragmatist/lexicalist-discussion. The hypotheses we have stated so far point in the direction of the lexicalist view. If Hypothesis 3 and Hypothesis 1 are both right, then the pragmatist view can not account for this. If *of* occurs in an environment in which speaker expertise is violated, as Hypothesis 3 states happens in the majority of cases, this corrupts step 6 in the Gricean reasoning proposed by the pragmatic account. This would mean either the inclusive meaning of *of* is most frequent (which would mean Hypothesis 1 is false), or the Gricean pragmatist view can not account for a proportion of the readings of *of* as found in spoken Dutch. This is not a paraphrased version of the Speaker Expertise Paradox, as the incompetence of the speaker in our proposal does not arise from the mere fact that *of* is used, but from other information in the sentence. If we believe that the exclusive reading is most frequent (hypothesis 1), yet *of* will predominantly occur in sentences in which speaker expertise is compromised (hypothesis 3), this means we cannot possibly stick to the Gricean pragmatic account, as it can not explain this pattern. The lexicalist account, on the other hand, would have no problem explaining these findings, since SI's arise by default. We adopt the lexicalist account, as its predictions are in line with our own. This leads us to Hypothesis 6.

*Hypothesis 6: Exclusive interpretations arise when the speaker competence assumption is violated, as well as when it is intact.*

In order to further test the predictions of the lexicalist view as opposed to the pragmatic view, we consider the interpretation of *of* in embedded sentences. The pragmatist view predicts no exclusive readings of *of* in embedded clauses, since the reasoning that leads to an exclusive interpretation can only be done on the level of the matrix clause. The lexicalist predicts exclusive readings to occur in embedded clauses as well as matrix clauses, because the SI arises by default. Since I adopted the lexicalist view, my hypothesis is:

*Hypothesis 7: Exclusive interpretations will arise in embedded clauses as well as in matrix clauses.*

Hypothesis 6 can be evaluated using the factors we will also use to test Hypothesis 1 and 3. In order to test Hypothesis 7, we will also annotate for the **Clause type** *of* occurs in.

### 4.4 Possible perks and pitfalls of a corpus study on *of*

Theoretical studies and experiments both share one possibly biasing characteristic: the sentences used either as examples in a theoretical study or as stimuli in an experiment, are made up by the investigator. This is not the case in a corpus study. A corpus study may therefore offer refreshing new insights.

However, a corpus study also shares a possibly biasing characteristic with introspective studies: the interpretation of sentences is done by the scientist. Geurts & Pouscoulous (2009) stress this problem for introspective studies and show that the interpretation of the investigator, strongly filtered by his theoretical knowledge, may not align with the interpretation of participants that lack expertise. I will try to control for this problem as much as possible by asking a second annotator for doing the actual interpretation. This annotator was not involved in the development of the research questions. A high measure of agreement between the two annotators would increase the reliability of the study. Also, the interpretation of *of* will be done first, and the annotation for the possibly influencing factors will be done in a second annotation round, to reduce annotator bias through learning.

## 5 Method

The corpus study involved four stages. First, the corpus was assembled. Secondly, a first annotation was done. In this annotation, unsuitable sentences were excluded from analysis and the interpretation of *of* was done. This was deliberately done before the annotation of the factors that might be influencing the interpretation, so that the risk of biased annotations was reduced as much as possible. Thirdly, a second annotation round was done on the interpretable sentences. In this annotation round, the factors described in section 4 were annotated for. Finally, the data were statistically analysed using chi-square-tests.

I will now describe the four stages of the study in further detail.

### 5.1 *Assembling the corpus*

In order to perform the current study, a sub-corpus was constructed from the ‘Corpus Gesproken Nederlands’ (CGN; Nederlandse Taalunie, 2004). The CGN is a corpus of spoken Dutch, about 10.000.000 words in size, with conversations and monologues in varying degrees of formality. The CGN offers (amongst many other useful features) an orthographic transcription and Part-Of-Speech-tagging (POS-tagging) of all the incorporated speech. The Dutch word *of* can be used as a coordinator, like *or* in English, and it can also be used as a subordinator. When used as a subordinator, its meaning is much like the English *if* or *whether*. Although the subordinating use is very interesting in its own right, this use of *of* is not the subject of this study, so subordinative uses of *of* were excluded. The sub-corpus was constructed by performing a search using the exploration software COREX on orthographic annotations of *of* that were POS-tagged to be coordinative conjunctions. This search resulted in over 43.000 sentences, too large a sample to include all of it in this study.

The corpus was reduced in size in two ways. First, a list of idiomatic phrases with *of* was automatically removed from the corpus. *Of* is part of multiple fixed expressions in Dutch, such as *een stuk of vier* (‘a piece or four’, meaning ‘approximately four’) and *of zo*, a fixed expression that has an approximative meaning and is widely used in spoken Dutch. Sometimes *of* still has a disjunctive meaning in these fixed expressions, but mostly this meaning is hardly distinguishable, and in any case, it usually contributes little to nothing to the truth value of the sentence as a whole. These sentences are therefore excluded from the corpus. Next, the corpus was further reduced in size by selecting only every fifteenth sentence, thus obtaining a cross section of the corpus that incorporates different types of speech. This resulted in a corpus of 2339 sentences.

### 5.2 *First annotation: interpreting of*

Two annotators were involved in this annotation. The instruction was written by the author. Both the author and a second annotator, trained in semantic annotation but unfamiliar with the discussion around *of*, independently annotated according to the instruction. After an initial pilot-annotation of 100 sentences, the answers of the two annotators were compared and any obscurities in the instruction that were established in this comparison or noticed earlier by the annotators were clarified.

Several control variables (capitalized and printed in bold) were annotated for to determine which sentences were interpretable and could be included for further analysis. Two of these variables were **Beginning** and **End**, indicating *of* was used at the beginning or end of a sentence. *Of* in Dutch (as *or* in English) is placed between two disjuncts. A sentence with *of* at the beginning or end thus misses one of the disjuncts and therefore can not be interpreted without looking at the conversation of which they were part. It was decided to exclude these sentences.

In some instances, occurrences of *of* had mistakenly been POS-tagged as coordinating, when they were really subordinating. These sentences were marked to be **Subordinating**. In Dutch speech, *of* can be used to indicate a correction, as shown in sentence 4.

4. *Jan is vierendertig of (ik bedoel) vijftendertig jaar oud.* (John is thirty-four or (I mean) thirty-five years old.)

This use is remarkable. It may indicate an exclusive basic reading, since it translates roughly to ‘what I said before was false, what I will say next is correct’. However interesting in its own right, this use is certainly not a classic case of disjunction, in which both disjuncts are considered possible and the speaker expresses doubt about which is true. Sentences that had this use of *of* were marked for **Correction**.

Sentences with *of* in a fixed expression that we missed in the automatic process of reducing the corpus are labelled **Expression**.

The sentences in which none of the control variables appeared were considered interpretable. These sentences were now annotated for the **In/exclusivity** of *of*. Also, an annotation was made for **Practical exclusivity** - that is, A and B can not occur together based on knowledge of our world, such as in sentence 5.

5. *John is in Paris or in Amsterdam.*

For sentences like 5, an inclusive reading is impossible - but this may be due to world knowledge rather than logical or linguistic factors. This variable was included to help with the interpretation, since practically exclusive sentences may for example obscure the effect of factors promoting inclusive reading.

The annotators came across a few other sentences during the annotation that could not be interpreted as disjunctions, for reasons that did not surface in the pilot-annotation. The annotators agreed to add a control category **Different construction** as a label for these sentences. This category had not been included in the annotation instruction. The annotation for these sentences was done in deliberation after the independent annotations had been done.

When comparing their annotations for Correction, the annotators noted that those sentences that were labelled to be corrections by only one of them were often ambiguous. The phrases with *of* could either be read as corrected mistakes or as disjunctions. To prevent these ambiguities from complicating the second annotation round and future analysis, all sentences that were labelled Correction by at least one of the annotators were ultimately annotated as Correction and therefore excluded from further analysis. The number of interpretable sentences was now 1325.

In some instances, one of the annotators had first marked a sentence for one of the control variables, but this decision was judged to be false in the deliberation over the final annotation. This meant some sentences were not annotated for In/exclusivity by one of the annotators, since no annotation was made for that category when the sentence was labelled for one of the control variables. These sentences were annotated again by the annotator that had ignored it at first.

After this additional annotation round, Cohen’s kappa was calculated for In-/exclusivity and the annotators deliberated on the final annotation for In/exclusivity. Fifteen sentences could not be interpreted, due to incompleteness or ambiguity, and were therefore taken out of the corpus before the second annotation round, leaving a corpus of 1310 sentences.

### 5.3 *Second annotation: factors*

In the second annotation round, the factors introduced in the *Goals and Hypotheses*-section were annotated. Only the author was involved in this annotation. The 1310 sentences that had been annotated for In/exclusivity were incorporated in this annotation round. The relevance of these factors for several of the hypotheses has been explained in the *Goals and Hypotheses*-section. I will now only provide an overview of the factors and their levels.

#### Clause-type

- *of* is part of the main clause
- *of* is part of an embedded clause
- *of* coordinates two main clauses
- *of* coordinates two embedded clauses
- *of* is not in a sentence
- *of* coordinates a full sentence and a free element

#### Time

- The sentence describes an action or situation set in the past
- The sentence describes an action or situation set in the past
- The sentence describes an action or situation that's either set in the future or hypothetical
- *Of* is not in a sentence

#### Speech act

- Providing information
- Asking for information
- Directive utterance
- *Of* is not in a sentence

#### Violation of Speaker Competence

- Speaker competence is explicitly violated (e.g. the speaker says *maybe* or *I suppose*)
- There is no such explicit violation

#### Negation

- The disjunction is negated
- The disjunction is not negated

#### Genericity

- The sentence is generic
- The sentence is particular
- *Of* is not in a sentence or ambiguous

### 5.4 *Statistical analysis*

For the interpretation of *of*, values of Cohen's kappa were calculated using SPSS. Chi-square tests were performed using R to analyse the relation between the factors annotated in the second annotation and the interpretation of *of*.

## 6 Results

### 6.1 Control variables

Counts and percentages for the control variables are listed in Table 2. Because some sentences were marked for more than one control variable, the percentage of the corpus accounted for by the control variables is slightly lower than one might assume from Table 2. The control variables accounted for 1014 sentences or 43.4% of the corpus. This left 1325 of the initial 2339 sentences for further analysis.

Table 2: counts and percentages of control variables

Category	N	Percentage of corpus
Subordinating	114	4.8
Beginning	405	17.3
End	139	5.9
Expression	139	5.9
Correction	246	10.5
Different construction	14	.6

### 6.2 Interpreting of

Table 3: Counts, percentages and Cohen's Kappa for the interpretation of of

Annotation	N	Percentage	Cohen's Kappa
Undecided	15	1.1	.515
Inclusive	498	37.6	
Exclusive - practical exclusive	812 532	61.3 40.2	
			.210*

\* Only exclusive occurrences of *of* were taken into account.

The 1325 sentences were annotated for the interpretation of *of*. The counts, percentages and value of Cohen's Kappa are in Table 3. In the majority of the sentences, the interpretation of *of* was exclusive, 61.3%. Inclusive interpretations made up 37.6% of the interpretable sentences. Fifteen sentences, making up 1.1% of the sentences that were taken into account, were not interpretable due to ambiguity or incompleteness. As the majority of the sentences received an exclusive interpretation, these data support Hypothesis 1.

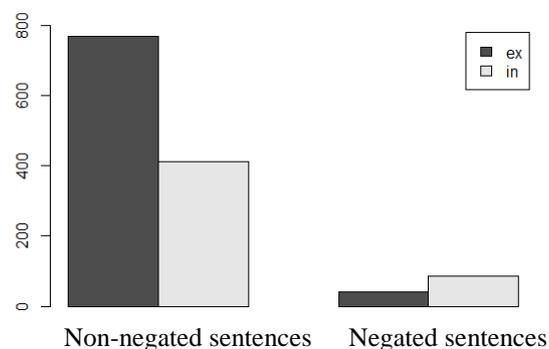
Cohen's kappa for in/exclusivity was .515, which is moderate according to Rietveld & Van Hout (1993). Cohen's kappa for practical exclusivity was .210, which is fair (but only just) (Rietveld & Van Hout 1993). The factor was therefore not included in further analysis.

### 6.3 Factors influencing the interpretation of of

I have proposed many variables that might influence the interpretation of *of*. Counts for the separate factors and their interpretations are in Table 4. The counts for 'no sentence' vary per factor, because incomplete sentences may sometimes provide enough information to annotate for one factor, but insufficient to annotate for another. I will now discuss the results in relation to the hypotheses. In all figures, the dark colour represents exclusive readings (labelled 'ex' in the caption) and the light colour represents inclusive readings (labelled 'in' in the caption).

As can be read from Table 4 and is illustrated in Figure 1, negated phrases get an inclusive reading more often than an exclusive reading. For non-negated phrases, the opposite is true; they are more often interpreted exclusive than inclusive. A Chi-square test showed the relation between negation and the interpretation

Figure 1: Interpretation by negation



of *of* was significant ( $\chi^2(1, N = 1310) = 51.26, p < 0.05$ ). This provides some support for Hypothesis 2, as *of* is more often interpreted as being exclusive when under negation, but still there are also some inclusive readings under negation.

Of the 1310 occurrences of *of* in our corpus, 512 were in a sentence in which speaker competence was intact. In the other 798 sentences, speaker expertise was violated, either because it was a question, the speaker explicitly stated he was unsure, or because the sentence described a future or hypothetical event. The majority of the occurrences of *of*, 60.9%, was in a sentence in which speaker expertise was violated. This supports Hypothesis 3.

A chi-square test showed a significant relation between the violation of speaker competence and the interpretation of *of* ( $\chi^2(1, N = 1310) = 68.32, p < 0.05$ ). However, as can be clearly seen from Figure 2, it is in fact the violated condition that elicits more exclusive readings. The occurrence of exclusive readings in speaker competence-violated conditions supports Hypothesis 6. We will now analyse each of the factors contributing to speaker expertise separately, in order to find the cause of the found effect.

A chi-square-test showed a highly significant relation between speech act and the interpretation of *of* ( $\chi^2(3, N = 1310) = 147.58, p < 0.05$ ). As can be seen from figure 3, questions elicit more exclusive interpretations than informative and directive sentences. This is likely to be the cause of the effect of the violation of speaker competence. There was also a relation between the time described and interpretation ( $\chi^2(3, N = 1310) = 8.97, p = 0.03$ ). This relation was only just significant, and, as can be seen in Figure 4, the different time conditions show very similar proportions of in- and exclusive readings. It seems the ‘no sentence’-condition is responsible for the found relation. There was no relation between the explicit violation of speaker competence and the interpretation of *of* ( $\chi^2(1, N = 1310) = 0.23, p = 0.63$ ). None of the factors that contribute to speaker competence show smaller proportions of exclusive readings in violated conditions, which provides more support for Hypothesis 6.

We found 167 sentences that resembled experimental stimuli, in that speaker expertise was intact, the speech act was to inform and the sentence was particular. Of these 167 occurrences of *of*, 77 received an inclusive reading. Inspecting these sentences further learned that 35 of them were annotated for negation, leaving 42 experimental-type sentences. This finding contradicts Hypothesis 5.

Figure 2: Interpretation when speaker competence is intact and when it is violated

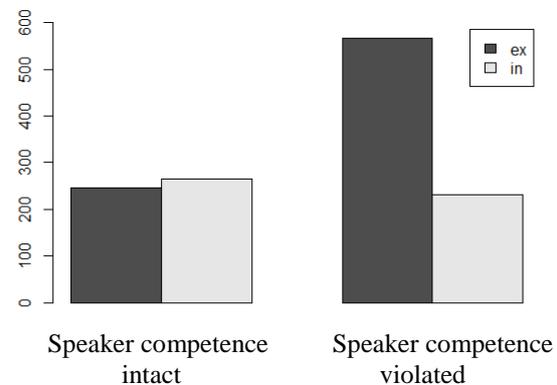


Figure 3: Interpretation by Speech act

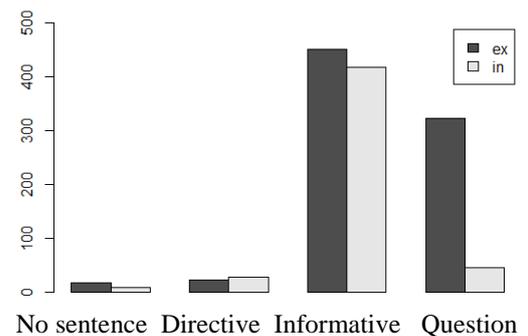


Figure 4: Interpretation by Time of action

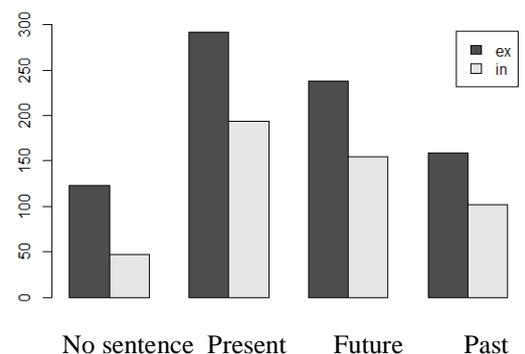


Figure 5: Interpretation by genericity

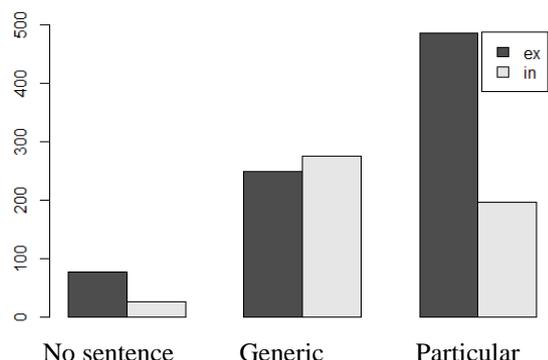
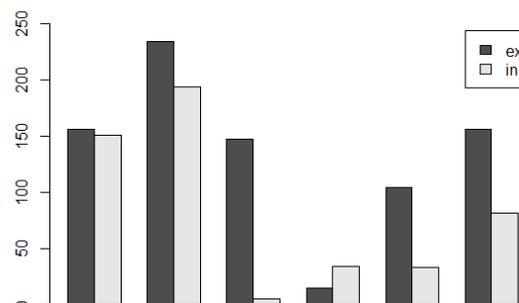


Figure 6: Interpretation by clause type



There was a significant relation between genericity and the interpretation of *of* ( $\chi^2(2, N = 1310) = 79.17, p < 0.05$ ). Particular sentences are more likely to be interpreted as exclusive, as illustrated in Figure 5. This supports Hypothesis 4.

There was a significant relation between clause type and interpretation,  $\chi^2(5, N = 1310) = 136.98, p < 0.05$ . However, there are no less than six levels in this factor and we do not know which of these levels is responsible for the effect found. The columns in Figure 6 from left to right are the embedded clauses, matrix clauses, loose elements, coordinating embedded clauses, coordinating matrix clauses and no sentence. Looking at figure 6, it seems the significant relation between clause type and interpretation is not due to the difference between embedded and matrix clauses, but rather to the other levels. *Of* in embedded clauses is in fact slightly more often interpreted exclusively than inclusively. This supports Hypothesis 7.

Table 4: Counts for all factors and corresponding interpretations.

Factor	Annotation	Inclusive	Exclusive
Speaker expertise	Explicitly violated	74	130
	Not explicitly violated	424	682
Sentence type	Matrix	194	234
	Embedded	151	156
	Free element	5	147
	Coordinating matrix clauses	33	104
	Coordinating embedded clauses	34	15
	No sentence	81	156
	Time	Past	102
	Present	194	292
	Future	155	238
Speech act	No sentence	47	123
	Providing information	417	451
	Asking for information	45	322
	Directive	28	22
Negation	No sentence	8	17
	no negation	412	771
	negation	86	41

## 7. Discussion and conclusions

The exclusive reading of *of* was the most frequent in this study, confirming Hypothesis 1. Negated disjunctions were more likely to be interpreted inclusively, supporting Hypothesis 2. These findings are in line with common intuitions about the interpretation of *of*.

Several factors that might influence the interpretation of *of* were considered. These factors will be discussed in relation to the goals of the study. The study also identified a new factor, being genericity. Particular sentences were more likely to receive an exclusive reading than generic sentences.

This study confirmed that *of* occurs in situations in which speaker competence is violated in 60.9% of the cases, supporting Hypothesis 3. We found many cases of exclusive interpretation in instances where the speaker expertise assumption was violated. In fact, we found no effect of speaker competence being violated, other than an effect of questions - and they received in fact more exclusive interpretations than other speech acts. None of the other factors violating speaker competence, time of action, and even explicit violations of speaker competence, influenced the interpretation of *of*. This supports Hypothesis 6. This finding contradicts the predictions of the pragmatic account and provides support for the lexicalist view.

The lexicalist view is further supported by the many occurrences of exclusive reading in an embedded clause that were found, confirming Hypothesis 7. The pragmatist view can not account for exclusive interpretations in embedded clauses, because the Gricean reasoning that leads to the rise of an SI only happens at the level of a whole utterance.

Our findings thus provide evidence against the pragmatic theory and support for the lexicalist theory.

One of the goals of this study was to prove that the sentences used in experimental research are abnormal. In order to prove this, we stated we should not be able to find any sentences that were particular, in which speaker expertise was intact and the speech act was to inform, and received an inclusive interpretation. We did in fact find 77 of these sentences, of which 35 were under negation, thus leaving 42 of these sentences that were not under negation. This contradicts Hypothesis 5. However, these sentences make up less than 0.5% of the corpus. I believe the finding of these sentences, especially in such a small number, is really due to annotation errors. Almost all annotated factors were involved in testing this hypothesis and thus the error rate was inflated. When inspecting the sentences in this list, I felt each and every one of these sentences should really be annotated for one of the factors that sets it apart from experimental sentences. A list of the sentences found is added as an appendix, for readers to evaluate.

Although Hypothesis 5 is certainly not confirmed, the very low proportion of sentences resembling experimental sentences nevertheless indicates that the use of inclusive sentences by well-informed speakers is atypical. The importance of this finding was explained in the introduction: if the use of *or* in such sentences is as atypical as it seems, the atypicality of the sentences may be responsible equivocal truth value judgements and long reaction times. This should be considered when interpreting experimental studies using these stimuli, and also when setting up new experiments.

Cohen's kappa for the interpretation of *of* was no higher than 0.52. This is certainly not the high measure of agreement we were aiming for. For now, I must conclude our corpus study is far from ideal as a method for investigating the interpretation of *or*. The Kappa-score should be considered when evaluating the results of this study.

Inspection of the sentences that the annotators did not agree on brought some confusing factors to light; many of them were also responsible for the very poor agreement on the practical exclusive category that had to be excluded. I believe that if these factors are considered before the writing of an instruction, corpus studies are still a useful research method in this discussion. Factors that seemed to confuse us when annotating were amongst others numerals and embedded sentences. Sentence 6 illustrates a confusing use of numerals and sentence 7 illustrates a confusing embedded occurrence of *or*.

6. *John has three or four children.*

7. *Sarah said that John was in Paris or Berlin on Saturday.*

Sentences like proved to be confusing for us in the annotation. One of the annotators reasoned ‘well, if John has four children, then he does not have five children, and vice versa’ and thus arrived at an exclusive interpretation, whereas the other annotator reasoned ‘if John has five children, that means he has four children - in fact, he has even more!’ and arrived at an inclusive interpretation. Sentence 7 was confusing, because although John can not possibly be in Paris and Berlin at once, Sarah might just have said both.

These discrepancies between the two annotations may well be resolved with a more thorough instruction. I think a higher measure of inter-annotator agreement can be achieved in future corpus studies investigating the interpretation of ‘or’, if more possibly confusing factors can be identified beforehand. It seems too soon to discard corpus studies as a method of research on the interpretation of *or* altogether. The current study was a first, therefore suffering teething problems. The found effect of negation and the exclusive reading being most frequent do nevertheless raise trust in the method. Future corpus studies may be able to obtain higher measures of inter-annotator agreement if they consider the suggestions in this paragraph. We encourage future research on the subject matter, because the serious flaws in our research may be overcome, but certainly it seems a corpus study does provide a new window into the mysteries of *or*.

In short, this study provides evidence from Dutch natural conversation against a pragmatic account of the derivation of the exclusive reading of ‘or’ and support for the lexicalist account. However, the results need to be interpreted with care, as the measure of inter-annotator agreement was not ideal. The study also strongly suggests the sentences mostly used as stimuli in experiments studying the interpretation of *or* are atypical and do not occur in natural speech. This has consequences for the interpretation of the results of such studies, and it is recommended to take this into consideration when developing experiments in future. This study identified a new factor in the interpretation of *or*, being genericity. More research is needed to further understand the role of this factor in the interpretation of *or*.

## References

- Braine, M., & Romain, B. (1981). Children's comprehension of "or": Evidence for a sequence of competencies. *Journal of Experimental Child Psychology*, 31, 46–70.
- Chevallier, C., Noveck, I. A., Nazir, T., Bott, L., Lanzetti, V. & Sperber, D. (2008) Making disjunctions exclusive. *The Quarterly Journal of Experimental Psychology*, 61(11), 1741-1760. DOI: 10.1080/17470210701712960.
- Grice, H. P. (1975). Logic and Conversation. In P. Cole & J. L. Morgan (Eds.), *Syntax and Semantics, Vol. 3, Speech Acts* (41-58). New York: Academic Press.
- Geurts, B., & Pouscoulous, N. (2009). Embedded implicatures?!?. *Semantics and Pragmatics*, 2(4), 1–34. doi:10.3765/sp.2.4.
- Levinson, S. C. (2000). *Presumptive meanings*. Cambridge, MA: MIT Press.
- Nederlandse Taalunie (2004). *Corpus Gesproken Nederlands*
- Paris, S. G. (1973). Comprehension of Language Connectives and Propositional Logical Relationships. *Journal of Experimental Child Psychology*, 16, 278-291.
- Pelletier, F. J. (1977). "Or". *Theoretical Linguistics*, 4, 61–74.
- Rietveld, T. & Van Hout, R. (1993). *Statistical techniques for the study of language and language behaviour*. Berlin: Mouton de Gruyter.
- Van Rooij, R., and Schulz, K. (2004). Exhaustive interpretation of complex sentences. *Journal of Logic, Language, and Information*, 13, 491–519.
- Sauerland, U. (2004). Scalar Implicatures in complex sentences. *Linguistics and Philosophy*, 27 (3), pp. 367-391
- Sauerland, U. (2012). The Computation of Scalar Implicatures: Pragmatic, Lexical or Grammatical?. *Language and Linguistics Compass*, 6(1), 36–49.
- Storto, G. & Tanenhaus, M. K. (2005) Are scalar implicatures computed online? *Proceedings of SuB*, 9, 431-445.
- Zimmermann, T. E. (2001). Free choice disjunction and epistemic possibility. *Natural Language Semantics*, 8, 255–290.
- Zondervan, A. J. (2010). *Scalar implicatures or focus: An experimental approach*. Utrecht: LOT.

## Appendix

### Sentences supposed to be experimental-type sentences

The considered occurrence of *of* is in curly brackets.

---

dat ze echt uh moslim die het uh die de oude Koran aanhingen moslims die nieuwe Koran aanhingen en {of} uh in de oorlog van Bosnië Servië dat uh dat sommige cursisten absoluut niet bij elkaar in de klas konden zitten.

---

ik bedoel een een uh een Anna Enquist {of} uh Joost Zwagerman uh Grunberg ja dat zijn uh auteurs die op het ogenblik veel gelezen worden.

---

door de vele kleine activiteiten {of} dat door dat die ruimte hier ja dat zal ook met die ruimte die ruimte was de die tuinkamer die was uh was niks en die hebben we dinsdagavond uh aangekleed.

---

'k heb leuke lekker ham gehaald {of} uh komijnekaas.

---

maar u zit nu uhm toch ja aanmerkelijk ver daarvandaan en te praten over over zoals 't niveau uh C {of} uh of uh D.

---

tien jaar ervaring of het nu bij McDonald's {of} bij Rhône-Poulenc was hebben me ervan overtuigd dat de ideale manager een onbenul is die weet dat hij niets kan en daar niet mee zit die de juiste mensen om zich heen heeft weten te verzamelen zonder iemand te kort te doen.

---

hij wilde door niets {of} niemand gestoord worden.

---

en röntgenfoto's van gezicht borst en andere lichaamsdelen die gebroken {of} zwaar gekneusd zijn.

---

terwijl weer anderen gevluchte slaven {of} bedienden waren.

---

op dat moment was 't niet meer alleen de ziekte van haar opa maar misschien ook de ziekte van haar moeder {of} zelfs de ziekte van haarzelf.

---

en nu ik hier in mijn eentje in mijn rolstoel zit te wachten kan ik niets bedenken wat ik zou willen kopen {of} zien.

---

bemoeizucht is het regelzucht autohaat {of} gewoon de zoveelste minister die zich wil profileren.

---

het voelt geheimzinnig net iets uit een verhaal {of} een film.

---

nog eens vijfentachtig mensen werden op de bon geslingerd omdat ze drugs bij zich hadden {of} het aan het dealen walen waren.

---

is leuk voor op de badkamer {of} op de d op de WC.

---

nee ja 'k vind 't wel jammer dat 't niet lukt {of} niet kan.

---

we willen iets waar we naartoe kunnen leven nou da 's een optreden {of} een uh ...

---

ggg maar ze had van die uh voor haar tuin want ze heb zelf een grote tuin en nou ja daar heb ze af en toe effe hulp bij had ze wat uh bloembakken of standaard had ze hier {of} daar besteld.

---

wat betreft Haalder {of} wat betreft de jeugd of wat betreft de de toekomst van Haalder of noem maar op.

---

toen wisselden ze zo'n beetje wat grappen uit {of} of gegevens.

---

ik weet in elk geval van twee mensen dat ze 't helemaal niet wilden {of} liever niet wilden.

---

die begon over een publicatie {of} een uh artikel wat ie had geschreven wat ook uh d'rop leek wat zij had gedaan maar dat 't van hun werd afgekeurd vanwege bla bla bla.

---

en dus ook die uh werkbalkjes staat er dan van Office en die wil ik eigenlijk uh verbergen {of} ergens anders maar dat lukt me ook niet.

---

dat ze met uh met met met koppels die niet bij elkaar horen dus m uh Mary met bijvoorbeeld Trudy of uh {of} uh Antoon met bijvoorbeeld uh ...

---

want ik heb op school ook nog gevraagd wie wie of uh of zo {of} een beetje quasi-nonchalant wie is de ma ...

---

en in de verre omgeving heeft die schokgolf {of} de explosie uh hebben heel veel schade aangericht aan huizen in de omgeving.

---

---

ze zijn dus vergeten over dat typisch Nederlands en de uh die positie van het Nederlands te midden van andere Europese talen {of} wereldtalen.

---

stelling bewering die ik als stelling {of} bewering accepteer.

---

nee i image en imago {of} corporate image dat zijn drie dezelfde termen.

---

nou ja en dan hebben we uitgewerkt uhm welke kinderen dan uh specifiek tijd krijgen {of} in ieder geval uh uitgebreid besproken worden binnen 't team.

---

de vraag is of zij 't niet kunnen {of} niet wensen of ...

---

en dan nu worden we nog altijd gekloot door 't stadsbestuur zo met post die soms 'ns trager is {of} uh bepaalde allee post van 't stadsbestuur xxx die gewoon ...

---

dat was azo lijk dat er ne grote film ging beginnen {of} azo waar dat de massa stond aan te schuiven.

---

maar hij zag dat wel zitten om bijvoorbeeld een keer naar Barcelona {of} een keer naar uh ...

---

want want op cello speelde ik uh een baslijn {of} een tegenmelodie die tegelijk als baslijn geldt en de accordeon speelt een melodie.

---

laat staan wat wij kennen van Pakistaanse {of} van Finse films.

---

ik pleit meteen nog voor hij burgemeester of minister-president {of} paus wordt voor zijn standbeeld.

---

en van die variaties zoals ze uitproberen uh in uh {of} waar ze aan denken in Nederland of uh het vooral toespitsen op jongeren die mogen maar onder invloed want die hebben minder rijervaring.

---

en ja toen dus uh niet-socialistische politici als Chirac {of} Louis Michel uh ook zich uitgesproken hebben voor het behouden van die sancties werd het dan België en Frankrijk.

---

da 's een een onbegrijpelijke denkfout bijna even ridicuul als uh vechten voor de vrede {of} uh neuken voor de maagdelijkheid.

---

hij begint te roepen en te tieren {of} ah 'k dacht dat dat jij diegene was die altijd xxx maar gij roept altijd.

---

in de Odyssee leert Hermes Odysseus dat hij op het moment dat hij Circe nadert die voor een vorm van matriarchale energie staat z'n zwaard moet trekken {of} tonen.

---

ik kreeg opeen razend veel zin om met Dust een partijtje voetbal te spelen {of} om met hem de velden in te trekken.

---

de raadplegingen die sinds negentien zesenvijftig binnen de Conseil De Cité hadden plaatsgevonden waren uitgemond in regels onder meer over de voorwaarden om zich kandidaat te stellen {of} om aan de raadpleging deel te nemen.

---

Salvador is teruggekomen Bélita zei ik om zijn stiletto op te halen of om mij af te maken {of} omdat onze prille liefde zijn gevoelens kwetst of misschien wel overall voor.

---

al die Vlaamse of Waalse {of} Brusselse of Duitstalige regeringen het is gewoon onze politieke koterij.

---