A contest of strength: *or* versus *either–or*[1]

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Abstract. Many languages have more than one way of conveying disjunction. Often one of these forms seems more strongly associated with an exclusive interpretation than the other. For example, in English *either–or* is felt to be more exclusive than plain *or*, and the same holds for German *entweder–oder* vs plain *oder*. In this paper we demonstrate experimentally that the difference in strength only arises when the two forms are both used; in isolation both disjunctions exhibit the same level of exclusivity. Our theoretical account assumes that only the stronger form is obligatorily associated with an implicature generating exhaustification operator, but given the strongest meaning preference in neutral, non-contrastive, contexts, the exhaustified interpretation is also employed for the weaker form. To account for contrastive contexts, we must furthermore employ the covert epistemic modal from Meyer (2013), and claim that the strong form acts as an alternative to the weak form, thereby generating an implicature that blocks the application of the strongest meaning preference.

Keywords: disjunction, alternatives, scalar implicature, exhaustification.

1. Introduction

Most languages have more than one way of conveying disjunction. In English we find *or* and *either–or*, in German *oder* and *entweder–oder*, in French *ou*, *ou–ou* and *soit–soit*, in Romanian *sau*, *ori*, *ori–ori*, *fie–fie*, and in Hungarian *vagy*, *vagy–vagy* and *akár–akár*. One of the main differences between these ways of conveying disjunction within a language relates to whether the disjunction is interpreted inclusively or exclusively in positive contexts.[2] In example (1), the exclusive inference is that Mary didn't visit both John and Bill. But both the simple disjunction *or* in (1a) and complex disjunction *either–or* in (1b) seem to support the exclusive inference.

(1)   a.   Mary will visit John or Bill. ⤳ *Mary won't visit both.*
      b.   Mary will visit either John or Bill. ⤳ *Mary won't visit both.*

Nevertheless the two disjunctions are intuitively felt to be different as is shown by the fact that logic textbooks in both English and German use the complex disjunction for exclusive

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[2] Nonetheless, in the languages that make a three and even a four-way distinction, it remains to be understood what other levels of variation there are.

disjunction. Why do linguistically naive speakers agree that *either–or* is the natural language counterpart of the logical exclusive disjunction, while *or* is the natural language counterpart of the logical inclusive disjunction? A difference between the two types of disjunctions becomes apparent when we try to cancel the exclusive inference, as shown below:

(2)   a.   Mary will visit John or Bill, *and possibly both*.
      b.   Mary will visit either John or Bill, #*and possibly both*.

The same contrast is observed cross-linguistically. In French, for example, the difference between the disjunctions *ou* and *soit–soit* can be argued to be parallel to the difference noted above from English.[3] Similarly to the contrast between English *or* and *either–or*, *soit–soit* gives rise to the exclusivity inference more robustly than *ou*, as noted by the fact that a continuation which contradicts the scalar inference 'she will go on both days,' is significantly less natural if the complex disjunction *soit–soit* was used.

(3)   a.   Marie ira au cinéma lundi ou mardi. Absolument! Et elle ira même à la fois lundi ET mardi.
           'Marie will go to the movies on Monday or Tuesday. Absolutely! She will even go both days.'
      b.   Marie ira au cinéma soit lundi soit mardi. #Absolument! Et elle ira même à la fois lundi ET mardi.

In (4) we see the same contrast surfacing in German, with *entweder oder* exhibiting the same restriction as *either–or* and *soit–soit*.

(4)   a.   Maria geht nächsten Freitag oder Samstag ins Konzert, und vielleicht an beiden Tagen.
           'Mary will go next Friday or Saturday to a concert, and maybe on both days.'
      b.   #Maria geht entweder nächsten Freitag oder Samstag ins Konzert, und vielleicht an beiden Tagen.

Differences in the strength of implicatures have recently been shown in other domains by van Tiel et al. (2016) experimentally. But a theoretical understanding of such differences has remained elusive. The difference between *or* and *either–or* provides new insights on this debate. In this paper, we first investigate empirically the difference in implicature strengh in both English and German in section 3. We show that when *or* and *either–or* are compared across subjects no difference arises, but when the two are compared within subjects there is a difference. Our account of these data is presented in Section 4. Before we present our new data, we introduce some theoretical background in the form of an account of implicatures (the grammatical approach), and some discussion of previous work on simple vs complex disjunction.

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[3]The French data is from Spector (2014), unless otherwise noted.

2. Preliminaries

2.1. The grammatical approach to implicatures

In this paper we adopt the view that implicatures are derived in the grammar via a mechanism of exhaustification. The idea is that scalar elements activate alternatives and the grammar integrates these alternatives in a systematic way within the meaning of the utterance. Chierchia, Fox, and Spector (2012) (building on work in Krifka 1995, Chierchia 2004, Spector 2006, Fox 2007, among others) argue that scalar implicatures are the result of a syntactic ambiguity resolution in favor of an LF which contains a covert exhaustivity operator $\mathcal{E}xh$. This operator makes the same contribution as *only*, with the only difference being that $\mathcal{E}xh$ asserts rather than presupposes the truth of its prejacent, as in (5).[4]

(5) $\mathcal{E}xh(p) = p \wedge \forall q \in \mathcal{A}lt(p))[p \not\sqsubseteq q \rightarrow \neg q]$
       (the assertion p is true and any alternative q not entailed by p is false)

Consider the example below, where the relevant alternative is the conjunction.

(6)   John talked to Mary or Bill.
       a. $\mathcal{A}lt$(John talked to Mary or Bill) = {John talked to M or B, John talked to M and B}
       b. $\mathcal{E}xh$[John talked to Mary or Bill] = John talked to Mary or Bill but not both.

In (6), exhaustification proceeds via $\mathcal{E}xh$. $\mathcal{E}xh$ negates all stronger statements which can be obtained from the prejacent by replacement of the scalar element (disjunction) with an alternative (conjunction), thus delivering the enriched meaning in (6b). It is worth noting, however, that a sentence like (6) does not always have the enriched meaning in (6b)—depending on the context, the implicature that 'John didn't talk with both Mary and Bill' may or may not be present. Assuming this grammatical approach to scalar implicatures, there are a few ways to think about the optionality of implicatures. One option is to take exhaustification to be an obligatory operation and appeal to a notion of alternative pruning in order to derive non-enriched meanings (cf. Fox and Katzir 2011 among others). Under this approach the difference between the inclusive and exclusive use of disjunction would be the result of what alternative set $\mathcal{E}xh$ makes reference to: for the inclusive reading the alternative set would be empty, whereas for the exclusive reading the alternative set would be as in (6a). Another option is to assume that the exhaustification operator is itself optional. Under this approach, a sentence like (6) can be said to be ambiguous between the two LFs in (7); note that under this approach the alternative set would remain constant.[5]

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[4]This is a vastly simplified version but it will do for our purposes.
[5]It is worth noting that assuming optional exhaustification is akin to assuming that all distinct alternatives are pruned.

(7)   John talked to Mary or Bill.
    a.   John talked to Mary or Bill   *inclusive*
    b. $\mathcal{E}xh$[John talked to Mary or Bill]   *exclusive*

2.2. Simple versus complex disjunctions

As already discussed above, on the approach we adopt, the scalar implicature 'not both' comes about as the result of applying the $\mathcal{E}xh$ operator, as outlined below:

(8)   a. $\mathcal{E}xh(p \vee q) = (p \vee q) \wedge \neg(p \wedge q)$
    b. $\mathcal{E}xh$[Mary will visit John or Bill] = Mary will visit John or Bill & Mary won't visit John and Bill

How can we account for the intuition that the SI 'not both' associated with *either–or* is stronger than the SI associated with *or*? Spector (2014) claims that *either–or*, but not *or*, triggers obligatory exhaustification. In other words, plain disjunction is ambiguous between the two LFs in (9), whereas complex disjunction is unambiguously interpreted with an $\mathcal{E}xh$ operator; that is, only the LF in (9b) is available with complex disjunction.

(9)   a. $[p \vee q]$ $^{\checkmark}$*or*, $^{\times}$*either–or*
    b. $\mathcal{E}xh[p \vee q]$ $^{\checkmark}$*or*, $^{\checkmark}$*either–or*

Spector leaves open though how the ambiguity *or* creates is resolved by speakers when the implicature is not blocked by other semantic content as in the implicature cancellation data in (2). As we mentioned, authors of math and logic textbooks uniformly find a contrast between *or* and *either–or* even though it is unlikely that they all thought about implicature cancellation contexts before deciding to use plain *or* for inclusive disjunction, and *either–or* for exclusive disjunction. To this end, we designed a series of experiments to detect a difference between *or* and *either–or* in examples not involving implicature cancellation.

3. Experiments

3.1. Experiment 1

The data from 80 native-English subjects was included in this experiment. Participants took the experiment online using the web-based Amazon Mechanical Turk platform. The first page included a demographic question, a declaration of their voluntary and confidential participation in the study, as well as a training session consisting of one example in order to ensure they understood the task. Subjects were asked to select "yes" or "no" in response to the question: "Is English your native language?". They were compensated for their participation regardless

of their answer to this question. We excluded subjects who took the experiment multiple times, as well as those who reported their native language as something other than English.

The subjects were shown 28 pairs of sentences and for each pair, they were asked to judge how likely it is that the sentence between quotation marks suggests the sentence in italics. They were instructed to give answers as diverse as necessary to represent their intuition, which they did by clicking on one of seven buttons below the sentences, ranging from "very unlikely" to "very likely". In order to move on to the next item, a selection on the likelihood scale for the current item had to be made first. Each trial was presented separately on its own page. The trials had the format below:

> "Sandy bought a dress or a shirt."
> **suggests**
> *Sandy didn't buy both a dress and a shirt.*
>
> very unlikely ○ ○ ○ ○ ○ ○ ○ very likely

We manipulated one factor, DISJUNCTION TYPE, which corresponds to which type of disjunction was used: *or* versus *either–or*. Each subject saw 28 trials: 14 critical trials and 14 fillers. This experiment had a between-subject design, and the participants were randomly assigned to one of two groups. The critical trials differed, depending on which of two groups the subjects were assigned to. The 14 critical trials in group 1 were of the form "a or b → not both a and b" (see (I)), while the trials in group 2 were of the form "either a or b → not both a and b" (see (II)). The fillers consisted of scalar items (e.g. "some → not all" and "can → doesn't have to"), as well as non-scalar items (e.g. "visit London → travel to Europe"). Distinct randomized lists were created for every subject, with the only constant being that the first two trials in each list were always fillers.

3.1.1. Results

Averaged ratings for the two conditions are given in the table in (10). Each condition had 40 participants. We fit a linear mixed effects model predicting response by condition (disjunction type). The model included random intercepts for participants and items. We found no significant effect of disjunction type ($p = 0.772$, $\beta = -0.103$, SE $= 0.289$, $t = -0.357$). In Figure 1 we present a violin plot for the two different conditions, *or* and *either–or*; this plot is similar to a box plot except that it also shows the kernel probability density of the data at different values.
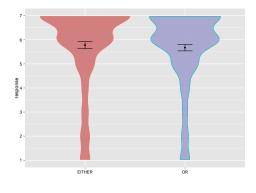

Figure 1: Experiment 1

(10)   *Average response by condition*

	OR	EITHER−OR
Experiment 1	5.671	5.773

3.1.2. Discussion

As discussed above, there is no significant difference between the two conditions, meaning that subjects rated the likelihood of the exclusive inference "not both a and b" as likely for *or* as for *either–or*. The result is consonant with similar findings of a lack of contrast between the simple and complex disjunctions in French and Japanese child language reported by Tieu et al. (2015). But the result is unexpected in light of the discussion in the introduction about the perceived contrast between the two types of disjunctions in terms of the strength of the exclusive inference. There are two main issues that need addressing at this point: (i) how can we reconcile these results with our intuitions, and (ii) how do these results fit in with the theoretical claims we proposed. We postpone the discussion of the first issue for after we have presented the rest of the experiments.

Based on the intuition that *or* is ambiguous between an inclusive and an exclusive interpretation whereas *either–or* unambiguously gives rise to an exclusive interpretation, Spector (2014) proposes an analysis of plain disjunction *or* as ambiguous between the two LFs in (11) while maintaining a non-ambiguous interpretation for the complex disjunction which can only be associated with the LF in (11b). (11b) entails the non-strengthened meaning in (11a).

(11)   a. $[p \vee q]$ $^\checkmark or, ^\times either–or$
         b. $\mathcal{E}xh[p \vee q]$ $^\checkmark or, ^\checkmark either–or$

Prima facie we would expect there to be more variability in the likelihood associated with the exclusive inference for the plain disjunction than for the complex disjunction given the proposed ambiguity. The fact that we do not see such variability and furthermore, that the plain disjunction *or* is as likely as the complex disjunction *either–or* to give rise to the exclusive inference, suggests that subjects strongly prefer the interpretation associated with the LF in (11b) for the plain disjunction. In other words, subjects choose the strongest of the two possible readings associated with *or*. In light of what we know about ambiguity resolution this turns out not to be a surprising finding after all since the general tendency when resolving ambiguities is to choose the strongest interpretation possible barring any contradictions with the context. One solution that immediately suggests itself is that of appealing to a version of the Strongest Meaning Hypothesis (SMH, cf. Heim 1991, Dalrymple et al. 1998, Singh 2011), a pragmatic principle which says that in a sentence with two possible readings, there is a preference for the strongest possible interpretation. We believe that the SMH is indeed implicated in the explanation of our data, but *prima facie*, the SMH would predict that *or* and *either-or* should be equally strong outside of implicature cancellation contexts contrary to our intuitions. Our next experiment tested whether *or* and *either–or* differ when they both occur in the same experiment.

3.2. Experiment 2a

Experiment 2a had a within-subject design. The task and instructions were identical to those in Experiment 1. Unlike in Experiment 1, every participant in this experiment saw the same 14 critical trials, 7 from the *or* condition and 7 from the *either–or* condition, a subset of the trials in Experiment 1, namely (I a-g) and (II a-g). The fillers were the same as before.

3.2.1. Results

The data from 30 subjects was analyzed for this experiment. Averaged ratings for the two conditions are provided in (12). Unlike in Experiment 1, which had a between-subject design, in Experiment 2a which had a within-subject design we found a significant effect of disjunction type ($p < 0.05$, $\beta = -0.291$, $SE = 1.109$, $t = -2.677$), with the *or* condition receiving lower likelihood ratings than the *either–or* condition.
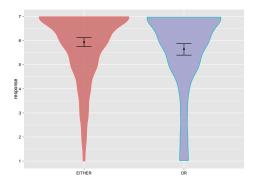

Figure 2: Experiment 2a

(12)   *Average response by condition*

	OR	EITHER−OR
Experiment 1	5.671	5.773
Experiment 2a	5.655	5.946

3.2.2. Discussion

We observe a difference in results once we switch to a within-subject design: ratings for the *or* condition are significantly lower than for the *either–or* condition. One way to interpret these results is as suggesting that subjects are less likely to derive an exclusive inference for *or* sentences than for *either–or* sentences. Given the theoretical foundations introduced above, we could take this to suggest that *or*, otherwise ambiguous between an inclusive and an exclusive interpretation, gets disambiguated in favor of the inclusive interpretation. This raises the question of why there should be a difference in the within-subject experiment but not the between-subject experiment. One may wonder if the difference in ratings between the *or* and *either–or* conditions may be due to the design, namely the fact that the target to filler ratio was one-to-one and thus too small to mask the critical items. If the critical items are not masked well enough, the subjects may adopt a strategy wherein they choose to disambiguate between the two types of disjunctions.

3.3. Experiment 2b

The goal of Experiment 2b was thus to see if additional fillers would affect the results. The task and instructions were identical to those in Experiments 1 and 2a. The only difference is that more fillers were added, bringing the total number to 36. Among the new fillers, 24 of them were of the form "some → not all" and "some but not all → all." When prompted for comments at the end of the task, a few of the participants' comments suggest that they thought the experiment focused on *some/some but not all*, proving that we indeed managed to mask the critical trials more successfully than in the previous experiment.

3.3.1. Results

The data from 40 subjects was analyzed for this experiment. Averaged ratings for the two conditions are provided in the table in (13). As before, we fit a linear mixed effects model predicting response by condition (disjunction type). The model included random intercepts for participants and items. In Experiment 2b, which had a within-subject design similarly to Experiment 2a, we still found a significant effect of disjunction type ($p < 0.05$, $\beta = -0.236$, SE $= 0.094$, $t = -2.505$), with the *or* disjunction receiving lower likelihood ratings than the *either–or* condition.
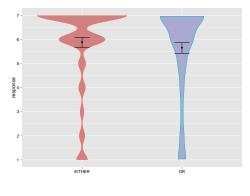

Figure 3: Experiment 2b

(13)   *Average response by condition*

	OR	EITHER−OR
Experiment 1	5.671	5.773
Experiment 2a	5.655	5.946
Experiment 2b	5.657	5.893

3.3.2. Discussion

The results of this experiment indicate once again that when subjects are presented with both types of disjunction, they tend to rate the *either–or* disjunction as more likely to give rise to an exclusive inference than the *or* disjunction. This experiment also shows that an increase in filler items does not affect the results. It is unclear at this point if the participants were actively disambiguating between the two disjunctions or if this "split" happened subconsciously. Nonetheless, it seems fair to conclude that given this task, subjects distinguish between the two conditions.

In the following experiment we probe this result further by changing the task. A possible confound of the current experimental task is that the conjunctive alternative is linguistically provided to the participants. Since our goal is to see if there is a difference between the two types of disjunction in terms of the strength of the exclusive inference, and since this inference comes about by negating, and thus accessing, the corresponding conjunctive alternative, one objection is that participants should not be provided with the alternative linguistically so as not to influence their interpretation.

3.4. Experiment 3

In this experiment we reformulated the task in such a way as to avoid making the conjunctive alternative available linguistically. The participants were shown pairs of sentences and were asked to decide if they could draw the conclusion stated in the second sentence, on a 7-point scale ranging from "not at all" to "yes, definitely." The first sentence was as before, of the form "a or b" or "either a or b", but unlike in the previous experiments, the second sentence was of the form "only one of these . . . ." An example of a critical trial is provided below:

> Jeremy bought a tie or a hat at Target.
> *can you conclude that*
> Jeremy bought only one of these things at Target.
>
> not at all ○ ○ ○ ○ ○ ○ ○ yes, definitely

The experiment consisted of 42 trials, 14 of which were target items and 28 fillers. The critical trials were minimally distinct from those in previous experiments (see (III) and (IV)). The 28 fillers were a subset of those in Experiment 2b, and were changed to reflect the change in the task. As before, distinct randomized lists were created for every subject, with the first two trials in each list being fillers. The subjects were compensated 50 cents for their participation.

3.4.1. Results

In the table below in (14) we report the averaged ratings collected from 36 subjects. A linear mixed effects model predicting response by condition (disjunction type) was fit. The model included random intercepts for participants and items. We found a significant effect of disjunction type ($p < 0.05$, $\beta = -0.274$, SE $= 0.099$, $t = -2.763$), with the conclusion "only one" being ranked lower in the *or* condition than in the *either–or* condition.
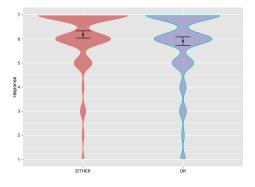

Figure 4: Experiment 3

(14)   *Average response by condition*

	OR	EITHER−OR
Experiment 1	5.671	5.773
Experiment 2a	5.655	5.946
Experiment 2b	5.657	5.893
Experiment 3	5.913	6.187

3.4.2. Discussion

The results of this experiment suggest, once again, that participants distinguish between *or* and *either–or* when asked to rate the likelihood of the exclusive inference. We see that this difference persists even when the conjunctive alternative is not provided linguistically to the participants. This experiment serves to show that even in the absence of an overt conjunctive alternative, subjects still employ this alternative to derive the exclusive inferences, and that just as before, they disambiguate between the two types of disjunctions.

3.5. Experiment 4

The goal of Experiment 4 was to see if the same contrast between plain and complex disjunction surfaces in German. Unlike the previous experiments, this experiment was hosted on Ibex Farm.[6] The first page included a demographic question, a declaration of their voluntary and confidential participation in the study, as well as a training session consisting of one example in order to ensure they understood the task. The entire experiment was in German. Subjects were recruited via mailing lists and were not compensated for their participation.

The subjects were shown 20 pairs of sentences and for each pair, they were asked to judge how likely it is that the sentence between quotation marks suggests the sentence in italics. They were instructed to give answers as diverse as necessary to represent their intuition, which they did by clicking on one of seven buttons below the sentences, ranging from *extrem unwahrscheinlich* "very unlikely" to *extrem wahrscheinlich* "very likely". In order to move on to the next item, a selection on the likelihood scale for the current item had to be made first. The trials had the format below:

> "Sonja has sich ein Kleid oder ein Shirt gekauft."
> **legt nahe:**
> *Sonja hat nicht ein Kleid und ein Shirt gekauft.*
>
> extrem unwahrscheinlich ○ ○ ○ ○ ○ ○ ○ extrem wahrscheinlich

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[6] http://spellout.net/ibexfarm/

We manipulated the same factor as before, DISJUNCTION TYPE, corresponding to which type of disjunction was used: *oder* "or" versus *entweder–oder* "either–or". This experiment had a within-subject design similarly to Experiments 2a, 2b and 3. Each subject saw the same 20 trials: 10 critical trials and 10 fillers. The 10 critical trials were evenly split between the two conditions (see (V) and (VI) for the specific items). The fillers consisted of both scalar and non-scalar items.

3.5.1. Results

In the table below in (15) we report the averaged ratings collected from 33 subjects. We fit a linear mixed effects model predicting response by condition (disjunction type), with random intercepts for participants and items. We found a significant effect of disjunction type ($p < 0.001$, $\beta = -0.479$, SE $= 0.128$, $t = -3.747$), with the *or* disjunction receiving lower likelihood ratings than the *either–or* condition.
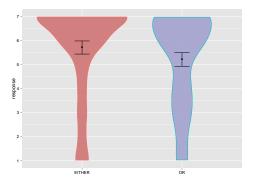

Figure 5: Experiment 4

(15)   *Average response by condition*

	OR	EITHER−OR
Experiment 2a	5.655	5.946
Experiment 4	5.230	5.709

3.5.2. Discussion

The results of this experiment show that German participants exhibit the same difference between simple and complex disjunctions as English participants do.

4. General discussion

The question posed by the results of Experiments 2–4 suggests that subjects ascribe different meanings to the two types of disjunctions. The most straightforward interpretation of these results is to claim that the plain disjunction *or* is disambiguated in favor of its non-exhaustified meaning, namely the inclusive interpretation.

(16)   a.   **LF for *or*:** $p \vee q$
        b.   **LF for *either–or*:** $\mathcal{E}xh[p \vee q]$

This interpretation of the data does not quite capture the observation that this disambiguation is parasitic on the co-occurrence of the two types of disjunctions. In the following we formulate a different proposal that capitalizes on this fact by arguing that what is actually going on is that in a context where both *or* and *either–or* are used to express disjunction, the two disjunctions enter into a competition with each other such that the alternative relevant when computing the meaning of *or* is not *and* but rather *either–or*.

To this end, the first option we may consider is as in (17), where the alternative to *or* is *either–or*, on its interpretation provided in (16b). We retain the claim in Spector (2014) that *either–or* triggers obligatory exhaustification, meaning that *or* will always have as its alternative an already exhaustified expression. The problem with this approach is that it amounts to *or* receiving a conjunctive interpretation. This clearly is not the interpretation subjects ascribe to the plain disjunction *or* given the setup of the experiments. Recall that the subjects were asked to judge the likelihood of the exclusive interpretation. If the plain disjunction did in fact receive the meaning in (17b), we would expect the exclusive inference to be rated very low since it is in clear contradiction with the exhaustified meaning of *or*. Our results thus suggest that this is not the appropriate prediction.

(17) $\mathcal{E}xh[p \vee q]$
     a. $\mathcal{A}lt(p \vee q) = \{p \vee q, (p \vee q) \wedge \neg(p \wedge q)\}$
     b. $[\![\mathcal{E}xh[p \vee q]]\!] = (p \vee q) \wedge \neg[(p \vee q) \wedge \neg(p \wedge q)]$
                   $= p \wedge q$

In light of this obstacle, we suggest a different approach which relies on the analysis pursued in Meyer (2013). Meyer argues that uncertainty implicatures (*I don't know which one*) normally thought of as arising via pragmatic principles (e.g. via Grice's Cooperative Principle), can also be derived in the grammar, similarly to scalar implicatures. The claim is that assertively used sentences contain a covert doxastic operator which is adjoined at the matrix level at LF (cf. also Kratzer and Shimoyama (2002), Chierchia (2006) and Alonso-Ovalle and Menéndez-Benito (2010) for similarly minded proposals). Meyer calls this operator **K** following Gazdar (1979) and gives it the semantics in (18). We will represent this operator as a necessity modal throughout the remainder of the text.

(18) $[\![\mathbf{K}_x \, \mathrm{p}]\!] = \lambda w.\forall w' \in \mathrm{Dox}(x)(w) : p(w')$
        $w' \in Dox(x)(w)$ *iff given the beliefs of x in w, w' could be the actual world.*

By bringing this operator into the grammar, the result of exhaustification will vary between what Sauerland (2004) calls primary ($\neg\mathbf{K}p$) and secondary implicatures ($\mathbf{K}\neg p$) implicatures, depending on whether the exhaustification operator scopes above or below the doxastic operator.[7] If $\mathcal{E}xh$ takes widest scope, as in (19), the resulting meaning for *either–or* will be as in

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[7] For the purposes of this presentation we only consider exhaustification with respect to the scalar alternative; this will keep the presentation simpler without actually affecting the end result.

(19b) with a primary implicature, given the alternative in (19a).

(19)   **LF for *either–or*:** $\mathcal{E}xh\mathbf{K}[p \vee q]$
    a. $\mathcal{A}lt(\mathbf{K}[p \vee q]) = \{\mathbf{K}[p \vee q], \mathbf{K}[p \wedge q]\}$
    b. $[\![\mathcal{E}xh\mathbf{K}[p \vee q]]\!] = \mathbf{K}[p \vee q] \wedge \neg\mathbf{K}[p \wedge q]$

Recall our proposal: *or* competes with *either–or*, so the alternative to *or* is the strengthened disjunction, rather than the conjunction. That means that in order to derive the strengthened meaning of *or*, we have to check what happens when exhaustification occurs with respect to the alternative derived in (19b).

(20)   **LF for *or*:** $\mathcal{E}xh\mathbf{K}[p \vee q]$
    a. $\mathcal{A}lt(\mathbf{K}[p \vee q]) = \{\mathbf{K}[p \vee q], \mathcal{E}xh\mathbf{K}[p \vee q]\}$
                   $= \{\mathbf{K}[p \vee q], \mathbf{K}[p \vee q] \wedge \neg\mathbf{K}[p \wedge q]\}$
    b. $[\![\mathcal{E}xh\mathbf{K}[p \vee q]]\!] = \mathbf{K}(p \vee q) \wedge \neg[\mathbf{K}[p \vee q] \wedge \neg\mathbf{K}[p \wedge q]]$
                   $= \mathbf{K}[p \wedge q]$

We see that just as before, we derive a much too strong meaning for the simple disjunction, one that is crucially in conflict with the exclusive inference. Recall that plain *or* is still judged to allow an exclusive inference. We can conclude thus that participants are not interpreting *or* as in (20b), i.e. that the alternative to *or* is not *either–or* on the LF in (19).[8]

Another possible scenario is one where *either–or* is associated with the LF in (21) and receives the interpretation in (21b).

(21)   **LF for *either–or*:** $\mathbf{K}\mathcal{E}xh[p \vee q]$
    a. $\mathcal{A}lt(p \vee q) = \{p \vee q, p \wedge q\}$
    b. $[\![\mathbf{K}\mathcal{E}xh[p \vee q]]\!] = \mathbf{K}[p \vee q] \wedge \mathbf{K}\neg[p \wedge q]$

Given this meaning for *either–or*, let's check what happens when *or* takes as its alternative this stronger meaning under the LF in (22).

(22)   **LF for *or*:** $\mathcal{E}xh\mathbf{K}[p \vee q]$
    a. $\mathcal{A}lt(\mathbf{K}[p \vee q]) = \{\mathbf{K}[p \vee q], \mathbf{K}\mathcal{E}xh[p \vee q]\}$
                   $= \{\mathbf{K}[p \vee q], \mathbf{K}[p \vee q] \wedge \mathbf{K}\neg[p \wedge q]\}$
    b. $[\![\mathcal{E}xh\mathbf{K}[p \vee q]]\!] = \mathbf{K}[p \vee q] \wedge \neg[\mathbf{K}(p \vee q) \wedge \mathbf{K}\neg(p \wedge q)]$
                   $= \mathbf{K}[p \vee q] \wedge \neg\mathbf{K}\neg[p \wedge q]$

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[8]This meaning is probably out for independent reasons, such as the fact that the result of exhaustification gives rise to a meaning that is stronger than the alternative.

This strengthened meaning for *or* is now compatible with the results of our experiments: the meaning associated with *or* is weaker than the meaning associated with *either–or*. Furthermore, this strengthened meaning of *or* is compatible with $\neg\mathbf{K}[p \wedge q]$, explaining why subjects did not rate the exclusive inference on the low end of the scale.

5. Conclusion

We have shown that, out of the blue, plain *or* and *either–or* have the same interpretation and specifically, that the exclusivity inference is equally strong for both. We argued that this comes about due to a general pragmatic principle which dictates that the strongest meaning should be employed when a sentence is ambiguous. Only when the two structures are contrasted within the same experiment does a difference surface between *or* and *either–or*. We showed that the data could be derived if we assume that the meaning of the *either p or q* sentence with its secondary implicature $\mathbf{K}\neg[p \wedge q]$ is available as an alternative for *p or q* when the two are contrasted. Our account makes the prediction that the order of presentation should have an effect on the results such that *or* should be interpreted with the implicature from above only after at least the first occurrence of *either–or*. In future work we plan to investigate this prediction in more detail.

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6. Appendix

6.1. Experiments 1 & 2 critical trials

(I) **Or**

  a. Bill gave Mary flowers or chocolate for her birthday. *suggests* Bill didn't give her both flowers and chocolate.

  b. Mark sent Jon a puzzle or a Gameboy. *suggests* Mark didn't send Jon both a puzzle and a Gameboy.

  c. Sandy bought a dress or a shirt. *suggests* Sandy didn't buy both a dress and a shirt.

  d. Danny met with Laine or Suzy. *suggests* Danny didn't meet with both Laine and Suzy.

  e. Joanne invited David or Sabine to the party. *suggests* Joanne didn't invite both David and Sabine to the party.

  f. Tia inherited the desk or the piano from her grandfather. *suggests* Tia didn't inherit both the desk and the piano from her grandfather.

  g. Monika has pain in her forearm or her shoulder. *suggests* Monika doesn't have pain in both her forearm and her shoulder.

  h. Ellen discussed these issues with Martin or Adam. *suggests* Ellen didn't discuss these issues with both Martin and Adam.

  i. Jenny received a bill or an invitation in the mail today. *suggests* Jenny didn't received both a bill and an invitation in the mail today.

  j. Horatio complained about the staff or the meals to the manager. *suggests* Horatio didn't complain about both the staff and the meals to the manager.

  k. Jack purchased a sports car or a truck at the dealership. *suggests* Jack didn't purchase both a sports car and a truck at the dealership.

l.   Toby finished his math or his history homework. *suggests* Toby didn't finish both his math and his history homework.

m.   Fiona watched a movie or a tv show last night. *suggests* Fiona didn't watch both a movie and a tv show last night.

n.   Peter borrowed a hammer or a screwdriver from Jason. *suggests* Peter didn't borrow both a hammer and a screwdriver from Jason.

(II)   **Either–or**

a.   Jack gave Sue either champagne or jewelry for her birthday. *suggests* Jack didn't give her both champagne and jewelry for her birthday.

b.   Toby sent Beth either a doll or a board game. *suggests* Toby didn't send Beth both a doll and a board game.

c.   Terry bought either a blouse or a skirt. *suggests* Terry didn't buy both a blouse and a skirt.

d.   Fiona talked with either Nigel or Jordan. *suggests* Fiona didn't talk with both Nigel and Jordan.

e.   Becky invited either Sam or Rick to the ball. *suggests* Becky didn't invite both Sam and Rick to the ball.

f.   Peter inherited either the painting or the wardrobe from his grandmother. *suggests* Peter didn't inherit both the painting and the wardrobe from his grandmother.

g.   Pam has pain either in her thumb or in her elbow. *suggests* Pam doesn't have pain both in her thumb and in her elbow.

h.   Ellen discussed these issues with either Martin or Adam. *suggests* Ellen didn't discuss these issues with both Martin and Adam.

i.   Jenny received either a bill or an invitation in the mail today. *suggests* Jenny didn't received both a bill and an invitation in the mail today.

j.   Horatio complained either about the staff or the meals to the manager. *suggests* Horatio didn't complain about both the staff and the meals to the manager.

k.   Jack purchased either a sports car or a truck at the dealership. *suggests* Jack didn't purchase both a sports car and a truck at the dealership.

l.   Toby finished either the math or the history homework. *suggests* Toby didn't finish both the math and the history homework.

m.   Fiona watched either a movie or a tv show last night. *suggests* Fiona didn't watch both a movie and a tv show last night.

n.   Peter borrowed either a hammer or a screwdriver from Jason. *suggests* Peter didn't borrow both a hammer and a screwdriver from Jason.

6.2. Experiment 3 critical trials

(III)   **Or**

a.   Bill gave Mary flowers or chocolate for her graduation. *can you conclude that* Bill gave Mary only one these two things for her graduation.

b.   Mark sent Jon a puzzle or a Gameboy for his birthday. *can you conclude that* Mark

sent Jon only one thing for his birthday.

    c.   Jeremy bought a tie or a hat at Target. *can you conclude that* Jeremy bought only one of these two at Target.

    d.   Danny met with Laine or Suzy before the conference. *can you conclude that* Danny met with only one of these two women before the conference.

    e.   Joanne invited David or Sabine to the party. *can you conclude that* Joanne invited only one of these two to the party.

    f.   Tia inherited the desk or the piano from her grandfather. *can you conclude that*Tia inherited only one thing from her grandfather.

    g.   Monica finished her math assignment or her history assignment. *can you conclude that* Monica finished only one of these two assignments.

(IV)   **Either–or**

    a.   Jack gave Sue either champagne or jewelry for her birthday. *can you conclude that* Jack gave Sue only one of these two things for her birthday.

    b.   Toby sent Beth either a doll or a board game yesterday. *can you conclude that* Toby sent Beth only one of these two things yesterday.

    c.   Terry bought either a blouse or a skirt at Macy's. *can you conclude that* Terry bought only one of these two pieces of clothing at Macy's.

    d.   Fiona talked with either Nigel or Jordan at the bar. *can you conclude that* Fiona talked with only one of these two men at the bar.

    e.   Becky invited either Sam or Rick to the ball. *can you conclude that* Becky invited only one of these two men to the ball.

    f.   Peter inherited either the painting or the wardrobe from his grandmother. *can you conclude that* Peter inherited only one thing from his grandmother.

    g.   Pam finished either the ironing or the vacuuming while her mom was away. *can you conclude that* Pam finished only one of these two chores while her mom was away.

6.3. Experiment 4 critical trials (German)

(V)   **Oder** ('or')

    a.   Bernd hat Maria Blumen oder Schokolade zum Geburtstag geschenkt. *legt nahe* Bernd hat Maria nicht Blumen und Schokolade geschenkt.

    b.   Markus hat Jan ein Puzzle oder einen Gameboy geschickt. *legt nahe* Markus hat Jan nicht ein Puzzle und einen Gameboy geschickt.

    c.   Sonja hat sich ein Kleid oder ein Shirt gekauft. *legt nahe* Sonja hat nicht ein Kleid und ein Shirt gekauft.

    d.   Daniel hat sich mit Luisa oder Susi getroffen. *legt nahe* Daniel hat sich nicht mit Luisa und mit Susi getroffen.

    e.   Janine hat David oder Sabine zur Party eingeladen. *legt nahe* Janine hat nicht David und Sabine zur Party eingeladen.

    f.   Ellen hat diese Fragen mit Martin oder Adam diskutiert. *legt nahe* Ellen hat diese

Fragen nicht mit Martin und mit Adam diskutiert.

g. Jenny hat eine Rechnung oder eine Einladung in ihrer Post. *legt nahe* Jenny hat nicht eine Rechnung und eine Einladung in ihrer Post.

h. Harald hat sich ber das Personal oder ber das Essen beim Manager beschwert. *legt nahe* Harald hat sich nicht ber das Personal und ber das Essen beim Manager beschwert.

i. Tina hat den Schreibtisch oder das Klavier von ihrem Grovater geerbt. *legt nahe* Tina hat nicht den Schreibtisch und das Klavier von ihrem Grovater geerbt.

j. Monika hat Schmerzen im Unterarm oder in der Schulter. *legt nahe* Monika hat Schmerzen nicht im Unterarm und in der Schulter.

(VI) **Entweder oder** ('either–or')

a. Jonas hat Susanne entweder Champagner oder Schmuck zum Geburtstag geschenkt. *legt nahe* Jonas hat Susanne nicht Champagner und Schmuck zum Geburtstag geschenkt.

b. Tobias hat Betty entweder eine Puppe oder ein Brettspiel geschickt. *legt nahe* Tobias hat Betty nicht eine Puppe und ein Brettspiel geschickt.

c. Tatjana hat entweder eine Bluse oder einen Rock gekauft. *legt nahe* Tatjana hat nicht eine Bluse und einen Rock gekauft.

d. Fiona hat entweder mit Norbert oder mit Johannes geredet. *legt nahe* Fiona hat nicht mit Norbert und mit Johannes geredet.

e. Beate hat entweder Samuel oder Richard zum Ball eingeladen. *legt nahe* Beate hat nicht Samuel und Richard zum Ball eingeladen.

f. Boris hat seinen Vorschlag entweder mit Janine oder Rafael abgesprochen. *legt nahe* Boris hat seinen Vorschlag nicht mit Janine und mit Rafael abgesprochen.

g. Ferdinand hat entweder ein Gutachten oder einen Scheck heute mit der Post erhalten. *legt nahe* Ferdinand hat nicht ein Gutachten und einen Scheck heute mit der Post erhalten.

h. Elisabeth hat sich entweder ber die Betten oder die Garage bei der Rezeption beschwert. *legt nahe* Elisabeth hat sich nicht ber die Betten und die Garage bei der Rezeption beschwert.

i. Peter hat entweder das Gemlde oder den Kleiderschrank von seiner Oma geerbt. *legt nahe* Peter hat nicht das Gemlde und den Kleiderschrank von seiner Oma geerbt.

j. Pamela hat entweder im Daumen oder im Ellbogen Schmerzen. *legt nahe* Pamela hat nicht im Daumen und im Ellbogen Schmerzen.