Ignorance and Grammar

by

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M.A., Humboldt University Berlin (2008)

Submitted to the Department of Linguistics and Philosophy
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

September 2013

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Abstract

In this thesis, I propose a new theory of implicature. I argue that the two main theories available so far – the (Neo-)Gricean pragmatic theory on the one hand (e.g., Sauerland (2004)), and the hybrid grammatical theory of scalar implicatures on the other hand (e.g., Fox (2007)) – cannot provide a satisfactory account of disjunctions like *Al drank some or all of the beers*. As I will show, the meaning of these sentences is characterized by the presence of grammatical ignorance implicatures. In this they differ from their simpler alternatives. I will show how the proposed Matrix K theory of implicature derives this result. The new theory is a radically grammatical theory in that all kinds of implicatures – weak, scalar, and ignorance implicatures – are derived in the grammar. I will also show how Hurford's constraint can be derived from a general principle of manner in the new theory. I will then turn to logically underinformative statements like *Some elephants are mammals* and show how their oddness falls out from the Matrix K theory without further stipulations. Next, I argue that the theory extends to infelicitous Hurford disjunctions like *Jean is from France or from Paris*. Both phenomena can receive a uniform explanation in terms of grammatically derived, contextually inconsistent implicatures, without stipulating obligatory scalar implicatures. Lastly, I turn to the case of implicature suspension and show how the new theory can account for missing implicatures.

Thesis Supervisor: Irene Heim
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Acknowledgments

Abstracting away from the pressure and uncertainty which seems to be essential to thesis-writing, I immensely enjoyed working on this dissertation. The fact that I am able to make such a claim is due in no small part to the selfless support I have received from other people, and most importantly, from the members of my committee –

Irene Heim, Uli Sauerland, Danny Fox, Kai von Fintel.

I thank them for their interest in my work, for the time they have taken to help me improve it, and for the energy they have invested in broadening my knowledge and understanding.

Irene Heim has been my advisor for the last five years, and I am convinced that the strong correlation between time spent as her student and knowledge gained is best explained in terms of causation. I have always been most impressed by Irene's integrity, sobriety, and love of truth. Though I can never hope to meet her standards, I am grateful to her for taking the time and energy to impose these standards on my work, however hopeless it may have seem at times.

Uli Sauerland could not serve as co-chair of my committee because of MIT internal regulations. For all intents and purposes, however, he was. I am deeply grateful to him for being such an incredibly supportive and motivating advisor and teacher, and for encouraging me to apply to MIT in the first place. I continue to be impressed by how Uli is able to turn even the most chaotic, flawed proposal into a set of well-structured, valuable ideas, and I could not be more grateful to him for applying this great gift to the ideas that I presented to him.

If nothing else, this thesis is witness to my fascination with formal pragmatics, and this fascination was fostered by Danny Fox. Discussions with Danny have always been a highlight in my schedule. His criticism and comments, combined with his incredible enthusiasm, have been a great source of motivation for me. I am extremely grateful to Danny for having been such a constructive critic and enthusiastic teacher.

Kai von Fintel has advised me on many more topics than are covered in this dissertation. I have never had a meeting with him during which I did not – at least momentarily – feel like I was completely ignorant. Kai's incredible radar for weak points has been an invaluable incentive for me to make progress, and I am grateful to him for providing me with what seems like enough material to think about for the rest of my career.

I am also grateful for the great administrative and technical support I have received from Christine Graham, Mary Grenham, Christopher Naylor, Jennifer Purdy and Matthew Sikorski. I will miss their friendliness, patience, and readiness to help very much.

Having had such amazing classmates was a true gift, and I will miss them dearly. Thanks to Sam Al Khatib, Young Ah Do, Natalia Ivlieva, Liudmila Nikolaeva, Rafael Nonato, Alexander Podobryaev and Igor Yanovich for making these five years a very precious experience. I am particularly grateful to Natasha Ivlieva for her friendship and support during the last stages of writing this thesis.

Lastly, I would like to express my gratitude to my previous professors, who made it possible for me to come to MIT: Manfred Krifka and Olaf Müller in Berlin, and Arnim von Stechow, Wolfgang Sternefeld and Hubert Truckenbrodt – who was the first to arouse my interest in linguistics – in Tübingen.

Contents

Chapter 1

Introduction

1.1 Surface Redundancy in Disjunction

Throughout the first part of this thesis, I will be concerned with what I call Surface Redundancy. A particularly striking case of such redundancy can be found in disjunctions like the following:

(1) They have locations in Alewife or Braintree, or both

(2) Al drank some or all of the beers

I assume, uncontroversially, that *both* is elliptical for *both of A, B* and that this in turn is semantically equivalent to the conjunction *A and B*. Assume now a simple hypothesis according to which *A or B* is defined in terms of logical disjunction

$A \vee B$ and the quantificational expression *some* in terms of the existential quantifier $\exists$. It seems like these disjunctions should then be equivalent to one of their disjuncts:

(3) They have locations in Alewife or Braintree

(4) Al drank some of the beers

But if this is so, why would a speaker bother to add the second, seemingly redundant disjunct?

It might seem like a poor terminological choice to call a redundancy that is identified at LF a *surface* redundancy. There is good reason to stick with this terminology, however. Redundancy is a semantic notion and as such only identifiable at a level of syntactic representation which is interpreted semantically; I assume this representation to be Logical Form. As we will see shortly, adding covert operators at LF may obviate the redundancy, which in this sense is a *surface* redundancy.

Given this intuitive understanding of surface redundancy, we can now turn to the theoretical challenges this phenomenon presents and how these challenges have been addressed in previous research.

1.2 Background: Implicatures

1.2.1 Pragmatically Derived Implicatures

Pragmatic theories of implicature assume that the meaning of a sentence can be divided into a semantic component and a pragmatic component, where the latter is derived through Gricean principles of communication (cf. Grice (1975, 1989); Gazdar (1979); Horn (1984, 2004); Hirschberg (1985); Matsumoto (1995); Levinson (2000); Kadmon (2001); Sauerland (2004, 2011); Spector (2006); Geurts (2010). All implicatures belong to the pragmatic component and are thus derived post-grammatically, by comparing the speaker's assertion to potential alternative assertions in view of Grice's maxims of conversation. Collapsing these maxims, the Gricean system can be summarized by the following principle (cf. Matsumoto (1995); Katzir (2007)):

(5) GRICE'S COOPERATIVE PRINCIPLE

A cooperative speaker does not assert W if there is a sentence S such that:

1. $S \Rightarrow W \wedge \neg(W \Rightarrow S)$
2. S is relevant
3. K(S)

Before we go on, a remark about relevance is in order. Though I make no attempt at contributing to this question here, I hasten to say that giving a more precise definition of relevance is not a trivial matter. For now, the following informal characterization will do: A sentence is relevant only relative to a given discourse context. A context can be defined in terms of the question that is currently being discussed (the $\mathcal{QUD}$, cf. von Kuppevelt (1995); Roberts (1996); Magri (2009)). Then we can define a sentence as relevant in a certain context if (and only if) it gives at least a partial answer to the current $\mathcal{QUD}$ (cf. Spector (2007); Zondervan et al. (2008); Benz and Salfner (2013)).

I assume as an axiom that speakers are being cooperative unless they explicitly opt out of cooperative communication (for example, by being ironic). Furthermore I assume that being cooperative entails making only relevant assertions. It follows that an assertion is always relevant in the context it is made (cf. Magri (2009)). This allows us to reconstruct the currently discussed $\mathcal{QUD}$ in case it is not explicit.

If a principle of communication like (5) is indeed governing linguistic communication, the reasoning that is set in motion by the assertion of a weak sentence W can be described as follows:

1. The speaker asserted *Al drank some of the beers* (let's abbreviate this as W)
2. Since he did not explicitly signal that he is being un-cooperative, this means there is no other sentence S which satisfies all of the three criteria from the cooperative principle (5):
   (a) S is logically stronger than W

(b) S is relevant

(c) the speaker is sure that S (KS)

3. S = *Al drank all of the beers* is clearly stronger than the asserted sentence W = *Al drank some of the beers*

4. In contexts in which W is relevant, S will typically be relevant, too (just consider the fact that the $\mathcal{QUD}$ which W typically addresses is *How many drinks did Al have?*)

5. Therefore, neither the first nor the second criterion could be the reason why the speaker didn't assert S instead of W

6. By exclusion, the speaker's epistemic state must be the culprit:
   She is not sure that Al drank all of the beers

Looking back at the cooperative principle in (5), we have thus derived the negation of the third criterion. Formally:

(6) $\neg K_S$ (Al drank all of the beers)

Here and throughout, I use K as a doxastic necessity operator, i.e., K_S expresses necessity relative to the beliefs of a doxastic source s, which in most contexts will be the speaker. Where there is no ambiguity, I will therefore leave out the subscript S; as a paraphrase for $(\neg)K\psi$ I use the locution 'the speaker is (not) sure that ψ'. Likewise, I will refer to implicatures of the form $\neg K\psi$ as *weak implicatures.* Weak implicatures thus amount to the conclusion that the speaker asserted a weak sentence W rather than a stronger relevant alternative S because he is not sure that S is true.

As pointed out by Fox (2007a), however, a weak implicature is so-called because it makes a weak claim. By this I mean that $\neg K(S)$ covers a relatively large set of situations, which can be further partitioned into two kinds:

SITUATION	FORMAL DESCRIPTION
The speaker is sure that S is false	$K(\neg S)$
The speaker is ignorant as to whether or nor S is false	$\neg K(S) \wedge \neg K(\neg S)$

Thus, both $K(\neg S)$ and $(\neg K(S) \wedge \neg K(\neg S))$ asymmetrically entail $\neg K(S)$:

(7) a. $K(\neg S) \Rightarrow \neg K(S)$

b. $(\neg K(S) \wedge \neg K(\neg S)) \Rightarrow \neg K(S)$

To introduce a further terminological convention, I will refer to inferences of the form $K\neg\psi$ as *scalar implicatures,* while I use the term *ignorance implicatures* to refer to inferences of the form $(\neg K(S) \wedge \neg K(\neg S))$.

The Gricean hearer who hears an assertion of W and, reasoning on the basis of the cooperative principle as illustrated above, derives the weak implicature $\neg K(S)$

could thus faced with a follow-up decision problem: Since the derived weak implicature is consistent with both situations in **??**, he may want to decide whether to strengthen $\neg K(S)$ into a scalar implicature, or whether to strengthen $\neg K(S)$ into an ignorance implicature (cf. Soames (1982); van der Sandt (1988); Horn (1989); van der Sandt (1988); Horn (1989); Sauerland (2004)).

The choice between the two options ultimately depends on what he thinks about the speaker: If he assumes she is informed about S (formally: $K(S) \vee K(\neg S)$, cf. Soames (1982)), then he will strengthen the initially derived inference $\neg K(S)$ into $K(\neg S)$. If he thinks the speaker is not informed, this can only mean that $\neg K(S)$ is to be strengthened into the ignorance implicature $(\neg K(S) \wedge \neg K(\neg S))$ instead (cf. Soames (1982); van der Sandt (1988); Horn (1989); Sauerland (2004); Chemla (2008)). As we will see below (see 2.1), however, this should not be considered a forced choice: Hearers cannot always adequately judge the competence of a speaker regarding stronger alternatives; in this case, they have to content themselves with the inference that $\neg KS$.

1.2.2 Grammatically Derived Implicatures

In the grammatical theory of implicatures, the dividing line between semantic and pragmatic components is drawn rather differently: Scalar implicatures are derived in the semantic, rather than the pragmatic module, while the pragmatic component, based as before on Grice's cooperative principle, derives ignorance implicatures (see especially Fox (2007a)). Semantically derived scalar implicatures are now the result of a syntactic ambiguity resolution in favor of an LF which contains a covert exhaustivity operator EXH (cf. Krifka (1995); Chierchia (2004); van Rooij and Schulz (2004); Spector (2006); Fox (2007a)). Roughly, EXH adjoins to a clause W and adds to the meaning of W the negation of W's stronger alternatives (for the sake of simplicity, and where this creates no confusion, I will use the same variable for a sentence and its denotation):

(8) $[\![\text{EXH } W]\!] = W \wedge \forall S \in \mathcal{A}\mathrm{LT}(W) \text{ s.t. } (S \Rightarrow W \wedge \neg(W \Rightarrow S)): \neg S$

Let us apply this to a sentence which contains the scalar item *some*:

(9) EXH [Al drank some of the beers]

In order to calculate the meaning of this LF, we first have to identify the set of formal alternatives $\mathcal{A}\mathrm{LT}$. Let us assume as before that $\mathcal{A}\mathrm{LT}$is defined as those sentences which would answer the same contextually given $\mathcal{QUD}$; for simple examples like (9), the only alternative is thus the singleton set {Al drank all of the beers}.

For the LF in (9), this will derive the denotation in (10). I use the opportunity to introduce a notational convention which I will be using throughout this thesis: Deriving the denotation of an LF containing one or more exhaustivity operators requires several intermediate steps and calculations, for instance, listing the alternatives which the exhaustivity operator excludes. I will explicitly list these intermediate steps below the first line of the computation, which is simply the expression to be calculated (i.e., $[\![\phi]\!]$); after listing the intermediate steps in the derivation, the last line of the calculation gives the full denotation of the expression in question:

(10) $[\![$ EXH [AL drank some of the beers] $]\!]$ =

-$\mathcal{A}$LT(Al drank some of the beers) = {AL drank all of the beers}

= Al drank some of the beers & Al didn't drink all of the beers

But the semantics of EXH needs to be refined once we try to apply it to disjunctions. Let's assume, uncontroversially, that not only the corresponding conjunction, but also the disjuncts are themselves relevant alternatives to a disjunction. A disjunctive sentence like (11-a) will then be associated with the alternatives in (11-b) (cf. Sauerland (2004); Spector (2006); Katzir (2007)):

(11) a. Al went to Alewife or to Braintree

b. $\mathcal{A}$LT(Al went to Alewife or to Braintree) = {Al went to Alewife, Al went to Braintree, Al went to Alewife and to Braintree}

All of these alternatives asymmetrically entail the disjunction. As a consequence, if (11-a) is parsed with an exhaustivity operator EXH, the semantics of EXH in (8) predicts the following, inconsistent meaning for the LF:

(12) $[\![$ EXH [Al went to Alewife or to Braintree] $]\!]$ =

Al went to Alewife or to Braintree & Al didn't go to Alewife & Al didn't go to Braintree & Al didn't go to Alewife and Braintree

$= \bot$

This problem can be fixed if we adopt a more fine-grained definition of EXH as proposed in Fox (2007), which is given below:

(13) $[\![\text{EXH} W]\!] = W \wedge \forall S \in \mathcal{IE}(W, \mathcal{A}\text{LT}(W)): \neg S$

This definition provides a new domain of quantification for the operator EXH: this domain is no longer $\mathcal{A}$LT itself, but only a subset of all alternatives $\mathcal{A}$LT. Fox calls this subset the *innocently excludable* alternatives $\mathcal{IE}$. In nutshell, this set can be defined as those alternatives in $\mathcal{A}\text{LT}(\phi)$ whose negation can be added to ϕ without entailing any other alternative of ϕ. This is what the following definition states:

(14) $\mathcal{IE}(W, \mathcal{A}\text{LT}(W)) = \lambda\psi. \neg\exists\phi \in \mathcal{A}\text{LT}^{\not\Rightarrow}(W) \text{ s.t. } W \wedge \neg\psi \Rightarrow \phi$

where $\mathcal{A}\text{LT}^{\not\Rightarrow}(W)$ are those elements among $\mathcal{A}\text{LT}(\text{W})$ which are not entailed by W

For a disjunction like (12), the set $\mathcal{IE}$ will no longer include the disjuncts; as illustrated in **??**, negating a disjunct and adding it to the disjunction entails the other disjunct:

(15) (Al went to Alewife or to Braintree) $\wedge \neg$(Al went to Alewife) $\Rightarrow$ Al went to Braintree

With the updated definition of EXH, then, the predicted meaning for an LF like (12) is the following:

(16) $[\![$ EXH [Al went to Alewife or to Braintree] $]\!]$

-$\mathcal{A}$LT(Al went to Alewife or to Braintree) = {Al went to Alewife, Al went to Braintree, Al went to Alewife and to Braintree}

-$\mathcal{IE}$ = {Al went to Alewife and to Braintree}

= Al went to Alewife or Braintree $\wedge$ Al didn't go to Alewife and Braintree

Summing up the picture so far, the scalar implicature that the speaker believes Al didn't drink all of the beers in examples like (61), or that Al didn't go to both locations in examples like (11-a), arises when the sentence is assigned an LF which includes the operator EXH. The operator adds to the basic semantic meaning the negation of certain stronger alternatives, namely, those which can be innocently excluded as defined in (14).[1]

But a scalar implicature, at least the way we have used the term, is an inference of the form K$\neg\psi$ (cf. Soames (1982); Horn (1989); Sauerland (2004)), while the exhaustivity operator merely adds $\neg\psi$ to the meaning of its argument. Under a grammatical theory of scalar implicatures, this epistemicized version of the inference follows from $\neg\phi$ under the assumption that the speaker believes what he says, as expressed for example in Grice's maxim of QUALITY (cf. Grice (1975)).

1.2.3 Symmetry

Let us go back and consider what kind of implicature(s) the pragmatic theory predicts for a disjunction. As before, we assume that the alternatives of a disjunction *A or B* are defined as the set {A, B, (A and B)}. All of these alternatives are stronger and equally relevant. From the cooperative principle in (5), the hearer will thus derive the weak implicatures that the speaker chose the weak disjunction rather than any stronger relevant alternative because she is not sure about any of these alternatives:

[1] As we will discuss in more detail in this chapter and in 3.1, the parse including EXH is of course not obligatory – there is no empirical evidence that a sentence containing a weak scalar item always carries the scalar implicature that the speaker is sure that the stronger alternative are false (cf. Noveck (2001), Noveck et al. (2002), Papafragou and Musolino (2003), Bott and Noveck (2004), Guasti et al. (2005), Breheny et al. (2006), Chevallier et al. (2008), Zondervan et al. (2008).

(17) A or B

$\rightsquigarrow \neg K(A), \neg K(B), \neg K(A \wedge B)$

According to what we said in section 1.2.1, we might expect that any of these weak implicatures could be contextually strengthened into scalar implicatures if the speaker is assumed to be competent about the relevant alternatives. For example, the weak implicature $\neg K(B)$ might be strengthened into the scalar implicature $K(\neg B)$. Together with the assertion, this scalar implicature would then entail that the speaker is sure that A is true, as shown below (recall that the assertion of *A or B* warrants the assumption that $K(A \vee B)$):

(18) $[K(A \vee B) \wedge K(\neg B)] \Rightarrow K(A)$

If this kind of strengthening is not ruled out, we predict that an assertion of *A or B* may in principle convey that the speaker is sure that *A* is true.

As pointed out by Kroch (1972), von Fintel and Heim (unpublished class notes), Horn (2000); Fox (2007a), the problem is not limited to disjunction, but will arise with all alternatives which have the following property:

(19) SYMMETRY

Two alternatives $\alpha_n, \alpha_k \in \mathcal{A}\mathrm{LT}(\phi)$ are symmetric iff $\phi \wedge \neg\alpha_k \Rightarrow \alpha_n$ & $\phi \wedge \neg\alpha_n \Rightarrow \alpha_k$

Note that according to this definition, the disjuncts A and B are symmetric alternatives of a disjunction *A or B*.

In Sauerland's (2004) pragmatic theory, the solution to this problem is based on the idea that weak implicatures are given precedence (whence Sauerland's terminology, who calls them *primary* implicatures), and that scalar implicatures need to pass a consistency test against all primary implicatures in order to be licensed at all (cf. also Soames (1982)). Sauerland's test works as follows:

(20) SAUERLAND CONSISTENCY CHECK

Given an assertion of W, the scalar implicature $K(\neg S)$ is licensed for any stronger relevant alternative S iff the following is consistent:

$$[K(W) \wedge \bigcap_{\psi \in \mathcal{WI}} \psi \wedge K(\neg S)]$$

(where $\mathcal{WI}$ is the set of all weak implicatures, i.e., those of the form $\neg K(S)$)

This has the desirable consequence of ruling out the empirically unattested strengthening of the weak implicatures $\neg K(A)$ and $\neg K(B)$, since this would contradict the conjunction of the assertion and all weak implicatures which the cooperative principle derives:

(21) $K(A \vee B) \wedge \neg K(A) \wedge \neg K(B) \wedge \neg K(A \wedge B) \wedge K(\neg B) = \perp$

By contrast, strengthening the weak implicature $\neg K(A \wedge B)$ into a scalar implicature is licensed, accounting for the exclusive interpretation of disjunctions:

(22) $K(A \vee B) \wedge \neg K(A) \wedge \neg K(B) \wedge \neg K(A \wedge B) \wedge K\neg(A \wedge B) \neq \perp$

But not only disjunctions may have symmetric alternatives. Above we assumed that for the sentence W = *Al drank some of the beers,* the relevant stronger alternative was S = *Al drank all of the beers.* As it turns out, however, there might be another stronger relevant sentence, namely, *Al drank some but not all of the beers.*

It will be easier to check the consequences of this additional factor if we introduce the following abbreviations:

(23) a. SOME = Al drank some of the beers
b. ALL = Al drank all of the beers
c. SBNA = Al drank some but not all of the beers

Given these alternatives, what kind of implicatures does Sauerland's pragmatic system predict for the assertion of SOME? Since both ALL and SBNA are stronger than SOME, two weak implicatures will be derived from the cooperative principle:

(24) Al drank some of the beers (= SOME)
$\rightsquigarrow \neg K(\text{ALL})$
$\rightsquigarrow \neg K(\text{SBNA})$

Sauerland's consistency check in (20) prevents scalar implicatures to arise for any of these alternatives:

(25) a. $K(\text{SOME}) \wedge \neg K(\text{ALL}) \wedge \neg K(\text{SBNA}) \wedge K(\neg\text{SBNA}) = \bot$

b. $K(\text{SOME}) \wedge \neg K(\text{ALL}) \wedge \neg K(\text{SBNA}) \wedge K(\neg\text{ALL}) = \bot$

But preventing the scalar implicature $K(\neg\text{ALL})$ turns out to be empirically inadequate, since it would rule out the following attested interpretation:

(26) Al drank some of the beers

$\rightsquigarrow$ K ¬(Al drank all of the beers)

Symmetric alternatives like {SOME, SBNA} are problematic for the grammatical theory, too, for exactly the same reason: They seem to prevent any scalar implicatures from arising, including the ones which are empirically attested. This is because, given an alternative $\mathcal{A}\text{LT}(W)$ which includes symmetric alternatives of W, the set $\mathcal{IE}$ of innocently excludable alternatives will always be empty, as shown below:

(27) EXH [Al drank some of the beers] (= EXH SOME)

-$\mathcal{A}\text{LT}(\text{SOME}) = \{\text{ALL}, \text{SBNA}\}$

-$\mathcal{IE} = \varnothing$

= Al drank some of the beers

In sum, if a sentence like *Al drank some of the beers* is associated with the set of alternatives {*Al drank some but not all of the beers, Al drank all of the beers*}, neither the pragmatic, nor the grammatical theory as we have presented them so far would be able to derive the scalar implicature that (the speaker is sure) that Al didn't drink all of the beers.

1.2.3.1 Formal Alternatives

The solution to the challenge posed by symmetry is to restrict the alternatives which are considered during implicature computation to a formally defined set $\mathcal{A}\mathsf{LT}$ (cf. Horn (1972); Gazdar (1979); Atlas and Levinson (1981); Sauerland (2004)). Horn hypothesized that the lexicon contains special *scalar* items which come with a lexical specification of their alternatives, now known as Horn-scales (cf. **??**). Katzir (2007) offers a fully general mechanism to derive the set $\mathcal{A}\mathsf{LT}$ of formal alternatives which doesn't make reference to Horn-scales, but only to the lexicon in general. The idea is to define $\mathcal{A}\mathsf{LT}(\phi)$ as the union of ϕ's lexical alternatives, and ϕ's sub-constituents:[2]

[2]The full algorithm proposed in **??** also includes the operation of *contraction*, but since we won't be making use of this option in what follows, I don't include it in the definition of his algorithm in (28).

(28) KATZIR ALTERNATIVES

Let ϕ be a sentence containing one or more scalar items v. ψ is a formal alternative of ϕ, $\psi \in \mathcal{A}\mathrm{LT}(\phi)$, iff ψ can be obtained from ϕ by (i) replacing one or more terminal nodes in ϕ with a member of the same syntactic category taken from the lexicon and/or (ii) deleting sub-constituents in ϕ

As opposed to Horn's original suggestion, Katzir's algorithm predicts the full set of disjunctive alternatives {A, B, (A and B)}: While only the conjunction could be derived from the Horn-scale ⟨or, and⟩, Katzir's DELETE-operation allows us to add the disjuncts A, B to the set $\mathcal{A}$LT(A or B). Likewise, Katzir's algorithm solves the puzzle posed by SBNA (see (23) above): since *Al drank some but not all of the beers* (SBNA) cannot be derived from *Al drank some of the beers* (SOME), it will not be part of $\mathcal{A}$LT(SOME).

Let us briefly check how the new definition of formal alternatives is implemented in the pragmatic and the grammatical theories. In the latter, the implementation is straightforward: It is now the formal alternatives $\mathcal{A}$LT which provide the domain of quantification for the operator EXH. Since SBNA $\notin \mathcal{A}$LT(SOME), there will now be exactly one innocently excludable alternative, resulting in the observed scalar implicature:

(29) EXH [Al drank some of the beers] (= EXH SOME)

-$\mathcal{A}$LT(SOME) = {ALL} = $\mathcal{IE}^3$

= Al drank some of the beers & Al didn't drink all of the beers

In the pragmatic theory, formal alternatives are implemented by restricting the scope of the cooperative principle ((cf. Fox (2007a))), which necessitates a slight re-formulation, given below:

(30) A cooperative speaker does not assert W if there is a sentence S such that:

1. $S \in \mathcal{ALT}(W)$
2. $S \Rightarrow W \wedge \neg(W \Rightarrow S)$
3. S is relevant
4. K(S)

The crucial change is the addition of the first criterion: Since SBNA $\notin \mathcal{ALT}$(SOME), no weak implicature $\neg$K(SBNA) will be derived from the cooperative principle. This in turn enables the alternative ALL to pass Sauerland's consistency check:

(31) $K(SOME) \wedge \neg K(ALL) \wedge K(\neg ALL) \neq \bot$

[3]It follows from Katzir's formal definition of structural alternatives and the fact that each scalar item v is part of its own Horn-scale, that for every ϕ, $\phi \in \mathcal{ALT}(\phi)$. From the definition of EXH in (8) it follows that the negation of ϕ can never be added to ϕ. For the sake of simplicity, I will therefore omit ϕ when listing the set $\mathcal{ALT}(\phi)$ here and in what follows.

In sum, once we restrict implicature computation to the set of structurally-defined alternatives, symmetric alternatives will no longer be an obstacle to deriving attested scalar implicatures.

1.2.4 Ignorance Implicatures

Above I introduced a three-fold terminological distinction, to which I now want to return. Next to scalar implicatures, i.e., inferences of the form $K(\neg\phi)$, we defined weak implicatures as $\neg K(\phi)$ and ignorance implicatures as the conjunction $[\neg K(\phi) \wedge \neg K\neg(\phi)]$.

In the preceding sections we have concentrated on the derivation of scalar implicatures in the pragmatic and the grammatical systems as proposed by **??** and **??**.

In Sauerland's pragmatic system, all implicatures are derived on the basis of the cooperative principle in (30), which first yields weak implicatures about all stronger, formal alternatives $\mathcal{A}LT$. As pointed out in section 1.2.1, this may lead the hearer to further distinguish between the two kinds of situations which the weak implicature $\neg K(\phi)$ describes: On the one hand, those situations in which the speaker is sure that ϕ is false (= $K(\neg\phi)$), and on the other hand, those situations in which the speaker is truly ignorant with respect to ϕ (= $\neg K(\phi) \wedge \neg K(\neg\phi)$). We saw above that the first inference is only licensed if it passes Sauerland's consistency test for scalar implicatures. Though Sauerland (2004) does not explicitly deal with ignorance implicatures, the system allows weak implicatures to be strengthened into ignorant implicatures whenever the speaker is assumed to be in doubt about the stronger alternatives. Thus, based on contextual considerations, the weak implicature in (32) may subsequently be strengthened into a true ignorance implicature:

(32) Al drank some of the beers

WEAK IMPLICATURE:

$\rightsquigarrow \neg$K(Al drank all of the beers)

CONTEXTUAL STRENGTHENING:

$\rightsquigarrow \neg$K(Al drank all of the beers) $\wedge$ $\neg$K$\neg$(Al drank all of the beers)

In the grammatical theory proposed in by Fox on the other hand, if it is not parsed with matrix EXH, a simple sentence like (32), or a simple disjunction like *Al went to Alewife or Braintree* will always gives rise to a true ignorance implicature (cf. Fox 2007:24). This is because Fox rejects the claim that the cooperative principle is defined with reference to formal, rather than informal alternatives. Instead, Fox suggests the following hypothesis:

(33) FOX'S DICHOTOMY

The semantic component computes implicatures on the basis of formal alternatives $\mathcal{A}$LT, while the pragmatic component computes implicatures on the basis of all relevant sentences the language provides

Implicature computation in the semantic component is done by EXH while the pragmatic component derives implicatures based on Grice's cooperative principle. Obviously, under Fox's hypothesis in (33), the cooperative principle will be formulated without reference to $\mathcal{A}$LT, as in the version from (5) above.

We already saw that restricting EXH to formal alternatives was the only way to derive empirically attested scalar implicatures. As we will see now, having the cooperative principle range over all alternatives, including symmetric alternatives, also has far-reaching consequences. In order to understand what these are, let us look at our previous example SOME one more time. Recall the distinction between formal and informal alternatives ($\mathcal{A}\mathrm{LT}^{in}$ for short) for this sentence:

(34) Al drank some of the beers (=SOME)

a. $\mathcal{A}$LT(SOME) = {ALL}

b. $\mathcal{A}\mathrm{LT}^{in}$(SOME) = {SBNA, ALL}

As stated earlier the informal alternatives are defined without structural constraints but simply on the basis of relevance. Now, there are two possible LFs for this simple sentence, and two different semantic denotations, as we have seen above:

(35) $[\![$ SOME $]\!]$ = SOME

(36) $[\![$ EXH [SOME] $]\!]$ = SOME $\wedge \neg$ALL

At this point, the semantic component is done and pragmatic reasoning based on the cooperative principle will begin. Given Fox's dichotomy, this means that the two propositions will be compared to all relevant stronger alternatives $\mathcal{A}\mathrm{LT}^{\mathrm{in}}$(SOME) as given in (34-b). For the LF in (35) this will yield the following weak implicatures:[4]

(37) SOME

$\rightsquigarrow \neg$K(ALL)

$\rightsquigarrow \neg$K(SBNA)

But given the symmetry of the two alternatives, together with the premise that the speaker is sure of his assertion (=K(SOME), this logically entails true ignorance implicatures:

(38) K(SOME) $\wedge$ $\neg$K(ALL) $\wedge$ $\neg$K(SBNA)

$\models$ K(SOME) $\wedge$ $\neg$K(ALL) $\wedge$ $\neg$K($\neg$ALL) ($\wedge$ $\neg$K(SBNA) $\wedge$ $\neg$K$\neg$(SBNA))[5]

Thus, given the possibility of defining symmetric alternatives for any sentence (cf. Fox (2007b)), Fox's dichotomy allows to to state the following corollary:

[4]For the LF in (36) no pragmatic implicature will be derived since none of the alternatives in $\mathcal{A}\mathrm{LT}^{\mathrm{in}}$(SOME) is stronger than the proposition expressed by EXH [SOME].
[5]The part in parenthesis is redundant but is included here for completeness.

(39) FOX'S DICHOTOMY - COROLLARY

Either a weak sentence W gives rise to a semantically derived scalar implicature, or to pragmatically derived ignorance implicatures

To summarize, both in the grammatical theory and in the pragmatic theory of implicatures, assertion of W can give rise to an ignorance implicature about S, i.e., to the inference that $\neg K(S) \wedge \neg K(\neg S)$. In a pragmatic system, this is achieved under the premise that comparison driven by the cooperative principle is restricted to a formally defined set of alternatives $\mathcal{A}LT$; given this premise, weak implicatures can be strengthened both into scalar implicatures and into ignorance implicatures, depending on contextual assumptions about the speaker's competence. In the grammatical system, on the other hand, it is assumed that scalar implicatures are derived in the semantics by an operator EXH which quantifies over the restricted set of formally defined alternatives $\mathcal{A}LT$, and that the pragmatic module will derive implicatures on the basis of a broader set of alternatives, which in particular include structurally more complex, symmetric alternatives like SBNA. Given the presence of such symmetric alternatives in the pragmatic derivation, the implicatures derived in the pragmatics will always have the form of ignorance implicatures.

1.3 Obligatory Exhaustification and Hurford's Constraint

Having established the necessary background, we are now in a position to understand the theoretical challenge posed by surface redundant disjunctions like (40) and (41):

(40) Al drank some or all of the beers

(41) They have locations in Alewife or Braintree or both

We will start by assuming that the LF of these disjunctions is as suggested by their surface structure, schematically:

(42) a. SOME or ALL

b. [A or B] or BOTH

It is easy to see that the semantic meaning of these disjunctions is equivalent to one of their disjuncts:

(43) a. $[\![$ SOME or ALL $]\!]$ = SOME

b. $[\![$ [A or B] or BOTH $]\!]$ = A or B

But what kind of implicatures do the grammatical and the pragmatic theory predict for these surface redundant disjunctions? This will be the topic of the following sections.

1.3.1 Predictions of the Pragmatic Theory

Recall that in the pragmatic theory, both scalar and ignorance implicatures are computed on the basis of a formal set of alternatives $\mathcal{A}$LTas defined by Katzir's algorithm in (28). Applying this algorithm, we obtain the following formal alternatives:

(44) a. $\mathcal{A}$LT([A or B] or BOTH) = {(A or B), A, B, (A and B), [(A or B) and (A and B)]}

b. $\mathcal{A}$LT(SOME or ALL) = {(SOME, ALL, (SOME and ALL)}

But obviously some of these alternatives logically entail others, so we can rid the set of some logical redundancy; recall also the convention introduced earlier (see fn. 3) according to which ϕ will be not longer listed under $\mathcal{A}$LT(ϕ); we will apply this simplifying convention to items that are logically equivalent to ϕ:

(45) a. $\mathcal{A}$LT([A or B] or BOTH) = {A, B, (A and B)}

b. $\mathcal{A}$LT(SOME or ALL) = {(SOME, ALL}

All three elements in (45-a) are stronger relevant alternatives of the asserted disjunction [A or B] or BOTH. The hearer, using the cooperative principle, will therefore derive the following weak implicatures:

(46) [A or B] or BOTH

$\rightsquigarrow \neg$KA

$\rightsquigarrow \neg$KB

$\rightsquigarrow \neg$K(A and B)

Now, Sauerland's consistency check for strengthening weak implicatures into scalar implicatures (see (20)) predicts that $\neg$K(A and B) can be strengthened into K$\neg$(A and B) iff the following is consistent (cf. Chierchia et al. (2007)):

(47) K(A or B) $\wedge$ $\neg$KA $\wedge$ $\neg$KB $\wedge$ $\neg$K(A and B) $\wedge$ K$\neg$(A and B)

This is clearly the case, and as pointed out in Chierchia et al. (2007), the prediction that emerges under the pragmatic is that a speaker could use *They have locations in Alewife or Braintree or both* when she is sure that *They have locations in Alewife and Braintree* is false. The same empirically inadequate result is obtained for *Al drank some or all of the beers*, which is predicted to be usable in a situation in which the speaker is sure that Al didn't drink all beers. This prediction is empirically wrong and the theory would need to introduce additional constraints to remedy this. Given that EXHis not available (at least not in embedded position), however, it is unclear what these constraints might look like.

1.3.2 Predictions of the Grammatical Theory

As it turns out, the grammatical theory also needs additional assumptions to rule out this empirically wrong prediction. To see why, it suffices to note that there is nothing that would rule out the following LF:

(48) EXH[[A or B] or BOTH]

As stated above the set $\mathcal{A}$LTcontains the following (logically distinguishable) members: {A, B, (A and B)}. Recall from above that EXHwill add the negation of each these elements to its argument as long as the result will not entail any other member of $\mathcal{A}$LT(cf. the definition of innocently excludable alternatives $\mathcal{IE}$ in (14)). Given this definition of EXH, the meaning of (48) will be the following:

(49) ⟦ EXH[[A or B] or BOTH] ⟧

-$\mathcal{A}$LT([A or B] or BOTH) = {A, B, [A and B]}

-$\mathcal{IE}$ = {(A and B)}

$= (A \vee B) \wedge \neg(A \wedge B)$

If this LF is not blocked, again this results in the inadequate prediction that sentences of the form [A or B or BOTH] and [SOME or ALL] should be useable in situations in which the speaker is sure that (A and B) or ALL are false.

1.3.3 Hurford's Constraint

In order to remedy this, it is assumed that LFs like the one in (48) are simply ruled out by a particular constraint against certain types of disjunctions. The constraint goes back to the empirical description of Hurford (1974); Gazdar (1979) and is stated in (50):

(50) HURFORD'S CONSTRAINT

A disjunction [A or B] is ungrammatical if $A \Rightarrow B$ or $B \Rightarrow A$

Before we look at what this constraint achieves within the grammatical theory, let's first check what the consequences are within the pragmatic theory. Since there is no silent EXH operator, only LFs like those in (42) are available. As we saw, for these LFs the pragmatic theory makes the wrong prediction that a scalar implicature should be possible.[6] So without Hurford's constraint, the pragmatic theory predicts unattested readings, and with Hurford's constraint, it predicts a sentence like *Al drank some or all of the beers* to be infelicitous, contrary to fact.

[6]Even if we assume that EXHis available in the pragmatic theory in matrix position as an abbreviation for a pragmatically derived scalar implicature (cf. Sauerland (2011)), this leaves us with the LF in (48), which as we saw makes the same, empirically wrong prediction that [A or B] or BOTH could yield the scalar implicature *not both*.

The grammatical theory, on the other hand, is at an advantage. Though the availability of embedded adjunction sites for EXHhas recently been the topic of much debate, it is becoming more and more clear that embedded exhaustification is a real possibility (cf. ??)

But if we take the possibility of adjoining EXH to embedded clauses for granted, there is now another possible LF:

(51) [EXH [A or B)]] or BOTH

This LF satisfies Hurford's constraint because EXH[A or B] does not entail [A and B] (or vice versa). The full derivation of the denotation of (51) is shown below:

(52) $[\![$ EXH[A or B] $]\!]$

-$\mathcal{A}$LT(A or B) = {A, B, (A and B)}

-$\mathcal{IE}$ = {(A and B)}

$= (A \vee B) \wedge \neg(A \wedge B)$ (abbreviation: $(A \triangledown B)$)

(53) $[\![$ [EXH(A or B)] or BOTH $]\!]$

$= (A \triangledown B) \vee (A \wedge B)$

$\equiv A \vee B$

However, it seems like we are back at square one, since this is the exact same meaning of the simpler LF [A or B] (see (43)). Perhaps, then, the grammatical theory predicts the complex LF in (51) to have noticeable effects at the pragmatic level. To check this, we have to calculate the predicted pragmatic implicatures.

Recall that in Fox's (2007) system, pragmatic implicatures result from comparison of the assertion with all formal and informal alternatives $\mathcal{A}\mathsf{LT}^{in}$. As we saw above, this set includes symmetric alternatives. Now, the semantic meaning of the complex [EXH(A or B)] or BOTH was $(A \vee B)$. Its informal alternatives will therefore be defined as follows:

(54) $\mathcal{A}\mathsf{LT}^{in}$([EXH(A or B)] or BOTH) = {A, B, (A and B), $(A \triangledown B)$}

From the cooperative principle in (5) we derive the following implicatures:

(55) [EXH(A or B)] or BOTH

$\rightsquigarrow \neg K(A) \wedge \neg K(B) \wedge \neg K(A \wedge B) \wedge \neg K(A \triangledown B)$

Now, together with $K(A \vee B)$ (which follows from the assertion), this can be strengthened into:

(56) $\neg K(A) \wedge \neg K(\neg A) \wedge \neg K(B) \wedge \neg K(\neg B) \wedge \neg K(A \text{ and } B) \wedge \neg K \neg (A \wedge B)$

Would this be any different from the ignorance implicatures which would arise from the LF [A or B]? As stated above, the simpler [A or B] expresses the same semantic meaning and therefore, the same informal alternatives will be taken into consideration when calculating the pragmatic implicatures of [A or B]. As a result, the pragmatic implicatures will be exactly the same as in (56).

1.3.4 Intermediate Summary

We saw that for the pragmatic system, surface redundant disjunctions like SOME or ALL are an unsolved puzzle: The theory predicts the availability of unattested scalar implicatures $\neg$(ALL) without Hurford's constraint, but falsely predicts surface redundancy to be infelicitous if Hurford's constraint is assumed to be valid.

The grammatical theory, on the other hand, can explain the absence of the unattested scalar implicatures by adding Hurford's constraint as a primitive to the theory. However, the augmented theory still faces the challenge of explaining the function of surface redundant disjunctions. This is because as we saw, the theory predicts SOME or ALL to have a reading which could also be expressed by SOME.

One way for the grammatical theorist to respond to this challenge is to say that the virtue of surface redundancy vis-à-vis a simpler structure is that only the former, but not the latter, is unambiguous. This answer of course presupposes Hurford's constraint, according to which the only possible LF for a surface redundant disjunction like (57-a) is (57-b), while a simple structure like (58-a) can be parsed both as (58-b) and as (58-c):

(57) a. SOME or ALL

b. $[exh\,\text{SOME}]$ or ALL

(58) a. SOME

b. EXH SOME

c. SOME

Above we saw that the grammatical theory predicts that surface redundant structures – given Hurford's constraint – are both semantically and pragmatically equivalent to one of the readings of a corresponding simpler structure. Presupposing that this prediction is empirically correct, it is reasonable to view the advantage of surface redundancy in disambiguation.

In the next chapter, however, we will see that this prediction is empirically wrong and that surface redundant disjunctions actually differ in meaning from their simpler counterparts. I will propose a theory which can account for this subtle but robust difference in meaning between surface redundant and simple structures. Furthermore, I offer a way to derive Hurford's constraint from a principle of brevity, thus deriving the fact that structures like (57-a) cannot give rise to the scalar implicature $\neg$(ALL) without having to stipulate Hurford's constraint.

Chapter 2

The Matrix K Theory of Implicature

2.1 The proposal

In this chapter, I will introduce the basics of a new theory of implicature in which all implicatures are derived in the grammar. I will introduce the new system by showing how it replicates known implicatures of disjunction. I will then go on to show how the new theory addresses the puzzle of surface redundancy. We will see empirical evidence that surface redundant disjunctions are not equivalent to any reading a simpler structure may have. This empirical finding will be accounted for in the new theory. Lastly, I will show that Hurford's constraint can be derived from a a principle in the spirit of Grice's maxim of Manner. The new theory can thus adequately account for the unique contribution of surface redundancy, and furthermore does not rely on a stipulation like Hurford's constraint.

In the grammatical theory, and specifically, in the version proposed in Fox (2007), scalar implicatures and ignorance implicatures are derived by two completely different mechanisms, based on two different kinds of alternative sets. I propose a new theory in which three kinds of empirically attested implicatures – scalar, weak, and ignorance implicatures – are derived by one mechanism and on the basis of the same set of alternatives.

The first ingredient of the new system is the assumption that assertively used sentences contain a covert doxastic operator which is adjoined at the matrix level at LF (cf. Chierchia (2006); Alonso-Ovalle and Menéndez-Benito (2010)):[1]

(1) THE MATRIX K AXIOM

Attach K_x to every assertively used sentence ϕ

As mentioned earlier (see section 1.2.1), the operator K has the following seman-

[1] Abrusán (2011); Simons (2007) observe what I think are overt counterparts of the Matrix K operator. Simons calls these *parenthetical* uses of verbs like *know, believe, hear.* The Matrix K operator patterns with these uses by not, at least not directly, addressing or contributing to the current $\mathcal{QUD}$. As Abrusán points out, Simons' analysis suggest that these parenthetical uses of epistemic attitude verbs, and consequently, also the Matrix K operator, can be analyzed as evidentials (cf. Aikhenvald (2006); Speas (2008)). In this thesis, I will not contribute to this particular line of research, and I leave it for another occasion to investigate implications of the Matrix K hypothesis which are independent of its contribution to the topic of this thesis, namely, the theory of implicature.

tics:

(2) $[\![K_x\phi]\!] = \lambda w.\ \forall w' \in \mathcal{D}ox(x)(w): \phi(w')$

$w' \in \mathcal{D}ox(x)(w)$ *iff* given the beliefs of x in w, w' could be the actual world[2]

The subscript x refers to the doxastic source, i.e., the individual whose beliefs K is quantifying over. In the cases that we will be concerned with, x is the speaker. Where there is no ambiguity, I will therefore leave out the subscript of the Matrix K operator.

Secondly, I follow the grammatical theory in assuming that an exhaustivity operator can be adjoined at LF:

(3) EXHAUSTIFICATION

The operator EXH can be adjoined to any node $\nu_{\langle s,t \rangle}$

With these two ingredients, a surface structure ϕ can now be mapped unto a range of different LFs, which leaves the hearer with the task of syntactic ambiguity resolution. Pragmatics, under this view, is the sum of principles that guide

[2]As an abbreviation I will use the following convention: $[\![K_x \phi]\!]^w$ *iff* $K_x \phi$, i.e., I will use K also in the meta-language to abbreviate the denotation of the Matrix K operator.

this ambiguity resolution.

The workings of the Matrix K system, which is based on the axioms (1) and (3), will be introduced and discussed step by step in what follows. To get accustomed to the new theory, we will start with a case study of one of the most fundamental applications of any theory of implicature, namely, the case of disjunction. First, we will derive the range of possible meanings that is predicted for a simple disjunction like *Al went to Alewife or to Braintree.* Then we will turn to the question of ambiguity resolution and the 'pragmatics' of disjunction.

2.1.1 First application: Disjunction

Given the Matrix K Axiom, a disjunction *A or B* will be parsed as K (A or B) at LF. Given furthermore the availability of EXH, we are looking at (at least) four different possible LFs, given below:[3]

(4) a. K [A or B]

b. K exh [A or B]

c. EXH K [A or B]

d. EXH K exh [A or B]

[3] I will make a notational distinction between unembedded EXH and embedded exh in what follows.

What is the denotation of each of these LFs? In order to answer this question, we need to look both at the semantics of EXH and the set $\mathcal{A}\mathrm{LT}$ it operates on in more detail.

As a reminder, I repeat below the definition of EXH given above in (13) from Fox (2007a):

(5) $[\![\, \text{EXH}\phi \,]\!] = \phi \ \wedge \ \forall\alpha \in \mathcal{IE}(\phi, \mathcal{A}\mathrm{LT}(\phi)): \neg\alpha$

The set $\mathcal{IE}(\phi, \mathcal{A}\mathrm{LT}(\phi))$ was defined as those alternatives in $\mathcal{A}\mathrm{LT}(\phi)$ whose negation can be added to ϕ without entailing any other alternative of ϕ:

(6) $\mathcal{IE}(\phi, \mathcal{A}\mathrm{LT}(\phi)) = \lambda\alpha.\ \neg\exists\alpha' \in \mathcal{A}\mathrm{LT}^{\not\supset}(\phi)$ s.t. $\phi \wedge \neg\alpha \supset \alpha'$

where $\mathcal{A}\mathrm{LT}^{\not\supset}(\phi)$ are those elements among $\mathcal{A}\mathrm{LT}(\phi)$ which are not entailed by ϕ

The set $\mathcal{A}\mathrm{LT}$ (more specifically, its subset $\mathcal{IE}$) provides the domain of quantification for the operator EXH. $\mathcal{A}\mathrm{LT}$is at least partially defined by the syntactic configuration in which EXH occurs, as it is its sister node which defines the set $\mathcal{A}\mathrm{LT}$.

Looking at the list of possible LFs in (4), the definition of EXH thus predicts the quantificational domains for EXH in the LF EXH K [A or B] to differ from that in K exh [A or B] and in EXH Kexh [A or B]. The typographic difference EXH vs. exh is meant to highlight this difference. To calculate the meaning of these three LFs, then, the first task is to identify the quantificational domain of the exhaustivity operator in each of these structures.

2.1.1.1 A Simple Case: K exh ϕ

With an LF where EXH is embedded under K, as in (7), nothing will change – EXH will quantify over the set $\mathcal{A}$LT(A or B) as defined above (as before, where it can easily be recovered from context I will leave out the arguments $\mathcal{IE}$):

(7) $[\![$ K exh [A or B] $]\!]$ =

-$[\![$ exh [A or B] $]\!]$ = $(A \vee B) \wedge \forall\alpha \in \mathcal{IE} : \neg\alpha$

-$\mathcal{A}$LT(A or B) = {A, B, (A and B)}, $\mathcal{IE}$ = {(A and B)}

-$[\![$ exh [A or B] $]\!]$ = $(A \vee B) \wedge \neg(A \wedge B)$

$K[(A \vee B) \wedge \neg(A \wedge B)] = K(A \vee B) \wedge K\neg(A \wedge B)$

2.1.1.2 Deletion and Alternatives: EXH K ϕ

Let's now look at what happens when EXH takes scope above K instead:

(8) EXHK[A or B]

In order to calculate the meaning of this LF we will first have to establish what the set $\mathcal{A}$LT(K[A or B]) is. Recall from the previous chapter that Katzir's algorithm predicts that $\alpha \in \mathcal{A}\text{LT}(\phi)$ if (not iff!) α can be derived from ϕ by deletion (repeated from (28) in section 1.2.3.1):

(9) KATZIR ALTERNATIVES

Let ϕ be a sentence containing one or more scalar items ν. ψ is a formal alternative of ϕ, $\psi \in \mathcal{A}LT(\phi)$, iff ψ can be obtained from ϕ by (i) replacing one or more occurrences of ν in ϕ with a member of ν's Horn-scale and/or (ii) deleting sub-constituents in ϕ

The DELETE-operation is essential to deriving the single disjunct A as alternative for the disjunction *A or B*.

Crucially, Katzir's algorithm in (9) allows for the deletion of the Matrix K operator. Depending on whether or not we make use of this option to derive the alternatives for the LF in (8), the set $\mathcal{A}LT$ will consist of different elements – those in (10-a) if K cannot be deleted, but those in (10-b) if DELETE can target the K-operator:

(10) a. $\mathcal{A}LT$(K[A or B]) = {KA, KB, K(A and B)}

b. $\mathcal{A}LT'$(K[A or B]) = {KA, KB, K(A and B), (A or B), A, B, (A and B)}

Let's start by calculating the meaning of (8) on the basis of the alternatives in (10-a):

(11) ⟦ EXH K [A or B] ⟧

-⟦ K [A or B] ⟧ = K(A $\vee$ B)

-$\mathcal{A}LT$(K [A or B]) = {KA, KB, K[A and B]}

$-\mathcal{IE} = \{KA, KB, K[A \text{ and } B]\}$

$= K(A \vee B) \wedge \neg KA \wedge \neg KB \wedge \neg K(A \wedge B)$

$= K(A \vee B) \wedge \neg K(A \wedge B) \wedge \neg KA \wedge \neg K\neg A \wedge \neg KB \wedge \neg K\neg B$[4]

What would happen if we used the alternatives in (10-b)? The crucial change will be in the definition of $\mathcal{IE}$. Since there is no logical relationship between $K\phi$ and ϕ (recall from the definition in (2) that K is not factive), there will now be more innocently excludable alternatives:

(12) $[\![\text{EXH } K [A \text{ or } B]]\!]$

$-[\![K [A \text{ or } B]]\!] = K(A \vee B)$

$-\mathcal{A}LT'(K [A \text{ or } B]) = \{KA, KB, K[A \text{ and } B], [A \text{ or } B], A, B, [A \text{ and } B]\}$

$-\mathcal{IE} = \{KA, KB, K[A \text{ and } B], [A \text{ or } B], A, B, [A \text{ and } B]\}$

$= K(A \vee B) \wedge \neg KA \wedge \neg KB \wedge \neg K(A \wedge B) \wedge \neg(A \vee B)$[5]

$= K(A \vee B) \wedge \neg K(A \wedge B) \wedge \neg KA \wedge \neg K\neg A \wedge \neg KB \wedge \neg K\neg B \wedge \neg(A \vee B)$

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[4]As stated in the previous chapter (see section 1.2.4), when weak ignorance implicatures about two symmetric alternatives are derived, this will entail true ignorance implicatures about these symmetric alternatives.

[5]Note that $\neg(A \vee B)$ entails $\neg A$, $\neg B$, and $\neg(A \wedge B)$. Even though by definition of $\mathcal{IE}$, all of these can be added to the meaning of K(A or B), it will therefore be enough to just include $\neg(A \vee B)$.

As this derivation shows, if we were to use the alternatives in (10-b) to derive the denotation of the LF in (8), i.e., if these were the actual alternatives of K[A or B], the assertion of a disjunction *A or B* should in principle be able to convey that *A or B* is false (namely, if the disjunction is parsed as EXH K [A or B]). This is an empirically inadequate result, and the most obvious strategy to remedy this is rule out the alternatives in (10-b). This means that Katzir's DELETE-operation has to be restricted so as not to apply to the Matrix K operator.

In this context it is worth noting that there are cases in which an alternative set much like (10-b) seems to be possible and indeed desired. An example is given in (13):

(13) Al believes somebody stole his lighter
$\rightsquigarrow$ The lighter wasn't actually stolen

Generally, sentences of the form *x believes that p* can give rise to the inference that *p* does not actually hold (cf. **??**).[6]

[6]In fact, as noted by Simons (2007), this is only true as long as x doesn't have first person features, and even for first person features the inference re-emerges in past tense:

(14) I believe that somebody stole the lighter
$\not\rightsquigarrow$ The lighter wasn't actually stolen

This inference could be derived through the following alternative set, which is derived from the assertion by deleting the doxastic operator *believe*:

(16) EXH[Al believes somebody stole his lighter] =

$\neg\mathcal{A}$LT(Al believes somebody stole his lighter) =

{somebody stole his lighter} = $\mathcal{IE}$

A believes somebody stole his lighter & It is not the case that somebody stole his lighter

Before Katzir proposed his DELETE-AND-REPLACE algorithm in (9), it was thought that this result had to be derived by replacing *believe* by its factive alternative *know*, which would derive the same result as in (16) (cf. Heim (1991); Percus (2006); Chemla (2008)). On the other hand, with Katzir's DELETE-operation other options like the one presented in (16) become available. The use of deletion to

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(15) I believed that somebody stole the lighter
$\rightsquigarrow$ The lighter hadn't actually been stolen

Simons argues that the inference in (13) only arises with parenthetical uses of *believe* and other relevant verbs, and that first-person or first-person past tense uses are excluded from being used parenthetically.

Note also that this is not the full generalization yet, since a parallel behavior is observed with certain verbs of saying: *x claims that p* may indicate that *p* does not actually hold. The analysis can be extended to these cases in an obvious way, but for ease of exposition I will concentrate on epistemic attitude operators in what follows.

derive the alternatives of the epistemic operator *know* has also been suggested in **??**.

In sum, deletion of epistemic and doxastic attitude verbs to derive the alternatives of the relevant sentence seems to be an option which should not be ruled out categorically. It appears to be an available option in examples like (16) or presupposition triggers like *know*, as argued in **??**. Besides these possible applications, the DELETE-operation has most famously been used in deriving disjunctive alternatives (cf. **??**). On the other hand, example like (12) illustrate that the availability of deletion cannot be unrestricted. Further research is needed to establish the empirical scope of Katzir's DELETE-operation and its restrictions.

Though this thesis does not attempt to contribute to this research question, examples like (12) suggest the following generalization:

(17) A sentence of the form $\mathcal{OP}\phi$, $\mathcal{OP}$ a universal doxastic or epistemic quantifier, may give rise to the inference that $\neg\phi$ just in case $\mathcal{OP}$ is overt.

Turning this into a theoretical conclusions, this generalization the suggests that the following restriction applied to DELETE:

(18) RESTRICTIONS ON DELETE

The DELETE-operation may target only overt elements

This restriction would rule out the derivation in (12) but allow the one in (11), thus correctly ruling out the unavailable readings which (12) would give rise to.[7]

2.1.1.3 Recursive Exhaustification: EXH K $\mathtt{exh}$ ϕ

Importantly, the proposed restriction in (18) applies not only to the covert K operator, but to the covert exhaustivity operator EXH as well. This will become important in the derivation of the LF in (19), in which one exhaustivity operator occurs in the scope of another:

(19) EXH K $\mathtt{exh}$ [A or B]

In order to compute the denotation of this LF, we need to define two sets of alternatives, both for the matrix and the embedded exhaustivity operator. According to Katzir's algorithm, augmented with the proposed restriction on deleting covert material in ??, these two sets will look as follows:

(20) a. $\mathcal{A}$LT(K $\mathtt{exh}$ [A or B]) = {K $\mathtt{exh}$ A, K $\mathtt{exh}$ B, K $\mathtt{exh}$ (A and B)}

b. $\mathcal{A}$LT(A or B) = {A, B, (A and B)}

[7]Though I have nothing interesting to say about the role of focus and its interaction with implicatures here, it seems that the restriction on DELETE posited in (18) could be linked to focus and its role in determining the formal alternatives $\mathcal{A}$LT for implicatures; see Fox and Katzir (2009)

We can calculate the denotation of (19) in two steps, starting with the embedded clause K exh [A or B]. The denotation of this clause is straightforward:

(21) $[\![$ K exh [A or B] $]\!]$

-$\mathcal{A}$LT(A or B) = {A, B, [A and B]}

-$\mathcal{IE}$ = {[A and B]}

$= K(A \vee B) \wedge K\neg(A \wedge B)$

According to the definition of EXH the denotation of the entire LF will the denotation of K exh [A or B], as given in (21), conjoined with the negation of all innocently excludable alternatives within the set $\mathcal{A}$LT(K exh [A or B]). In order to identify these alternatives, it will first be necessary to compute the denotation of the elements in $\mathcal{A}$LT(K exh [A or B]):

(22) a. K exh A

b. K exh B

c. K exh [A and B]

What is the domain of quantification for the exhaustivity operator which is contained in these alternatives? This question will be discussed in greater detail in section 4.3.1; for now I simply presuppose that the relevant alternatives for the emebdded exhaustivity operator in (22-a)-(22-b) are simply given by the other disjunct (cf. **??**), while the exhaustivity operator is vacuous when adjoined to the conjunction. Consequently, the denotation of the alternatives in (22) will be the following:

(23) a. $[\![$ K exh A $]\!]$ = K(A) ∧ K(¬B)

b. $[\![$ K exh B $]\!]$ = K(B) ∧ K(¬A)

c. $[\![$ K exh [A and B] $]\!]$ = K(A ∧ B)

All of these alternatives can be added to [K(A ∨ B) ∧ K¬(A ∧ B)] without entailing another alternative. The overall denotation of the LF in (19) is thus defined as in **??**:

(24) $[\![$ EXH K exh [A or B] $]\!]$ = $[\![$ K exh [A or B] $]\!]$ ∧ $\forall\alpha \in \mathcal{IE}$: $\neg\alpha$

-$\mathcal{A}$LT(K exh [A or B]) = {KexhA, KexhB, K exh[A and B]} (see (20-a))

-$\mathcal{IE}$ = {KexhA, KexhB, K exh[A and B]}

= {[K(A) ∧ K(¬B)], [K(B) ∧ K(¬A)], K(A ∧ B)}

= K(A ∨ B) ∧ K¬(A ∧ B) ∧ ¬K(A ∧ ¬B) ∧ ¬K(B ∧ ¬A)

= K(A ∨ B) ∧ K¬(A ∧ B) ∧ ¬KA ∧ ¬K¬A ∧ ¬KB ∧ ¬K¬B

2.1.2 Intermediate Summary and Last Option: Kϕ

We have now derived the meaning of all LFs which contain an exhaustivity operator at a possible adjunction site.[8] But of course, the axiom in(3) doesn't state that exhaustification is obligatory – it is merely an option. Therefore, we have one last possible LF to consider, whose meaning should now be relatively simple to derive:

(25) K [A or B]

$[\![$ K [A or B] $]\!] = K(A \vee B)$

To sum up, this is where we are now: We have introduced the main ingredients of the new system, namely, the Matrix K axiom in (1) and the Exhaustification axiom in (3). These two axioms together assure that assertion of ϕ will be parsed as Kϕ, and that an exhaustivity operator can be inserted both above and below K, giving rise to the four possible LFs derived above for the case of ϕ = [A or B]. We have then derived the denotation of these possible LFs, which are repeated below:

[8] For now I will ignore cases where EXH occurs inside the disjuncts. These will be discussed in section 2.4 below and later in chapter 4.3

Summary: Possible LFs for Disjunction

$[\![K\,[A \text{ or } B]\,]\!] =$	$K(A \vee B)$
$[\![K\,exh\,[A \text{ or } B]\,]\!] =$	$K(A \vee B) \wedge K\neg(A \wedge B)$
$[\![\text{EXH}\,K\,[A \text{ or } B]\,]\!] =$	$K(A \vee B) \wedge \neg K(A \wedge B) \wedge \neg KA \wedge \neg K\neg A \wedge \neg KB \wedge \neg K\neg B$
$[\![\text{EXH}\,K\,exh\,[A \text{ or } B]\,]\!] =$	$K(A \vee B) \wedge K\neg(A \wedge B) \wedge \neg KA \wedge \neg K\neg A \wedge \neg KB \wedge \neg K\neg B$

2.2 Epistemic Transparency

It is now time to think about what these LFs actually mean and whether they all correspond to felicitous uses of a disjunctive sentence. We will start with the simplest LF:

(26) $[\![K\,[A \text{ or } B]\,]\!] = K(A \vee B)$

According to this LF, a disjunction conveys that the speaker is sure that one or both of the disjuncts are true, and nothing else. But this is consistent with the following speaker states (I call K ϕ a speaker state, by which I mean the state of mind of somebody who is sure that ϕ is true):

(27) a. $K(A \wedge B)$

b. KA

c. KB

In other words, if (26) were a possible LF for a disjunction like *Al went to Alewife or to Braintree*, we would predict that the sentence could be felicitously used both by somebody who is sure that Al went to Alewife (or to Braintree), and by somebody who is sure that he went to both locations.

A similar problem arises with the following LF:

(28) $[\![\text{K exh [A or B]}]\!] = K(A \vee B) \wedge K\neg(A \wedge B)$

Nothing about the meaning of (28) rules out that the speaker is already sure of one of the disjuncts, which makes this LF empirically inadequate, too.

One might think that a simple solution to this problem could be found in a stipulation like the following:

(29) Scalar items carry a [*u*exh] feature

Being uninterpretable, this feature would have to be checked against the interpretable [exh] feature of an exhaustivity operator. This is essentially a fancy way of saying that EXH is obligatory (a version of (29) is actually proposed by **??**, which we will discuss in chapter 3.1.) But in the matrix K system, this will not help, as the LF from (28) illustrates:

(30) $[\![\text{K}\, exh\, [\text{A or B}]]\!] = \text{K}(\text{A} \vee \text{B}) \wedge \text{K}\neg(\text{A} \wedge \text{B})$

If the scalar element *or* really carried an uninterpretable [*u*exh] feature, this feature would be checked here and the whole LF sould be licensed. It cannot be licensed, however, for the same reason given earlier: Nothing about the denotation in (30) rules out that the speaker is already sure of one of the disjuncts. So (29) turns out to be useless.

In the theory of implicature I propose, what has previously been identified as the pragmatic component is reduced to the sum of principles guiding syntactic ambiguity resolution. The main principle guiding this ambiguity resolution, under the view advanced here, is what I will call *Epistemic Transparency*:

(31) EPISTEMIC TRANSPARENCY

An LF of the form $[\ldots \text{K}_S\phi]$ is licensed iff it entails S's state of mind about every $\psi \in \mathcal{A}\text{LT}(\phi)$[9]

States of mind are: (i) $\text{K}\psi$ (ii) $\neg\text{K}\psi$

In what follows, I will use the term *speaker state* to refer to $\text{K}\phi$ and $\neg\text{K}\phi$.

[9]As will be discussed in more detail in section 4.2.1.4 of Chapter 3, the set $\mathcal{A}\text{LT}$ as used in the definition of Epistemic Transparency is sensitive to contextually given relevance.

Transparency is very different from other principles which have been proposed within the grammatical theory of implicature, and which are also intended to guide the ambiguity resolution made necessary by the introduction of the exhaustivity operator. The gist of these proposals is that EXH needs to strengthen the meaning of the structure it attached to in order to be licensed (cf. Fox and Spector (2013)).

In a sense, Epistemic Transparency also is a strengthening principle; though in the Matrix K system, semantic strength does not automatically correlate with informedness of the speaker. As can be seen from comparison of the disjunctive LFs in above, an LF of the form EXH K ϕ is semantically stronger than K ϕ, though only EXH K ϕ, but not Kϕ, expresses that the speaker is not sure about the elements in $\mathcal{A}$LT(ϕ). In the new system, then, a semantically stronger sentence is one which is more explicit about the speaker's state of mind.

Let's now turn to the effect which Epistemic Transparency has on the interpretation of disjunction. We saw above that from the four possible LFs for a surface structure *A or B*, two need to be ruled out. The first of these problematic LFs, together with its denotation, is repeated below:

(32) $[\![\text{K[A or B]}]\!] = \text{K}(\text{A} \vee \text{B})$

As can easily be seen, Epistemic Transparency is not satisfied for this LF: No speaker state is entailed about any of the elements in the set $\mathcal{A}$LT(A or B) = {A, B, (A and B)}.

The other problematic LF and its denotation is given in (33):

(33) $[\![\, K\ exh\ [A \text{ or } B]\,]\!] = K(A \vee B) \wedge K\neg(A \wedge B)$

This time, checking whether Epistemic Transparency is satisfied will involve some more calculations. First, we need to calculate the set $\mathcal{A}LT(exh[A \text{ or } B])$. Following the by now familiar Katzir-algorithm and the restriction on deleting covert material, this will yield:

(34) $\mathcal{A}LT(\, exh\ [A \text{ or } B]) = \{exh\ A,\ exh\ B,\ exh\ (A \text{ and } B)\}$

$= \{(A \wedge \neg B), (B \wedge \neg A), (A \wedge B)\}$

To be sure, (33) does entail a speaker state about the last of these elements, namely, $K\neg(A \wedge B)$. But it doesn't entail a speaker state about any of the first two elements. The reason is this. That ϕ does not entail ψ means that ϕ is consistent with the negation of ψ (formally: $\phi \wedge \neg\psi \neq \bot$). Let's check if this is the case for the denotation in (33) and the two possible speaker states about the alternatives $(A \wedge \neg B)$ and $(B \wedge \neg A)$, viz., $K(A \wedge \neg B)$ and $\neg K(A \wedge \neg B)$ (and $K(B \wedge \neg A)$ and $\neg K(B \wedge \neg A)$):

$K(A \vee B)$ and $K\neg(A \wedge B)$ (= the denotation of (33)) means that in all of the speaker's doxastic alternatives, one of A, B are true and in none of her doxastic alternatives, both A and B are true. This is consistent with three scenarios:

1. In all of her doxastic alternatives, A is true and B is false

2. In all of her doxastic alternatives, B is true and A is false

3. in some of her doxastic alternatives, A is true and in some, B is true

Scenario 1 verifies $K(A \wedge \neg B)$, which is the negation of $\neg K(A \wedge \neg B)$. This means (33) does not entail $\neg K(A \wedge \neg B)$. Scenarios (ii) and (iii) verify $\neg K(A \wedge \neg B)$. This is the negation of $K(A \wedge \neg B)$. Therefore, (33) does not entail $K(A \wedge \neg B)$. In sum, (33) does neither entail $\neg K(A \wedge \neg B)$ nor $K(A \wedge \neg B)$. Mutatis mutandis, the same argument applies to $(B \wedge \neg A)$, leading to the conclusion that (33) does neither entail $K(B \wedge \neg A)$ nor $\neg K(B \wedge \neg A)$. In sum, (33) neither entails a speaker state about $(A \wedge \neg B)$, nor about $(B \wedge \neg A)$. *QED.*

This leaves us with two other LFs, which we will check for Epistemic Transparency in turn. The first one and its denotation is given below:

(35) $[\![\text{EXH K [A or B]}]\!] =$
$$K(A \vee B) \wedge \neg K(A \wedge B) \wedge \neg KA \wedge \neg K\neg A \wedge \neg KB \wedge \neg K\neg B$$

The alternatives for which a speaker state has to be entailed are given by the set $\mathcal{A}LT$(A or B) = {A, B, (A and B)}. Obviously, Transparency is satisfied and the LF is licensed. Checking the other possible LF is a bit more complicated:

(36) $[\![\text{EXH K } exh\text{[A or B]}]\!] =$
$$K(A \vee B) \wedge K\neg(A \wedge B) \wedge \neg KA \wedge \neg K\neg A \wedge \neg KB \wedge \neg K\neg B$$

Here, Transparency requires that $K\phi$ or $\neg K\phi$ be entailed for all $\phi \in \mathcal{A}LT(exh[A \text{ or } B])$. Let us first establish what this set is:

(37) $\mathcal{A}LT(exh\,[A \text{ or } B]) = \{exhA, exhB, exh(A \wedge B)\} = \{(A \wedge \neg B), (B \wedge \neg A), (A \wedge B)\}$

It is obvious that (36) entails a speaker state about the last alternative, namely, $K\neg(A \wedge B)$. But what about the first two alternatives?

The LF in (36) expresses that (i) in all of the speakers doxastic alternatives, one of A or B is true, (ii) in none of her doxastic alternatives, both are true, (iii) in some of her doxastic alternatives, A is true and in some A is false and (iv) in some of her doxastic alternatives, B is true and in some B is false. Now, if $K(A \wedge \neg B)$ were the case, then in all her doxastic alternatives, A would be true. This is a contradiction to (iii). Therefore, it must be the case that $\neg K(A \wedge \neg B)$. Likewise, if $K(B \wedge \neg A)$ were the case, in all her doxastic alternatives B would be true. This is a contradiction to (iv), so it must be the case that $\neg K(B \wedge \neg A)$. *QED.*

In sum, Epistemic Transparency predicts that the only acceptable LFs for disjunction are the following two:

(38) a. $[\![$ EXH K [A or B] $]\!] =$

$K(A \vee B) \wedge \neg K(A \wedge B) \wedge \neg KA \wedge \neg K\neg A \wedge \neg KB \wedge \neg K\neg B$

b. $[\![$ EXH K exh[A or B] $]\!] =$

$K(A \vee B) \wedge K\neg(A \wedge B) \wedge \neg KA \wedge \neg K\neg A \wedge \neg KB \wedge \neg K\neg B$

The only difference is that while the LF in (38-b) expresses that the speaker is sure that the corresponding conjunction is false, the LF in (38) expresses that the speaker is not sure that *A and B* is true.

It is important at this point to be aware of the strong tendency to interpret natural language *X is not sure that* ϕ as $\neg K\phi \wedge \neg K\neg\phi$, i.e., as conveying true ignorance with respect to ϕ. This feature makes it is a poor paraphrase for the derived meaning in (38-a), which merely states that there are at least some doxastic alternatives in which $(A \wedge B)$ is false.

I will stick to the terminology introduced earlier, and call $\neg K\phi$ a weak implicature. True ignorance implicatures are those meaning components of the form $\neg K\phi \wedge \neg K\neg\phi$. In what follows, I will elaborate on this difference and the empirical status of weak vs. ignorance implicatures in more detail.

Before we go on, a word about terminology. Traditionally, implicature is a term used for components of meaning which are derived post-grammatically, on the basis of pragmatic principles. In this sense, a grammatical theory of implicature is a contradiction in terms. In the theory I propose, the terminological issue is even more pressing because there seem to be no real (i.e., extra-grammatical) implicatures left at all. Nevertheless, for the sake of continuity I will stick to the traditional terminology and call an entailment of $K\phi$ which has the form $K\neg\psi$ or $\neg K\psi$ ($\psi \in \mathcal{A}LT(\phi)$) an implicature.

2.3 Weak Implicatures: Absence of Evidence or Evidence of Absence?

The question that I will address in this section is whether the two LFs in (38-a) and (38-b) are sufficient to cover the empirically attested readings of disjunction. Uncontroversially, I assume that one of these attested readings conveys that the speaker is ignorant about the disjuncts and that she is sure that the corresponding conjunction is false. This is adequately captured by the LF in (38-b).

I take it to be almost as uncontroversial that there is another reading. The least we can say about this reading is that it is characterized by the absence of a scalar implicature. I will call this the inclusive reading. Now an important question arises, which to my knowledge neither the empirical, nor the theoretical literature has addressed in much detail:

- Does the inclusive reading of disjunction indicate true ignorance about the corresponding conjunction?

My claim is that the answer to this question is No, and that the LF in (38-b) adequately captures the inclusive reading.

Important evidence for this claim comes from the following observation. If the inclusive reading really entailed an ignorance implicature, it should be possible to refer back to this implicature in subsequent discourse. One way to do so is the locution *Are you saying that* ψ?. I assume that it is appropriate as a response to a sentence ϕ if there is at least one reading of ϕ which implicates ψ. A quick survey of relevant cases confirms that this generalization is correct:

(39) A: My cleaning gentleman is coming tomorrow

B: Are you saying you have a cleaning gentleman?

(40) A: All my friends didn't call me for my birthday

B: Are you saying none of them called you?

(41) A: I tried to stop smoking

B: Are you saying you still smoke?

Ideally, we should also find evidence from infelicitous uses. As the following cases show, targeting propositions which are merely consistent with the asserted sentence is indeed ruled out:

(42) A: I will buy a Gamay or a Valdiguié

B: #Are you saying you will buy two bottles?

Likewise:

(43) A: Al went to South America for vacation

B: #Are you saying he went to Chile?

This allows us to employ the locution as a diagnostic for the presence (and absence) of implicatures. Let's first start with a relatively straightforward case, namely, scalar implicatures of weak sentences. As expected, the scalar implicature component can be targeted:

(44) A: I read some of your articles on the topic

B: Are you saying you didn't read them all?

The same is true for the scalar implicature of a simple disjunction:

(45) A: Table 3 ordered a sandwich or a hot chocolate

B: Are you saying they didn't order both?

Let us now turn to ignorance implicatures. In a simple disjunction, the ignorance implicatures about the disjuncts can be targeted without problem:

(46) A: Table 3 ordered a sandwich or a hot chocolate

B: Are you saying you don't know whether they ordered the sandwich or the hot chocolate?

Looking back at the denotations of the two admissible LFs in (38) and (38-b), this is predicted since both of those LFs entail true ignorance about the disjuncts.

Crucially, however, targeting a potential ignorance implicature about the conjunction is not a possibility, as the following case illustrates:

(47) A: Table 3 ordered a sandwich or a hot chocolate

B: #Are you saying you don't know whether they ordered both?

As pointed out by Irene Heim (p.c.), there is a variation of the *Are you saying* test which replicates this result. Consider the following minimal pair:

(48) A: Table 3 ordered a sandwich or a hot chocolate

B: Are you saying they might not have ordered both?

But compare this to the infelicitous example below:

(49) A: Table 3 ordered a sandwich or a hot chocolate

B: #Are you saying they might have ordered both?

In order to see how this relates to the question of whether or not the inclusive reading of simple disjunctions carry a true ignorance implicature, note first that the semantics of epistemic *might* can be defined in terms of existential quantification over doxastic alternatives. Given a simple semantics along these lines, B's question in (48) is about the following:

(50) $[\![\text{might (A and B)}]\!]^{w} \Leftrightarrow \exists w' \in \mathcal{D}ox(s)(w) : [\![\text{A and B}]\!]^{w'} = 1$

Let's use this semantics of *might* to give a semi-formal rendition of the exchange in (48) (where the speaker s = A):

(51) A: A or B

B: #Are you saying $[\exists w' \in \mathcal{D}\text{ox}(s)(w) : [\![\text{A and B}]\!]^{w'} = 1]$

Now, a true ignorance implicature of A's simple disjunction [A or B] entails the following:

(52) $[\![\neg\text{K} \neg(\text{A and B})]\!]^{w} \Leftrightarrow \neg\forall w' \in \mathcal{D}\text{ox}(s)(w) : [\![\neg(\text{A and B})]\!]^{w'} = 1$

$\Leftrightarrow \exists w' \in \mathcal{D}\text{ox}(s)(w) : [\![\text{A and B}]\!]^{w'} = 1$

Thus, if there was a true ignorance implicature about the conjunction, B's question in (48) should be felicitous and answerable by Yes.

By the same logic, the felicity of (48) supports the view that the simple disjunction only entails a weak implicature and that consequently, the LF in (38-a) is empirically adequate.

To see this better, we can look at the semi-formal rendition of the exchange in (48), as given below:

(53) A: A or B

B: Are you saying $[\exists w' \in \mathcal{D}\text{ox}(s)(w) : [\![\text{A and B}]\!]^{w'} = 0]$

A weak implicature of the simple disjunction would match the semantics of B's response and is this predicted to yield a felicitous exchange, as observed:

(54) $[\![\neg K \text{ (A and B)}]\!]^{w} \Leftrightarrow \neg\forall w' \in \mathcal{D}ox(s)(w) : [\![\text{A and B}]\!]^{w'} = 1$

$\Leftrightarrow \exists w' \in \mathcal{D}ox(s)(w) : [\![\text{ A and B }]\!]^{w'} = 0$

Sentences containing *some* behave completely parallel in this respect: While their scalar implicature can be targeted, this is not possible for the supposed ignorance implicature about the stronger alternative:

(55) A: Al returned some of your books yesterday

B: Are you saying he didn't return all of them?

Compare this to:

(56) A: Al returned some of your books yesterday

B: #Are you saying you don't know whether he returned all of them?

This is strong evidence in favor of the view that simple weak sentences *W* do not give rise to ignorance implicatures about S.

But now compare the behavior of a simple structure to that of a surface redundant structure. As it turns out, our diagnostic reveals the presence of an ignorance implicature in the latter case:

(57) A: Table 3 ordered a sandwich or a hot chocolate or both

B: Are you saying you don't know whether they ordered both?

And similarly for the example with *some*:

(58) A: Al returned some or all of your books yesterday

B: Are you saying you don't know whether he returned all of them?

I conclude from these observations that the role of surface redundancy in grammar is to explicitly mark ignorance implicatures.

But a few clarifications are in order. We saw above that the locutions *Are you saying that* ψ*?* and *Are you saying that* [*might* ψ]*?* can diagnose the presence of scalar, ignorance and weak implicatures.

One set of examples discussed above involved exchanges in which these locutions targeted supposed ignorance implicatures about stronger alternatives. While this yielded felicitous results for the ignorance implicatures about single disjuncts, the results were infelicitous when supposed ignorance implicatures about the corresponding conjunction were targeted. Crucially, however, targeting ignorance implicatures about the corresponding conjunction became possible with surface redundant disjunctions.

As pointed out in Chapter 1, however, a weak implicature of the form $\neg K(\psi)$, though it doesn't entail ignorance, is consistent with it. Though in this thesis I will not have much to say about what happens post-grammatically, it is likely that grammatically derived weak implicatures like $\neg K(A \wedge B)$, may be strengthened into true ignorance inferences given further contextual information about the speaker.

Given this possibility, the generalization that emerges from the data above is the following:

(59) *Are you saying that (might) ψ?* can only target grammatically derived implicatures

Thus, we seem to have found a diagnostic which is sensitive to the status of the meaning component they target and in particular, sensitive only to grammatically derived implicatures.

This sensitivity to grammatical status became apparent in two kinds of contrasts: While ignorance implicatures about the disjuncts can easily be targeted, the supposed ignorance inference about the conjunctive alternative of a simple disjunction can not (see (47) and (49) above). Crucially, however, the ignorance implicature about the corresponding conjunction can be targeted in a surface redundant disjunction (see (57) and (58).) Not surprisingly perhaps, scalar implicatures can always be targeted. The last crucial observation concerned weak implicatures: As opposed to ignorance implicatures, weak implicatures about the conjunction can be targeted in a simple disjunction.

As we will see shorty, these observations are accounted for by the Matrix K theory, which predicts grammatical ignorance implicatures for the disjuncts of (all kinds of) disjunctions. Furthermore, the theory predicts simple and surface redundant disjunctions to differ in their (grammatical) implicatures: While the former can only entail a weak implicature about the conjunctive alternative, the theory predicts the latter to give rise to a (grammatical!) ignorance implicature.

Regarding our initial question, then, the answer is clear: the inclusive reading of a simple disjunction does not entail ignorance and the LF in (38-a) is empirically correct.

In the next section, I will show how surface redundant structures are analyzed under the Matrix K theory, and how the theory accounts for the difference between simple and surface redundant sentences with respect to ignorance implicatures which we diagnosed above.

2.4 Surface Redundancy and Ignorance

I will begin by proving an existential claim: The Matrix K theory predicts that there is an LF for surface redundant structures which adequately captures the meaning of these structures and in particular, their ignorance implicatures. For the sake of simplicity, I will use the familiar abbreviations:

(60) Al went to Alewife or Braintree or both

[A or B] or [A and B]

(61) Al drank some or all of the beers

SOME or ALL

The two axioms that define the range of possible LFs for these and other sentences are the Matrix K axiom and the Exhaustification axiom, the latter stating that EXH can be inserted at any proposition-denoting node. Given these two assumptions, the following LF is a possible parse of (61):

(62) EXH K [(*exh* SOME) or ALL]

Here, one EXH is adjoined within the first disjunct. To calculate the meaning of this LF, the first step is to establish the alternatives which the matrix exhaustivity operator quantifies over.[10] The set is given below (as shown in section **??**, I exclude logically redundant alternatives even if they are technically part of $\mathcal{A}$LTgiven Katzir's algorithm):

(63) $\mathcal{A}$LT(K [(*exh* SOME) or ALL]) = {K(*exh* SOME), K(ALL)}

The denotation of (62) can then be calculated as follows:

[10] I will assume that ⟦ *exh* SOME ⟧ is the same in the context of the LF in (62) as in unembedded contexts, namely, (SOME $\wedge$ $\neg$ALL); as before I will abbreviate this meaning as SBNA.

(64) $[\![\text{EXH } K[(exh \text{ SOME}) \text{ or ALL}]]\!] =$

$[\![K[(\text{exh SOME}) \text{ or ALL}]]\!] \wedge \forall\alpha \in \mathcal{IE} : \neg\alpha$

$-[\![K[(exh \text{ SOME}) \text{ or ALL}]]\!] = K(\text{SOME})$

$-\mathcal{IE} = \{K\,(exh \text{ SOME}), K(\text{ALL})\}$

$= K(\text{SOME}) \wedge \neg K(\text{SBNA}) \wedge \neg K(\text{ALL})$

$= K(\text{SOME}) \wedge \neg K(\text{ALL}) \wedge \neg K(\neg\text{ALL})$

Now first we should make sure that the LF verifies Epistemic Transparency. Recall from above that this principle states that an LF of the form $[\ldots K\ \phi]$ is licensed only if it entails $K(\psi)$ or $\neg K\psi$ for all $\psi \in \mathcal{A}LT(\phi)$. For the LF the alternatives for which a speaker state has to be entailed are the following:

(65) $\mathcal{A}LT((exh \text{ SOME}) \text{ or ALL}) = \{(exh \text{ SOME}), \text{ALL}\}$[11]

As can be seen in (64), the LF entails $\neg K(exh \text{ SOME})$ (abbreviated here as $\neg K(\text{SBNA})$) and $\neg K(\text{ALL})$ and thereby satisfies Epistemic Transparency.

In sum, we have seen that the Matrix K theory predicts the existence of an LF for a surface redundant disjunction like *All drank some or all of the beers* which

[11]Strictly speaking there is also $[(exh \text{ SOME}) \text{ and ALL}]$, but this is inconsistent and we can omit this alternative here.

conveys that the speaker is sure that Al drank some beers, and that he is not sure whether Al drank all or only some of the beers – in other words, it predicts the existence of an LF which entails true ignorance with respect to the semantically stronger alternatives. This is the intuitively correct meaning.

After this proof of existence, we can now go on to verify that the theory does not predict any simpler sentence to convey this same meaning. The best candidate LF for the simple sentence *Al drank some of the beers* would be the following, which however only entails a weak implicature about the stronger alternative ALL:

(66) EXH K SOME

$[\![\ ]\!] = \text{K(SOME)} \wedge \neg\text{K(ALL)}$

As the discussion in the preceding section revealed, the predicted absence of a true ignorance implicature for simple, but not for surface redundant sentences is empirically adequate.

For completeness, we may also look at the derivation of the other surface redundant structure, namely, [(A or B) or (A and B)]. Given the availability of EXH and the Matrix K axiom, one possible LF is the following:

(67) EXH K [*exh* (A or B) or (A and B)]

To derive the denotation of (67), the first step is again to define the set $\mathcal{A}$LTwhich the topmost EXH quantifies over:

(68) $\mathcal{A}\text{LT}(\text{K}\,[\text{exh (A or B) or (A and B)}]) =$

$\{\text{K exh (A or B), KexhA, KexhB, K(A and B)}\} =$

$\{\text{K}(A \triangledown B), \text{K}(A \wedge \neg B), \text{K}(B \wedge \neg A), \text{K}(A \wedge B)\}$

Given this set, the meaning of (67) is defined as follows:

(69) $[\![\ \text{EXH K}[\textit{exh} \text{ (A or B) or (A and B)}]\ ]\!] =$

$[\![\ \text{K}[\textit{exh} \text{ (A or B) or (A and B)}]\ ]\!] \ \wedge \forall \alpha \in \mathcal{IE} : \neg \alpha$

-$[\![\ \text{K}[\textit{exh} \text{ (A or B) or (A and B)}]\ ]\!] = \text{K}(A \vee B)$

-$\mathcal{IE} = \{\text{K}(A \triangledown B), \text{K}(A \wedge \neg B), \text{K}(B \wedge \neg A), \text{K}(A \wedge B)\}$

$= \text{K}(A \vee B) \ \wedge \neg\text{K}(A \triangledown B) \ \wedge \neg\text{K}(A \wedge \neg B) \ \wedge \neg\text{K}(B \wedge \neg A) \ \wedge \neg\text{K}(A \wedge B) =$

$\text{K}(A \vee B) \ \wedge \neg\text{K}(A \wedge B) \ \wedge \neg\text{K}\neg(A \wedge B) \ \wedge \neg\text{KA} \wedge \neg\text{K}\neg\text{A} \ \wedge \neg\text{KB} \wedge \neg\text{K}\neg\text{B}$

Compare this to the two admissible LFs of the corresponding simple disjunction from (38) and (38-b) above:

(70) a. $[\![\ \text{EXHK}[\text{A or B}]\ ]\!] =$

$\text{K}(A \vee B) \ \wedge \ \neg\text{K}(A \wedge B) \ \wedge \ \neg\text{KA} \ \wedge \ \neg\text{K}\neg\text{A} \ \wedge \ \neg\text{KB} \ \wedge \ \neg\text{K}\neg\text{B}$

b. $[\![\ \text{EXHK exh}[\text{A or B}]\ ]\!] =$

$\text{K}(A \vee B) \ \wedge \ \text{K}\neg(A \wedge B) \ \wedge \ \neg\text{KA} \ \wedge \ \neg\text{K}\neg\text{A} \ \wedge \ \neg\text{KB} \ \wedge \ \neg\text{K}\neg\text{B}$

While (67) entails a true ignorance implicature about the conjunction, the only two available LFs for the simple disjunction are either the scalar implicature reading, or the inclusive reading which is mute with respect to whether or not the speaker is in a scalar implicature or an ignorance implicature state of mind. As we saw in the preceding section, this is the empirically correct result.

2.5 Architectural Efficiency and Hurford's Constraint

Above we saw that the Matrix K theory offers a new understanding of Surface Redundancy as a means to convey true ignorance, which as we saw is not part of the meaning of the corresponding simpler structures. In the Matrix K system, none of the possible LFs of simpler sentences express ignorance, while under the pragmatic and grammatical theory of implicature, these simpler sentences are predicted to be able to convey the same meaning as the more complex surface redundant structures.

So far, all these predictions were derived on the basis of two premises, namely, that assertions include a matrix K operator at LF, and that every proposition-denoting node is a possible adjunction site for the exhaustivity operator. We saw in section 2.2 that the resolution of the resulting ambiguity is guided by the principle of Epistemic Transparency, which effectively states that a weak scalar item should be used in a way that makes it clear to the hearer what the speaker's state of mind is concerning the alternatives.

However, this simple version of the theory over-generates meanings for surface redundant sentences. Specifically, as it stands, we predict a surface structure like *Al drank some or all of the beers* to have two other possible LFs, given below:

(71) $\mathrm{K}\,[\mathtt{exh}\ (\mathrm{SOME\ or\ ALL})]$

$[\![\ ]\!] = \mathrm{K}(\mathrm{SOME}) \wedge \mathrm{K}\neg(\mathrm{ALL})$

(72) $\textsc{exh}\ \mathrm{K}\,[\mathrm{SOME\ or\ ALL}]$

$[\![\ ]\!] = \mathrm{K}(\mathrm{SOME}) \wedge \neg\mathrm{K}(\mathrm{ALL})$

Let us first make sure that both of these LFs are indeed predicted to be licensed by Epistemic Transparency. For (71), ET is satisfied if a speaker state about both of the following alternatives is entailed:

(73) $\mathcal{A}\mathrm{LT}(\mathtt{exh}\ (\mathrm{SOME\ or\ ALL})) = \{\mathtt{exh}\ \mathrm{SOME}, \mathrm{ALL}\} = \{\mathrm{SBNA}, \mathrm{ALL}\}$

Recall that Epistemic Transparency defines two possible speaker states about an alternative ψ, viz., $\mathrm{K}(\psi)$ and $\neg\mathrm{K}(\psi)$. Let's start with the last alternative in (73): ALL. The denotation of (71) states that $\mathrm{K}\neg(\mathrm{ALL})$. Since this is stronger than, and thus entails, $\neg\mathrm{K}(\mathrm{ALL})$, a speaker state about the last element of these alternatives is indeed entailed by (71). What about SBNA? The denotation in (71) doesn't explicitly list a speaker state about this alternative, though it logically entails one:

(74) $[\![\ (71)\ ]\!] = \mathrm{K}(\mathrm{SOME}) \wedge \mathrm{K}\neg(\mathrm{ALL}) \vDash \mathrm{K}(\mathrm{SBNA})$

Checking Epistemic Transparency for (72) is even easier. The alternatives for which a speaker state has to be entailed are given by the set $\mathcal{A}$LT(SOME or ALL) = {SOME, ALL}. A quick look at the denotation of (72) confirms that ET is satisfied for this LF, too.

In sum, both the LF in (71) and the one in (72) are licensed by the basic Matrix K system as defined by the Matrix K axiom, the Exhaustification axiom, and Epistemic Transparency.

Now we can go on to show that this is indeed a problem. If (71) were a possible LF for the surface redundant sentence *Al drank some or all of the beers*, we would predict that the sentence could be felicitously used by a speaker who is is sure that Al didn't drink all of the beers.

Turning to (71), though it only entails a weak implicature about ALL, the prediction for this LF is the same: If this were a possible LF of *Al drank some or all of the beers*, the sentence could be used by a speaker who is sure that Al didn't drink all beers. This might sound like a contradiction to what we said earlier about the inclusive reading of disjunctions, which we defined merely as the absence of scalar implicature. But it is important to keep in mind that it it is the hearer who is in charge of ambiguity resolution. In the Matrix K theory, ambiguity resolution can quite literally be understood as the process of reasoning about the speakers state of mind. Now, even though this state of mind can only be either K¬(ALL) or (¬K(ALL) ∧ ¬K¬(ALL)) (given ¬K(ALL)), this doesn't mean the hearer can tell (cf. the discussion in section 1.2.4 of Chapter 1). And it is precisely in the situations were he can't tell that he would chose the LF in (72) – if it were available.

As for the *speaker* about which the hearer is reasoning, the semantics of (72) is consisted with him being in a K¬(ALL) state. Thus, if a hearer could chose the LF in (72) for *Al drank some or all of the beers*, she should not be surprised if the speaker continued with ... *I drank the others.*[12] But after assertion of the surface redundant sentence, this move is impossible (the simple sentence in (75-a) serves as a control):

(75) a. Al drank some of the beers ... I drank the others

b. Al drank some or all of the beers ... # I drank the others

Having reassured ourselves that both LFs are empirically inadequate, we can now go on to discuss possible solutions for this problem of over-generation.[13]

One solution – the only solution proposed so far – for this problem is of course Hurford's constraint (cf. Hurford (1974); Chierchia et al. (2007)):

(76) A sentence containing a disjunctive phrase is infelicitous if one disjunct

[12] Of course the same argument also applies to the LF which entails a scalar implicature (i.e., the one in (71)), but at this point it is important to understand that it applies even to the weaker LF (71), which only entails a weak implicature.

[13] There are two other possible LFs which would pose similar problems, namely, LF4 = K[SOME or ALL] and LF5 = K[(*exh* SOME) or ALL]. But as can easily be verified, both of these LFs are already ruled out by Epistemic Transparency and we need not worry about them in what follows.

entails the other

This constraint would effectively rule out the problematic LFs in (71) and (72) because these LFs contain the disjunctive phrase SOME or ALL, the right disjunct of which entails the left one.

But Hurford's constraint as stated in (76) is stipulative, and it would be a considerable improvement of the Matrix K theory if we could derive the constraint as a theorem, which is what I will try to do in what follows.

2.5.1 Deriving Hurford's Constraint: Efficiency

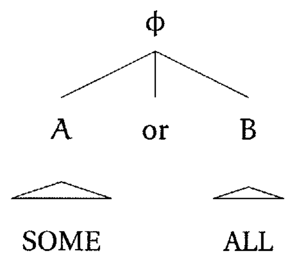
Looking at the meaning of the two problematic LFs in (71) and (72), the intuitive problem with these LFs is this: If this were the meaning the speaker would have wanted to express, he could have used a simpler sentence (namely, SOME). Capitalizing on this intuition, it might seem like a simple constraint agains unnecessary complexity – call it BREVITY – could do the job:

(77) BREVITY

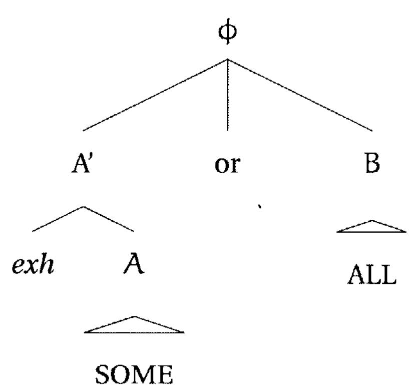
Let ϕ be a syntactic tree and let A be a sub-constituent of ϕ

$\#\phi$ if ϕ is equivalent to A

This constraint does indeed rule out the LFs in in (71) and (72) – as shown in (79), these LFs contain a subtree ϕ which violates BREVITY:

(78) 

Crucially, $[\![\phi]\!] \equiv [\![A]\!]$, and therefore, ϕ is ruled out by BREVITY. Unfortunately, however, the constraint also rules out the attested LF in which the first disjunct is exhaustified locally:

(79) 

Since $[\![\phi]\!] \equiv [\![A]\!]$, this LF would incorrectly be ruled out by the constraint in (77).[14]

The problem with BREVITY illustrates that structural complexity should not be constrained per se. Language seems to be sensitive to the available means of simplifying a given structure, and these means seem to be restricted.

I argue that the problem with the LFs in (71) and (72) is one of inefficiency: They have not much to offer by way of meaning to warrant their extra complexity. Inefficiency is encountered wherever complex structures are mapped to an LF which expresses a meaning that could have been expressed by a less complex LF. As a matter of architectural economy, inefficient choices of LFs are expected to be ruled out.

---

[14] Note that restricting (77) to immediately dominating nodes has the desired effect of licensing the attested LF:

(80) BREVITY (Version 2)
Let ϕ, A be non-terminal nodes s.t. ϕ *immediately* dominates A.
$\#\phi$ if $[\![\phi]\!] \equiv [\![A]\!]$

In what follows I will not make use of this rather stipulative modification but rather, suggest a principle which is based on Katzir's notion of structural complexity.

How can this theoretical intuition be stated formally? I suggest to make use of Kratzir's notion of structural complexity:[15]

(81) EFFICIENCY

An LF ϕ is ruled out if there is a competitor ψ such that

(i) $\psi \in \mathcal{COMP}(\phi)$

(ii) $[\![\psi]\!] \equiv [\![\phi]\!]$

$\mathcal{COMP}$ is the competition set of a given LF ϕ. It is defined in terms of Katzir's structural complexity:

(82) $\psi \in \mathcal{COMP}(\phi)$ iff $\psi \lesssim \phi$

According to this definition, $\mathcal{COMP}(\phi)$ will contain all LFs which can be obtained from ϕ by the familiar algorithm of replacing scalar items with their lexical alternatives and deleting sub-constituents. Importantly, the constraint against deleting covert elements we introduced in section 2.1.1.2 (see definition **??**) remains valid for the definition of $\mathcal{COMP}$, which means that K and EXH will not vary across elements in $\mathcal{COMP}$.

[15] I use the notation $\mathcal{COMP}$ rather than $\mathcal{A}$LT to indicate that, while both sets are derived through the same (i.e., Katzir's) algorithm, $\mathcal{COMP}$ refers to structural alternatives of LFs, while $\mathcal{A}$LT refers to structural alternatives of surface sentences.

Looking at the structure in (79), is becomes apparent what sensitivity to available simplifications means: Katzir's definition of structural complexity, together with the independently needed constraint on the deletion of covert material, is the crucial factor. Contrary to the principle of brevity stated in (77), the nodes ϕ and A are not competitors according to (81).

Let us now apply the principle of Efficiency to the problematic LFs from above to see its effect. For the first problematic mapping between the surface redundant disjunction SOME or ALL to the LF in (71), the principle is applied below:

(83) Surface: SOME or ALL

LF2: K[$\mathtt{exh}$ (SOME or ALL)]

$[\![\ ]\!]$ = K(SOME) $\wedge$ K$\neg$(ALL)

-$\mathcal{COMP}$(LF2) = {K $\mathtt{exh}$ SOME, K $\mathtt{exh}$ ALL}

-$\lightning$ Efficiency: $[\![$ LF2 $]\!] \equiv [\![$ K $\mathtt{exh}$ SOME $]\!]$

☞ LF2 ruled out

As this illustrates, the problematic LF looses against its competitor K $\mathtt{exh}$ SOME. This competitor is in fact a possible LF for the simple sentence *Al drank some of the beers.*

A similar result is obtained for the other problematic LF:

(84) Surface: SOME or ALL

LF3: EXH K [SOME or ALL]

$[\![\ ]\!] = K(\text{SOME}) \wedge \neg K(\text{ALL})$

-$\mathcal{COMP}$(LF3) = {EXHKSOME, EXHK ALL}

-↯ Efficiency: $[\![\text{LF3}]\!] \equiv [\![\text{EXH K SOME}]\!]$

☞ LF3 ruled out

This time, the problematic LF3 looses against the competitor EXH K SOME, which is again one of the possible LFs of the simpler surface sentence *Al drank some of the beers.*

Now let us check the predictions of Efficiency for the sentence *Al drank some but not all of the beers,* which is problematic for a simple Blocking condition like (85):

(85) BLOCKING

#S if there is a sentence S' such that $S' \lesssim S$ and $[\![S']\!] \equiv [\![S]\!]$

To see where the problem lies, let S = *Al drank some but not all of the beers.* There is a sentence S' such that $S' \lesssim S$ and $[\![S']\!] \equiv [\![S]\!]$. This sentence is *Al drank some of the beers,* parsed as K exh SOME. Thus, the blocking constraint in **??** is too strong and just like (77), will fix a problem of over-generation by introducing one of under-generation (cf. Katzir (2008)).[16]

Efficiency, on the other hand, should predict *Al drank some but not all of the beers* to be licensed, which means there has to be at least one admissible LF to which it can be mapped. Let's start with the simplest option, given below:

(86) LF1: K SBNA

$[\![\ ]\!] = K(SBNA)$

-$\mathcal{COMP}$(LF1) = {K(SOME), K(ALL)}

-✓ Efficiency: $\neg\exists\psi \in \mathcal{COMP}$ s.t. $[\![\psi]\!] \equiv [\![\text{LF1}]\!]$

☞ LF1 licensed

As this shows, the simple LF1 is licensed by Efficiency, and the sentence is thus predicted to be licensed precisely under the interpretation we do in fact observe.[17]

But now the worry might be that there could be further LFs which are licensed by EfficiencyEfficiency, but which correspond to empirically unattested uses. Below I show that this is not the case, and that on the contrary, Efficiency rules out some

[16]Note that BREVITY as stated in (77) will not rule out this sentence, at least not unless local exhaustification of *some* is made obligatory.

[17]It is easy to see that Epistemic Transparency is also satisfied: About all elements in $\mathcal{ALT}$(SBNA) = {SOME, ALL}, LF1 entails a speaker state, given that K(SBNA) = K(SOME) $\wedge$ K$\neg$(ALL).

LFs containing vacuous exhaustivity operators.

The first of these additional LFs is the following:

(87) K *exh* SBNA

It should be clear by now that the meaning of this LF would be equivalent to that of the simpler LF in (86), and that EXH is adjoined vacuously here:

(88) $[\![$ K *exh* SBNA $]\!]$ = $[\![$ K SBNA $]\!]$ = K(SBNA)

By Efficiency, the LF in (87) will in fact be ruled out. To see why, it is enough to look at the set $\mathcal{COMP}$(K*exh*SBNA) = {K*exh*SOME, K*exh*ALL}. Among these competitors, the first LF is equivalent to the LF in (87): $[\![$ K*exh*SOME $]\!]$ = $[\![$ K*exh*SBNA $]\!]$. Thus, even though the LF containing the vacuous exhaustivity operator is by definition empirically indistinguishable from the LF without the vacuous operator, Efficiency predicts this LF to be ruled out. As can easily be checked, the same result is obtained for the two other syntactically possible (but semantically indistinguishable) LFs K[(*exh* SOME) but not ALL] and [EXH K SBNA].

To conclude, I would like to point out the relation between the principle of Efficiency and the Matrix K hypothesis.[18] Suppose we tried to derive the effects of Hurford's constraint from Efficiency in the grammatical theory, i.e., a theory which assumes a covert exhaustivity, but no covert K operator. Under such a theory, Hurford's constraint would *not* follow from Efficiency. To see why, let us look at what are the possible LFs for a surface redundant disjunct like (89) and which of these LFs would be licensed by Efficiency:

(89) SOME or ALL

(90) LF1: SOME or ALL $[\![\ ]\!]$ = SOME

-$\mathcal{COMP}$(LF1) = {SOME, ALL, SOME and ALL}

-$\lightning$ Efficiency: $[\![$ LF1 $]\!] \equiv [\![$ SOME $]\!]$

☞ LF1 ruled out

Next is an LF where EXH is adjoined at the matrix level:

(91) LF2: EXH [SOME or ALL] $[\![\ ]\!]$ = SOME $\wedge \neg$(ALL)

-$\mathcal{COMP}$(LF2) = {EXH SOME, EXH ALL, EXH[SOME and ALL]}

[18]Thanks to Danny Fox (p.c.) for stressing this point.

-↯ Efficiency: ⟦ LF2 ⟧ ≡ ⟦ EXH SOME ⟧

☞ LF2 ruled out

Crucially, however, even the last remaining LF would be ruled out:

(92) LF3: [(*exh* SOME) or ALL] ⟦ ⟧ = SOME

-$\mathcal{COMP}$(LF3) = {*exh* SOME, ALL, [*exh* SOME and ALL], SOME}

-↯ Efficiency: ⟦ LF3 ⟧ ≡ ⟦ SOME ⟧

☞ LF3 ruled out

As this illustrates, the Matrix K hypothesis is an essential ingredient in the derivation of Hurford's constraint from a principle like Efficiency; in the absence of Matrix K, the same problem we have encountered above for BREVITY (see (77)) resurfaces. This argument of course abstracts away from a previously established result, namely, that the correct meaning for (89) is not adequately captured by any of these LFs; contrary to what the LF in (92) would predict, [SOME or ALL] is not in fact equivalent to SOME, but the two sentences differ with respect to their implicatures.

Chapter 3

A New Theory of Oddness

3.1 The Problem: Under-Informativeness and Contextual Equivalence

Let us refer to common belief (CB) as a set of propositions which describe the beliefs of all or the typical members of a certain group (e.g., Western society, the students of Pragmatics 101, human beings).[1] Each member of this group also believes that each member shares these beliefs, and that they share the believe

[1]Note that I depart from Magri (2009), to whom the following proposal is a response, in using belief rather than knowledge to define contextual entailment; the explanation of the oddness effects discussed in what follows (or, for that matter, any other effect discussed in this thesis) doesn't depend on whether or not the beliefs in question are actually true or not.

that they share these beliefs, and so on and so forth (cf. Schiffer (1972); Stalnaker (1974, 1978, 2002)). For example, among human beings it can be considered common belief that all men are mortal. I will abbreviate this as follows:

(1) $\vDash_{CB}$ All men are mortal[2]

Sometimes, a group of interlocutors witnesses an event which normally can then be considered common belief; for example, if the subjects in an experiment see a troll deliver all the pizzas, it is common belief among the group of subjects that the troll delivered all the pizzas (a story used in Gualmini (2004)). Likewise, among the students of a high-school in which PE classes are single-sex, the following can be considered common belief:

(2) $\vDash_{CB}$ All students in PE classes have the same gender

[2]As was the case with the Matrix K operator, CB is of course relativized to a group of believers, so that the notation CB_g would be more precise; but in what follows I will leave out the subscript since the relevant group can easily be recovered from context and content of the sentence in question.

Given this relatively trivial definition of common belief, let us now turn to an equally simple definition of logical under-informativeness:[3]

(3) LOGICAL UNDER-INFORMATIVENESS

A sentence W is logically under-informative iff there is an $S \in \mathcal{A}LT(W)$ s.t.

(i) $S \Rightarrow W$

(ii) $W \equiv_{CB} S$

The last condition states that W and S are contextually equivalent. To see what is meant by this, consider again mortality: In all worlds in CB, it holds that all men are mortal. Now, given that *All men are mortal* logically entails *Some men are mortal,* it will also hold in all worlds in CB that some men are mortal. In other words, the set of worlds compatible with common beliefs in which some men are mortal is identical to the set of worlds compatible with common beliefs in which all men are mortal. This is *contextual equivalence* as defined in Magri (2009:257):

(4) CONTEXTUAL EQUIVALENCE

W and S are contextually equivalent ($W \equiv_{CB}$ S) iff $CB \cap W = CB \cap S$

[3]If $\mathcal{A}LT$is the set of presuppositional alternatives of W, this definition will carry over to 'under-presuppositional' sentences like *I interviewed a father of the victim* (Hawkins (1991), modulo the definition of logical entailment $\Rightarrow$, which will have to be replaced by the corresponding ordering in terms of presuppositional strength (see e.g. Schlenker (2012)).

(5) CONTEXTUAL ENTAILMENT

S contextually entails W iff CB $\cap$ S $\subseteq$ W

But of course, it is not logically necessary that men be mortal. Therefore, there are worlds compatible with logic (though not with common belief) in which some, but not all men are mortal. Thus, that some men are mortal is contextually, but not logically equivalent to the corresponding universal statement. According to the definition in (3), *Some men are mortal* is logically under-informative when compared to its logically stronger alternative *All men are mortal,* even though it is contextually equivalent to this stronger alternative.

Now, an observation which turns out to be surprisingly non-trivial to explain is that logically under-informative statements sound odd:

(6) *(From one human being to another:)*

Some men are mortal

(7) *(In the gender-separating high school:)*

Some students in this PE class are girls

At first, it seems like the oddness of under-informative sentences can be explained with reference to Gricean maxims. If indeed there is a requirement to assert the strongest relevant sentence which one believes to be true (the maxims of QUANTITY, QUALITY and RELATION), then (6) will always be a bad choice:

The only excuse for a weak assertion is lack of evidence for any stronger alternative (given that they would be equally relevant); yet, since the two sentences in question are contextually equivalent, nobody who shares common beliefs about mortality could be sure of (6) while having doubts whether all men are mortal. Therefore, asserting the under-informative sentence is un-cooperative. If we assume furthermore that un-cooperative assertions may sound odd, (6) would be explained in a Gricean fashion. Indeed, an explanation along these lines seems to be what e.g. Horn (1985) and, regarding similar data concerning presuppositional strength, Hawkins (1991) had in mind.

However, as is well known by now, this Gricean argument involves a non-sequitur, as first pointed out by Heim (1991) (see also Percus (2006); Sauerland (2008); Schlenker (2012)). The problem is this. Gricean pragmatics is to be understood as a system of principles which apply post-grammatically, i.e., at a point where language is interpreted in its larger communicative context. At this point, however, the contextual equivalence between *Some men are mortal* and *All men are mortal* will have been taken into consideration, which has the undesirable consequence of making the two sentences indistinguishable from the point of view of QUANTITY. In sum, Heim's argument is that that QUANTITY does not actually predict a preference for the logically stronger sentence, since, by assumption, the maxim is sensitive to contextual rather than logical strength.

3.2 Experimental Data

Magri himself doesn't actually define the scope of his proposal; in particular, he does not offer a formal characterization of the kind of under-informative sentences he aims to cover. De facto, his proposal extends to all sentences which fall under the definition of under-informativeness stated in (3).

Thus, it extends to data which have been discussed independently in the experimental literature (see Paris (1973); Noveck (2001); Noveck et al. (2002); Papafragou and Musolino (2003); Bott and Noveck (2004); Gualmini (2004); Guasti et al. (2005); Breheny et al. (2006); Chevallier et al. (2008); Singh et al. (2013)).

These studies are all concerned with a sub-class of under-informative sentences, namely, those which (together with their stronger alternative) are already entailed by common beliefs. An example of this sub-class of under-informativeness was (6):

(8) #Some men are mortal

The sentence is under-informative according to the given definition in (3), since it is contextually equivalent, but logically weaker than *All men are mortal.* The only difference to the examples discussed by Magri concerns the status relative to common beliefs CB. In the examples he discusses, the weaker sentence does not already follow from CB:

(9) $\not\models_{CB}$ Some students in this PE class are girls

Once the premise that all students in PE have the same gender is added to CB, however, both classes of under-informative sentences are characterized by their contextual equivalence to their logically stronger alternative:

(10) a. Some men are mortal $\equiv_{CB}$ All men are mortal

b. Some students in PE are girls $\equiv_{CB}$ All students in PE are girls

Specifically, the equivalence in (10-b) holds because CB contains the proposition that all students in PE classes have the same gender; on the other hand, the equivalence in (10-a) simply holds because the stronger sentence is itself already part of CB. It is conceivable that this difference would be reflected in speaker's judgments of these two different kinds of under-informative sentences, thus limiting the validity of Magri's arguments for these kind of sentences.

Specifically, if an essential feature of assertion is that it reduces the set of common beliefs CB, as proposed most famously by Stalnaker (e.g. Karttunen (1974); Stalnaker (1978)), then neither *Some elephants are mammals* nor *All elephants are mammals* can be successfully asserted among speakers having an elementary school education (the sentence is used in a study by Bott and Noveck (2004)).[4] This factor may have influenced speaker's judgments, so that the results might be no longer comparable to the kind of under-informative sentences which Magri discusses, which are *not* entailed by common beliefs.

However, for subjects in an experimental setting, the most natural assumption would appear to be that the target sentences do not express common belief between subject and experimenter. Thus, if asked about a statement like *All elephants are mammals*, they might not object to its redundancy in view of common belief among human beings, but assume instead that the goal is to establish whether the sentence can indeed be considered common belief. Secondly, this factor does not distinguish between *All elephants are mammals* and *Some elephants are mammals*, so that a difference in ratings between the two can only be due to independent factors. It is precisely these factors for which Magri's theory offers an explanation.

In conclusion, the data discussed in the experimental literature falls within the scope of Magri's theory, and therefore, the findings reported in these studies is highly relevant to the proposal (and vice versa).

[4]Though it might not be an assertion in Stalnaker's sense, the statement may however have other useful effects like re-assuring the group that all are indeed mutually believing the proposition in question; given that not all common beliefs are equally salient, a seemingly redundant statement can also raise saliency of commonly believed propositions (these functions are highlighted by adding *recall that*...).

Returning now to the results of these experimental studies, they have been consistent in showing that under-informative sentences are indeed disprefered, though the rejection rates are not as high as might be expected based on theoretical proposals like Magri's own, as we will see shortly. Depending on the design, the acceptance rate of under-informative sentences in adults has been found to lie between 75% (Paris (1973); Noveck (2001)) and 20% (Guasti et al. (2005); Noveck et al. (2002)). In these studies, under-informativeness was either relative to long-established facts like elephants being mammals, or relative to ad-hoc established facts like in Gualmini's pizza delivery story. Note that acceptance of the stronger alternatives in contexts in which both the under-informative sentence and the stronger alternative is entailed by previously established beliefs consistently approaches 100% in all studies.

While the theoretical and the experimental literature might differ on the question whether the oddness is categorical or gradual (perhaps indicating several interpretational choices), it appears to be almost universally accepted that the rejection of under-informative sentences is linked to the calculation of scalar implicatures. This view can be subsumed under the following hypothesis:

(11) THE SCALAR IMPLICATURE HYPOTHESIS

Rejection of an under-informative sentence W is due to the scalar implicatures of W

This hypothesis is assumed both in Magri (2009) and in the experimental literature cited above. The assumption is that *Some elephants are mammals*, for those speakers who reject it, is interpreted as conveying that *Not all elephants are mammals*, which in turn contradicts common beliefs.

As is obvious in view of our earlier discussion, the hypothesis that rejection of under-informative sentences is due to scalar implicature computation can only be maintained if first Heim's problem is solved: Proponents of the scalar implicature hypothesis (SIH for short) need an alternative theory of implicature which, unlike Grice's, can distinguish between contextually equivalent sentences. Surprisingly, however, the problem has not been recognized in any of the experimental studies, which is perhaps due to the fact that the thematic connection between the experimental results and the theoretical insights of e.g. Heim (1991) has not been drawn, and that theoretical literature discussing the problem more broadly has only become available relatively recently (e.g., Percus (2006); Sauerland (2008); Schlenker (2012)).

But even if a theory of implicature consistent with the scalar implicature hypothesis is made available, the SIH is not self-evident: A speaker may well reject a sentence like *Some men are mortal* even if he does *not* take it to convey that *Not all men are mortal.* There might be an independent bias against under-informative sentences, even in the absence of a false implicature.[5]

However, in the experimental literature, the possibility of an alternative to the scalar implicature hypothesis is only discussed in Noveck et al. (2002), who conduct a follow-up experiment and consequently reject an alternative hypothesis.[6]

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[5]An example of such an independent principle is Heim's own *Maximize Presupposition*; given the above mentioned problems with contextual equivalence, Heim concludes that this principle has to be thought of as a primitive, not reducible to other pragmatic maxims.

[6]To test the alternative hypothesis that independent constraints, rather than scalar implicature, explain the rejection of under-informative statements, Noveck et al. (2002) use the following condition:

(12) P1 If A, then B and C
P2 A
$\therefore$ B

The authors find that there is a contrast in acceptance between the conclusion presented in (12) (92% and 75% acceptance rate in subsequent experiments), and the corresponding argument pattern with the conclusion *B or C* (25% acceptance rate). They interpret this as evidence that the rejection of the disjunctive conclusion in the latter is indeed due to scalar implicature computation, rather than an independence constraint against under-informativeness.

However, if the low acceptance of the disjunctive conclusion *B or C* in premise sets such as (12) were due to the scalar implicature $\neg$*(A and B)*, we would expect the same exhaustive interpretation to apply to the conclusion *B*, resulting in an interpretation of *B* as *(B and* $\neg$*C)*. This in turn would predict a lower acceptance rate of (12) than that found by Noveck et al. By contrast, their result is consistent with the assumption that an independent constraint against under-informative statements leads to rejection of the disjunctive conclusion. Under this alternative view, the high acceptance rate of the conclusion in (12) can be explained independently: I suspect that it is due to the fact that *B* alone, as opposed to the disjunction *B or C*, can easily be interpreted as the beginning of a list, thus leaving open the charitable interpretation that the list of possible conclusions will or could in principle be continued. In sum, whether or not rejection of under-informative statements is linked to scalar implicature computation has to be considered an open empirical question.

In sum, the oddness of under-informative sentences has been documented in a variety of experimental studies, though a substantial percentage of speakers do in fact accept under-informativeness, at least in these experimental settings. We also saw that on the theoretical side, the oddness of these sentences poses another intriguing challenge for a pragmatic (Gricean) theory of implicatures. As we have defined them above, these sentences are contextually equivalent to their stronger scalar alternatives, but somehow this contextual equivalence does not appear to be visible to the system that rules them out. However, Gricean pragmatics is defined as a set of principles governing rational communication and as such cannot be conceived of as blind to contextual equivalence. The conclusion which Magri (2009) draws is thus obvious: If the oddness of under-informative sentences is to be explained in terms of scalar implicature, we need a system of scalar implicature which is blind to this contextual equivalence, i.e, blind to common belief. In what follows, I will present Magri's account, which is based on the assumption that the scalar implicature hypothesis from **??** is correct. Consequently, the account is based on a grammatical theory of implicatures, building on proposals by Groenendijk and Stokhof (1984); Krifka (1995); van Rooy (2002); Chierchia (2004) and especially Fox (2007a).

3.3 Magri's Proposal: Obligatory Scalar Implicatures

As we have seen above, if the oddness of logically under-informative sentences is to be explained in terms of scalar implicature, the system that computes these implicatures needs to be blind to the contextual equivalence of the under-informative sentence to its stronger alternative. As Magri (2009) shows, this can easily be achieved within a grammatical theory of scalar implicature if the following hypothesis is adopted (see Magri 2009:257):

(13) BLINDNESS

The exhaustivity operator EXH is defined in terms of logical entailment

To see the effects of Magri's blindness hypothesis, consider first what would happen if EXH were defined in terms of contextual entailment. Suppose that the under-informative sentence from our PE class above is parsed as follows:

(14) EXH [Some students in this PE class are girls]

According to the simplest definition of EXH, the operator excludes all stronger alternatives of its argument. But if strength is defined in terms of contextual entailment $\Rightarrow_{CB}$, rather than logical entailment, EXH will not exclude any alternatives at all:

(15) $[\![$ EXH[Some students in this PE class are girls] $]\!]$ =

-$\mathcal{A}$LT(Some students in this PE class are girls) = {All students in this PE class are girls}

-$[\![$ Some students in this PE class are girls $]\!]$ $\equiv_{CB}$ $[\![$ All students in this

PE class are girls]]

$-\mathcal{IE} = \{\}$

= Some students in this PE class are girls

No scalar implicature can be derived if EXH is sensitive to the fact that the formal alternative *All students in this PE class are girls* is contextually equivalent to its argument. In other words, a definition of $\mathcal{IE}$ in terms of contextual entailment faces the same problem as the Gricean explanation, namely, that the (logically) stronger alternative will never be excluded. According to the scalar implicature hypothesis (see (11)), however, it is precisely the exclusion of the stronger alternative which explains the oddness of under-informative sentences.

Within a grammatical theory of scalar implicature, on the other hand, the problem doesn't necessarily arise, as argued by Magri (2009), and independently in Fox and Hackl (2006). The idea is that the computation of $\mathcal{IE}$ is part of a grammatical module which is informationally encapsulated in that it has access to logical relationships between sentences, but not to the meaning these sentences will have in a specific context of common beliefs and external facts

(see also Fodor (1983); on the other hand, Hobbs and del Rey (2011); Tanenhaus and Brown-Schmidt (2008); Hobbs and del Rey (2011) argue against against encapsulation, though the arguments presented there mostly concern lexical semantics, rather than implicature computation).

One particular consequence of this view is Magri's blindness hypothesis in (13): All those sentences in $\mathcal{A}$LTwhose negation does not lead to a logical contradiction can be innocently excluded by EXH. Within a modular view of implicature calculation, the blindness hypothesis would seem like a default.

Let us look at what Blindness predicts for the under-informative sentences in question. The contextual equivalence of the stronger alternative will no longer be accessible to EXH, so that the set of alternatives it will innocently exclude will no longer be empty:

(16) $[\![$ EXH[Some students in this PE class are girls] $]\!]$ =

- $\mathcal{A}$LT(Some students in this PE class are girls) = {All students in this PE class are girls}

- $[\![$ Some students in this PE class are girls $]\!]$ $\Rightarrow$ $[\![$ All students in this PE class are girls $]\!]$

= Some students in this PE class are girls $\wedge \neg$(All students in this PE class are girls)

Importantly, this is not a logical contradiction. Neither is the following, which is the result of having EXH 'blindly' exclude the logically stronger alternative:

(17) $[\![$ EXH Some men are mortal $]\!]$ = Some men are mortal $\wedge \neg$(All men are mortal)

Despite being contradiction-free in the logical sense, these meanings will yield a contradiction when interpreted relative to the common belief that all students in PE classes have the same gender, or the common belief among us human beings that all of us are mortal:

(18) a. Some but not all students in this PE class are girls $\wedge$ All students of PE classes have the same gender = $\perp$

b. Some but not not all men are mortal $\wedge$ All men are mortal = $\perp$

Specifically, it is the scalar implicature derived by the blind exhaustivity operator which causes the contradiction with common belief. Assuming that contradiction to common belief leads to oddness (Magri calls this the *Mismatch Hypothesis*), we have found an explanation for why under-informative sentences sound odd, even though they are contextually equivalent to their stronger alternatives.

3.3.1 The Problem with Obligatory Scalar Implicatures

As pointed out by Magri, however, to explain the oddness of under-informative sentences it is not enough to show that they will contradict common beliefs *if exhaustified.* What is needed is to make their exhaustification obligatory. In Magri's proposal, this is simply stipulated (cf. Magri (2009:261)):

(19) Attach EXH to every matrix clause

Under-informative sentences W (along with all other unembedded sentences) will now be obligatorily parsed as EXH W, and thus always be interpreted as $W \wedge \neg S$ for every $S \in \mathcal{A}LT(W)$. Since S is entailed by common beliefs by definition (see (3) above), this means they will always contradict CB. This is how their oddness is explained.[7]

But this explanation comes at a price, namely, the stipulation in (19). One of the predictions that emerges is that partially informed speakers can not say what they know. I argue that this is a serious problem for the theory: Even if I was unable to establish whether or not all invited guests came to my party, I should be able to inform you of the fact that *some* of them came, without being guilty of making an unjustified claim. But this is precisely what Magri's theory would convict me of. Assume that you asked me how many of the invitees came to the party. Given obligatory exhaustification as required by (19), you would have to parse my answer about the party attendance as in (20):

(20) EXH [Some of the invited guests came to the party]

[7]Note furthermore that Magri also rules out the possibility of excluding the stronger alternative from the set $\mathcal{A}LT$by making $\mathcal{A}LT$sensitive to relevance, while in turn making relevance be closed under contextual equivalence. This means that in all contexts in which the logically under-informative sentence is relevant, so is its logically stronger, though contextually equivalent alternative.

Given that $\mathcal{A}$LT(Some of the guests came) = {All of the guests came} and that this alternative is relevant in the given context, this means you would have to understand me as telling you that not all of the guests showed up – by assumption, a claim for which I lack evidence.

In Magri's (2009) theory, then, anybody who isn't on top of all the facts faces a lose-lose situation: If he doesn't make a weak claim he deprives his interlocutors of the (little) information he has and is thus being un-cooperative; if, on the other hand, he makes the weak claim of which he is sure, he is committed to a scalar implicature for which he lacks evidence and will thus likewise be accused of being un-cooperative.

Extending the original account, Magri (2011) acknowledges that obligatory exhaustification as required by (19) leads to problems in standard cases, where the stronger alternative is not contextually equivalent to the asserted sentence. Though Magri (2011) does not discuss the case of the under-informed speaker I pointed out above, he notes other cases where the optionality of scalar implicatures in sentences like (21) conflicts with the obligatory presence of EXH as stipulated by the theory:

(21) Al drank some of the beers

Magri notes that in contexts in which the $\mathcal{QUD}$ is *Who drank some of the beers?*, (21) will not usually give rise to the scalar implicature that Al didn't drink all of the beers (other implicatures, e.g., that Bill didn't drink some of the beers, may arise instead). To account for this variability in scalar implicatures while preserving obligatory exhaustification as required by (19), Magri relies on the following hypothesis:

(22) MAGRI'S RELEVANCE HYPOTHESIS

Absence of a scalar implicature $\neg$S is never due to missing EXH, but to the fact that S is not relevant in the given context

To implement this, we can assume that the set of formal alternatives $\mathcal{ALT}$ is sensitive to contextual relevance as defined e.g. by the $\mathcal{QUD}$ – if the question under discussion is *Who drank some of the beers?*, as we assumed in (21) above, the set $\mathcal{ALT}$(Al drank some of the beers) will no longer contain the sentence *Al drank all of the beers* (instead, it may contain alternatives of the form *x drank some of the beers*). As a result, even the obligatory presence of EXH won't lead to the scalar implicature that Al didn't drink all of the beers, at least not in contexts in which the $\mathcal{QUD}$ doesn't make this stronger alternative relevant.

Magri's relevance hypothesis in (22) thus explains the variability of scalar implicatures as dependent on the current $\mathcal{QUD}$ while leaving intact the obligatory exhaustification hypothesis in (19).

But what about cases like (20), where by assumption the stronger alternative is made relevant by the current $\mathcal{QUD}$? Given Magri's relevance hypothesis in (22), the only way to avoid unwanted scalar implicatures here would be to fiddle with relevance: We would have to claim that even if the initial $\mathcal{QUD}$ was *How many* *of the invitees came to the party?*, the under-informed speaker can make a weak claim if he succeeds in changing the $\mathcal{QUD}$ into a question which would make the stronger alternative, i.e., that which he doesn't have evidence for, irrelevant. Thus, at the point at which the speaker utters (20), we would have to assume the context was silently updated to a new $\mathcal{QUD}$, for example:

(23) *Did some of the invitees come to the party?*

$[\![$ EXH[Some of the invited guests came] $]\!]$

$\mathcal{A}$LT= {Some of the invited guests came, None of the invited guests came}

= Some of the invited guests came

In what follows, I will show that the Matrix K theory can account for Magri's data without recourse to obligatory scalar implicatures, and as consequence, without this volatile notion of relevance to account for missing scalar implicatures.

3.4 Under-Informativeness in the Matrix K Theory

Though I reject Magri's claim that it is obligatory scalar implicatures which explain the oddness of under-informative sentences, I agree with him that the encapsulation of implicature computation plays a crucial role in the puzzle, and that it is the resulting contradiction with context which leads to oddness.

Furthermore, I also agree with Magri that something like the scalar implicature hypothesis in (11) lies at the heart of the problem, though I am not committed to scalar implicatures as the sole source of oddness. My version of the hypothesis is thus less strong:

(24) THE IMPLICATURE HYPOTHESIS

Rejection of an under-informative sentence W is due to the implicatures of W

In fact, with the blindness hypothesis in (13), my account of the puzzle is almost complete: In the Matrix K theory, the oddness of under-informative sentences follows straightforwardly, without any additional assumptions, and in particular, without the problematic stipulation in (19). To see how, recall the central axiom of the theory:

(25) THE MATRIX K AXIOM

Assertion of ϕ by S is parsed as $K_S\phi$ at LF

The Matrix K theory is a radically grammatical theory of implicatures in that all implicatures – weak or scalar – are derived by EXH. The disambiguation of a surface structure is guided by the following principle:

(26) EPISTEMIC TRANSPARENCY

An LF of the form $[\ldots K_S\phi]$ is licensed iff it entails S's state of mind about every $\psi \in \mathcal{A}LT(\phi)$

States of mind are: (i) $K\psi$ (ii) $\neg K\psi$

Let us look at what this means for under-informative sentences as defined in (3). Given the Matrix K axiom, at LF these will at the very least contain a covert K-operator:

(27) K[Some men are mortal]

This LF simply expresses that the speaker is sure that some men are mortal. But since $\mathcal{A}$LT(Some men are mortal) = {All men are mortal}, the LF can only be licensed if entails a speaker state about the logically stronger alternative. At this point, we have to ask the same question that Magri raised in relation to EXH: Is the relevant notion logical entailment or contextual entailment? Above we followed Magri in attributing the blindness hypothesis in **??** to the more general view that the computation of implicatures is part of grammar, and in particular, part of a grammatical module which is context-independent, i.e., blind to common beliefs and external facts. Let us therefore replace the blindness hypothesis in (13) by a more general hypothesis (cf. Fox and Hackl (2006)):

(28) ENCAPSULATION

The semantics and distribution of EXHis defined in terms of logical entailment

The encapsulation hypothesis is a more general version of Magri's blindness hypothesis in that it defines logical entailment as the underlying notion not only in the definition of EXH itself, but also in the definition of Epistemic Transparency, i.e., the principle which guides the distribution of EXH:

(29) EPISTEMIC TRANSPARENCY

An LF of the form $[\ldots K_S \phi]$ is licensed iff it *logically entails* S's state of mind about every $\psi \in \mathcal{A}LT(\phi)$

Given that the principle is stated in terms of logical entailment, the LF in (27) violates Epistemic Transparency, since it does not logically entail the speaker's state of mind about the stronger alternative *All men are mortal.* Therefore, a parse including EXH becomes necessary. Crucially, and in contradistinction to Magri's theory, the exhaustivity operator can take scope below and above K; giving rise to either a scalar or a weak implicature:

(30) $[\![$ K exh [Some men are mortal] $]\!]$ =

K(some men are mortal) $\wedge$ K$\neg$(all men are mortal)

(31) $[\![$ EXH K [Some men are mortal] $]\!]$ =

K(some men are mortal) $\wedge$ $\neg$K(all men are mortal)

Both of these LFs, and only these two LFs, satisfy the principle ET and will be grammatically licensed. What remains to be done at this point is to show that both possible LFs are problematic, thus accounting for the oddness of under-informative sentences. In our terminology, the first LF entails the scalar implicature that the speaker is sure that not all men are mortal. Recall that I adopt Magri's view that it is contradiction to common beliefs which cause the sentences to sound odd. It is worthwhile thinking about where exactly the contradiction lies in this case. Assume the following axiom for common belief among a group G (cf. Lismont and Mongin (1994)); I write $K_G\phi$ for $\phi \in CB_G$:

(A1) $K_G\phi \Rightarrow K_x\phi,\ x \in G$

In contexts in which it it is common belief that all mean are mortal, the LF in (30) will lead to the following contradiction:[8]

(32) K_s (All men are mortal) (A1)

K_s ¬(All men are mortal) ((30))

$\lightning$

Now consider the second LF in (31), which contains only the weak implicature that the speaker isn't sure that all men are mortal. As can easily bee seen, this will also conflict with common belief:

[8]Given that beliefs of a speaker normally have to be consistent; see **??** for discussion

(33) K_S (All men are mortal) (A1)

$\neg K_S$ (All men are mortal) ((30))

$\lightning$

In sum, the only two licensed LF express a meaning which is logically consistent but, when interpreted in conjunction with common belief, result in a contradiction. Specifically, as we just saw, common belief entails that the speaker is sure about the stronger alternative, while the only licensed LFs either entail that he is not, or entail that he is sure of the negation of the stronger alternative.

Let us quickly look at what happens with those under-informative sentences which are not already entailed by common belief, as in our earlier example:

(34) Some students in this PE class are girls

Recall our earlier high school scenario, where PE classes are single sex. Among the group G of students, teachers, and parents in that school, it holds that:

(35) K_G (All students in PE classes have the same gender)

Now, among the group which share this common belief, the sentence in (34) will sound odd. By Epistemic Transparency, the two licensed LF of the sentence in **??** are parallel to the one shown in (30) and (31) above, i.e., one will entail K_S $\neg$(All students in this PE class are girls), while the other will entail the weak implicature that $\neg K_S$ (All girls in this PE class are girls). From (35) and the axiom in (A1), however, it follows that K_S (All students in PE classes have the same gender). Therefore, both LFs will lead again to inconsistency when common belief is taken into account:

(36) K_S (Some but not all students in PE are girls)

K_S (All students in PE have the same gender)

$\lightning$

(37) K_S(Some students in PE are girls) $\wedge \neg K_S$ (All students in PE are girls)

K_S (All students in PE have the same gender)

$\lightning$

Again, while the two licensed LFs are logically consistent, they predict inconsistent speaker beliefs when interpreted in the context of current common beliefs.

Finally, it should be noted that we have restored the ability of the partially informed speaker to communicate: In the absence of evidence for the stronger claim, his weak claim won't be interpreted as claiming evidence of absence – in other words, since Magri's stipulation in (19) is not needed anymore, a weak statement will no longer have to be interpreted as being obligatorily exhaustified and as a result, we no longer have to stipulate sudden changes in relevance, as done in (22), to neutralize the effects of obligatory exhaustification.

Chapter 4

Abolishing Hurford's Constraint

4.1 Short Review of Previous Results

In the first two chapters of this thesis, we have been concerned with surface redundant disjunctions like the following:

(1) Al went to Alewife or Braintree or both

We saw that these constructions are an unsolved puzzle for the pragmatic theory, and that the grammatical theory relies on a rather stipulative constraint to rule out LFs which would give rise to the unattested scalar implicature that Al didn't go to both locations – Hurford's constraint.

We then showed that even if Hurford's constraint is added as an axiom, the grammatical theory predicts surface redundant disjunctions like (1) to be semantically and implicature-wise identical to a simpler structure like *Al went to Alewife or Braintree*, at least under one possible reading of the latter sentence (namely, the one which is not exhaustified).

As we argued in section 2.3 of Chapter 2, however, this prediction is empirically inadequate: Surface redundant disjunctions are in fact different in meaning from their simpler counterparts. Whereas the simpler structure does not give rise to a true ignorance inference, surface redundant disjunctions do entail true ignorance with respect to the stronger alternative.

The rest of Chapter 2 was devoted to developing a new theory of implicature, based on and named after the Matrix K Axiom, which states that assertively used sentences are embedded under a covert doxastic operator at LF. The second ingredient was the basic grammatical hypothesis that a covert exhaustivity operator can attach at any proposition-denoting node at LF. The resulting ambiguity of sentences like (1) – stemming mainly from the resulting scopal interactions between K and EXH and the possibility of recursive exhaustification – was constrained by the principle of Epistemic Transparency. This principle states that an LF of a sentence S is licensed only if it entails the speaker's state of mind about S's alternatives, where the two possible state of minds were defined as $K(S')$ and $\neg K(S')$ (note that $K\neg(S')$ entails the latter and will therefore count when checking Epistemic Transparency).

After deriving the correct implicatures for simple and surface redundant structures in the new theory, we noted that just like in the grammatical theory, a sentence like (1) is predicted to also have an LF like (2), which does not correspond to an attested reading of the sentence and therefore needs to be ruled out:

(2) $[\![$ EXH K exh [A or B or both] $]\!]$ =

$K(A \vee B) \wedge K\neg(A \wedge B) \wedge \neg K(A) \wedge \neg K(B)$

While the grammatical theory relied on Hurford's constraint to rule out this LF, we proposed to derive Hurford's constraint from a principle in the spirit of Grice's BREVITY which we called the principle of Efficiency. Efficiency does not rule out surface complexity per se, but imposes a constraint on LFs which are structurally more complex, but semantically equivalent to their formally defined alternatives as given by the competition set $\mathcal{COMP}$.

As we saw, Efficiency correctly rules out the LFs which do not correspond to attested readings of surface redundant disjunctions; in particular it rules out the LF in (2) because its denotation is equivalent to that of a simpler competitor:

(3) $[\![$ EXH K exh [(A or B) or (A and B)] $]\!]$ =

$K(A \vee B) \wedge K\neg(A \wedge B) \wedge \neg K(A) \wedge \neg K(B)$

$\mathcal{COMP}$ = {..., K exh [A or B], ...} $\lightning$ Efficiency:

$K(A \vee B) \wedge K\neg(A \wedge B) \wedge \neg K(A) \wedge \neg K(B)$ = $[\![$ EXH K exh [A or B] $]\!]$

This LF for the surface redundant sentence *Al went to Alewife or Braintree or both* would end up conveying what *Al went to Alewife or Braintree* could also have expressed and is therefore blocked by Efficiency. The only remaining, *efficient* LF for the sentence is therefore the following (recall that I use the abbreviation $\triangledown$ for *exh* [A or B], i.e., for exclusive disjunction):

(4) $[\![$ EXH K [*exh* (A or B) or (A and B)] $]\!]$ =

$[\![$ K [*exh* (A or B) or (A and B)] $]\!]$ $\wedge\ \forall\alpha \in \mathcal{IE} : \neg\alpha$

-$[\![$ K[*exh* (A or B) or (A and B)] $]\!]$ = $K(A \vee B)$

-$\mathcal{IE} = \{K(A \triangledown B), K(A \wedge \neg B), K(B \wedge \neg A), K(A \wedge B)\}$

$= K(A \vee B) \wedge \neg K(A \triangledown B) \wedge \neg K(A \wedge \neg B) \wedge \neg K(B \wedge \neg A) \wedge \neg K(A \wedge B) =$

$K(A \vee B) \wedge \neg K(A \wedge B) \wedge \neg K \neg (A \wedge B) \wedge \neg KA \wedge \neg K \neg A \wedge \neg KB \wedge \neg K \neg B$

As a result of Efficiency, then, the only licensed LF is one in which an exhaustivity operator is adjoined locally at the first disjunct – the LFs which do not contain a local exhaustivity operator have nothing to offer by way of meaning to warrant their extra complexity and are therefore not licensed by Efficiency.

So far, then, we have only been concerned with surface redundant disjunctions which are felicitous, i.e., those sentences in which the entailment relation between the disjuncts is obviated by a covert exhaustivity operator.

But of course, there are surface redundant disjunctions which are not felicitous – these are the kind of sentences which Hurford (1974) was originally concerned with:[1]

(5) #Jean worked in France or in Paris

In our new terminology, then, what has traditionally been known as Hurford disjunctions are infelicitous surface redundant disjunctions. These infelicitous disjunctions may seem to pose a challenge for any theory which does not assume Hurford's constraint.

In what follows, I will show how these original Hurford disjunctions are accounted for under the Matrix K theory without Hurford's constraint. Before we get there, however, we will have to make a detour to discuss some issues concerning implicatures based on non-logical scales. Though this is of general interest, as we will see it will also be relevant for Hurford disjunctions, to which we will return in section 4.3.

[1] Hurford's own example was 'Jean was born in France or in Paris', but it has been pointed out that this particular disjunction suffers from the confound that one can only be born in one place, which is why I modify the example slightly to avoid this confound (Singh (2008) credits this observation to Irene Heim (p.c.))

4.2 Specificity Scales and Implicature

Grice (1975); Hirschberg (1985); Matsumoto (1995) drew attention to implicature-like inferences which seem to be based on specificity rather than logical strength. For example, in contexts in which the contextually given level of specificity is set at the city-level, an utterance involving the less specific item *California* may give rise to an inference about *San Francisco*:

(6) A: In which city did Al work again?

B: He worked in California

$\rightsquigarrow$ $\neg$K (Al worked in San Francisco)

This inference has the form of a weak implicature, and one way to interpret the example is to take this observation at face value and derive the inference through the same mechanism as implicatures involving logical scales. This hypothesis would entail the existence of *specificity scales*, i.e., sets of lexical items (partially) ordered by specificity. An example of such a scale would be ⟨USA, California, San Francisco⟩, from which the following formal alternatives could be derived:

(7) $\mathcal{A}$LT(Al worked in California) = {Al worked in the US, Al worked in California, Al worked in San Francisco}

Based on these formal alternatives, the inference in (6) could then be derived through the following LF:

(8) EXH K [Al worked in California]

But the hypothesis that a sentence of the form ϕ[California] can give rise to genuine implicatures about a more specific alternative like ϕ[San Francisco] seems to conflict with the observation that specificity scales cannot give rise to scalar implicatures, as observed by Singh (2008). Generally, I will say that specificity scales are involved in implicature computation or associate with *only* if the excluded alternatives involve items on a higher level of specificity than the item used in the assertion (or the prejacent in the case of *only*). The following example illustrates the absence of scalar implicature based on specificity scales:

(9) A: In which city did Al work again?

B: He worked in California

$\not\rightsquigarrow$ K ¬(Al worked in San Francisco)

Related to this is an observation made by Singh (2008) (based on a diagnostic used in Fox and Hackl (2006)), who presents the following example to illustrate that specificity items cannot seem to associate with *only*:[2]

(12) A: Did Al work in San Francisco?

B: #No, he only worked in California

$\not\leadsto$ Al didn't work in San Francisco

Compare this to the acceptable examples below, in which *only* associates with alternatives based on logical and evaluative scales:

(13) A: Did Al drink all of the beers?

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[2]As pointed out by Irene Heim (p.c.), Singh's observation is in fact part of a broader generalization which extends to logical scales. This is illustrated by the following example, which is completely parallel to (12) but involves alternatives based on logical scales:

(10) A: Did Al go to Alewife?
B: #No, he only went to Alewife or Braintree

As we will see below, the relevant generalization seems to be the following:

(11) *No, only* ψ is possible as a response to ϕ iff ϕ is an alternative of ψ which can be innocently excluded without contradiction

Since A is never part of the innocently excludable alternatives of a disjunction [A or B], (10) is expected based on this generalization. As for (12), we will see below that the specificity-based alternative *Al worked in San Francisco* may be excluded without logical contradiction, but that this exclusion will eventually lead to a (contextual) contradiction.

B: No, he only drank some of them

⇝ Al didn't drink all of the beers

(14) A: Is Al drink an excellent swimmer?

B: No, he is only a good swimmer

⇝ Al isn't an excellent swimmer

To sum up the observations so far, while specificity scales can be used to compute weak implicatures, they are neither available for scalar implicature computation, nor do they seem to be able to associate with *only*. This might be a reason to abandon our initial idea that the inference in (6), which looks like a weak implicature, should be derived as such, and simply conclude that specificity scales are not visible for implicature calculation or association with *only* at all.

Upon closer inspection, however, it turns out that specificity scales *are* able to provide the domain of quantification for *only*. As pointed out in Singh (2008), the evidence comes from examples of the following kind, based again on a diagnostic from Fox & Hackl, who investigate the unavailability of scalar implicature and apparent lack of association with *only* in numeral modifiers like *more than*:

(15) A: Did Al work in San Francisco?

B: I only know that he worked in California

⇝ I don't know if he worked in San Francisco

In this example, a sentence of the from *only* ϕ[California] is used to imply that $\neg\phi$[San Francsico], i.e., *only* does exclude more specific alternatives, contrary to what the example in (12) seemed to suggest.

Together, then, these data suggest the following conclusions:

- Specificity scales cannot give rise to scalar implicatures
- Specificity scales can give rise to weak implicatures
- Specificity scales sometimes, but not always, associate with *only*

The last point is illustrated by the contrast between the example in (12) and that in (15). To explain the difference between examples where *only* can exclude alternatives defined in terms of specificity, and those cases where this is impossible, it is therefore necessary to look for independent factors which distinguish the two.

4.2.1 Excludable Alternatives and Contextual Contradiction

4.2.1.1 Redefining the set $\mathcal{IE}$

As argued in Singh (2008); Fox and Hackl (2006), the contrast between **??** and (15) is indicative of a wider generalization which concerns the question which elements of $\mathcal{A}$LT(ϕ) operators like *only* and EXH are allowed to negate.

I follow Spector (2006); Fox (2007a) and others in assuming that *only* and EXH are lexically defined so as to avoid contradictions – a design feature for which

Fox (2007) coined the term *innocent* exclusion. Above we assumed the following definition of the set $\mathcal{IE}$:[3]

(16) $\alpha \in \mathcal{IE}(\mathrm{p})(\mathcal{A}\mathrm{LT})$ iff

$\alpha \in \mathcal{A}\mathrm{LT}^{\not p}(\mathrm{p})$ & $\mathrm{p} \wedge \neg\alpha$ doesn't entail another alternative $\alpha' \in \mathcal{A}\mathrm{LT}(\mathrm{p})$

This simplified definition worked fine for disjunction, since it avoids exclusion of the disjuncts while at the same time allowing exclusion of the conjunction: In *Al only owns a car OR a bike, only* negates the conjunction, but it doesn't negate that Al owns a car, since together with the initial statement this would entail that he owns a bike. Based on an argument made in Groenendijk and Stokhof (1984), however, Fox (2007) eventually adopts a more general definition of $\mathcal{IE}$, which replicates all results which were derived on the basis of the semantics in (16), but in addition can deal with the following problematic example from Groenendijk & Stokhof (1984):

(17) A: Who did Fred talk to?

B: He only talked to some girl

[3]For current purposes we can make the simplifying assumption that *only* and EXH differ only with respect to the presuppositional status of their argument: While *Only Al smoked* presupposes that Al smokes, the corresponding version with EXH will assert that he does (cf. **??**)

Fox illustrates the problem as follows. Assume a model M in which the extension of *girl* is this:

(18) $[\![\text{girl}]\!]^{M}$ = {Anne, Beth, Cate}

Assume furthermore that in some contexts, $\mathcal{A}$LT(Fred talked to some girl) = {Fred talked to Anne, Fred talked to Beth, Fred talked to Cate}. According to the old definition of $\mathcal{IE}$, the whole set $\mathcal{A}$LT can be innocently excluded by *only*: That Fred talked to some girl and that he didn't talk to Anne doesn't entail any other alternative in $\mathcal{A}$LT. Hence, *Fred talked to Anne* can be innocently excluded. The same argument applies to the two alternatives, making them innocently excludable, too. We end up predicting the following, logically contradictory meaning for B's answer in (17) (recall that there are only three girls in our model M):

(19) Fred talked to some girl
$\wedge$ Fred didn't talk to Anne $\wedge$ Fred didn't talk to Beth $\wedge$ Fred didn't talk to Cate
$=_M \perp$

To avoid this kind of contradiction, Fox suggests a definition of $\mathcal{IE}$ in terms of maximality. This new definition is spelled out below (adopted from Magri (2009)'s presentation of Fox (2007a)'s argument):

(20) EXH AS MAXIMALITY OPERATOR

Given the set $\mathcal{A}\mathrm{LT}(\phi)$ of formal alternatives of ϕ, the subset $\mathcal{IE}$ of innocently excludable alternatives of ϕ is derived as follows:

1. Build the set of all maximal, excludable subsets of $\mathcal{A}\mathrm{LT}(\phi)$
2. Build the intersection of all maximal excludable subsets of $\mathcal{A}\mathrm{LT}(\phi)$

(21) a. A subset A of $\mathcal{A}\mathrm{LT}(\phi)$ is excludable if $\phi \wedge \bigcap_{\alpha \in A} \neg\alpha \neq \bot$

b. An excludable subset A of $\mathcal{A}\mathrm{LT}(\phi)$ is maximal if it has no excludable superset $A' \in \mathcal{A}\mathrm{LT}(\phi)$

Before we go on, let us confirm that Groenendijk & Stokhof's problem is indeed solved by this updated definition. Assume again the same model in which $\mathcal{A}\mathrm{LT}$= {Fred talked to Anne, Fred talked to Beth, Fred talked to Cate}. There are three maximal excludable subsets:

(22) a. Max_1 = {Fred talked to Anne, Fred talked to Beth}

b. Max_2 = {Fred talked to Anne, Fred talked to Cate}

c. Max_3 = {Fred talked to Beth, Fred talked to Cate}

However, the intersection of Max_1 - Max_3 is empty. The contradictory exclusion from (19) is thus avoided with the more general definition of EXH in (20). If B wants her answer in (17) to be felicitous, she has to have some other contextually salient alternatives in mind which *only* can exclude, e.g., {Fred talked to some boys, Fred talked to some horses, Fred talked to some psychiatrists}.

4.2.1.2 Defining $\mathcal{IE}$ with Specificity Scales

Equipped with a more general definition of $\mathcal{IE}$, let us look at what this updated definition of excludable alternatives means for alternatives based on specificity scales. Starting with the behavior of *only*, we saw that there was a contrast between the unavailable exclusion in (12), where *only* attached to a sentence of the form ϕ, and the available exclusion in (15), where *only* attached to a sentence of the form $\Box\phi$. Both examples are repeated below (assume as before a context where city-level specificity is asked for):

(23) Al only worked in California
$\not\rightsquigarrow$ He didn't work in San Francisco

But:

(24) I only know that Al worked in California
$\rightsquigarrow$ I don't know if he worked in San Francisco

Let's start with (23) and consider the prediction that would emerge if we assumed that the domain of quantification for *only* can be given by the very restricted set of alternatives $\mathcal{A}$LT(Al worked in California) = {Al worked in San Francisco}. If that were the case, the set of innocently excludable alternative $\mathcal{IE}$ would be {Al worked in San Francisco} and the unattested reading in (23) should be possible.

I conclude from this that this restricted alternative set is unavailable. Instead I adopt Singh (2008)'s hypothesis that the specificity scale associated with *California* has to include *all* cities in California. This means that $\mathcal{A}$LT(Al worked in California) is formed by substituting *California* with all more specific items, for instance, *San Francisco, Los Angeles, Santa Barbara,* etc.. As we will see, this explains the missing interpretation in example (23). I will call this property Pervasiveness; it is a peculiarity of specificity scales which distinguishes these scales (and the alternatives based on them) from logical and evaluative scales:

(25) PERVASIVENESS OF SPECIFICITY SCALES

The scale of an item of specificity level n includes either *all* items of specificity level $n+1$ or none

As a corollary, the formal alternatives $\mathcal{A}$LTof a sentence which contains a specificity item v will contain either all sentences which can be derived from replacing v with its scale mates of specificity $n+1$ or none at all. Specifically, this means that in contexts in which it is relevant whether or not Al worked in San Francisco, a sentence like **??** will have the formal alternatives in (26-b):

(26) a. Al worked in California

b. $\mathcal{A}$LT(Al worked in California) = All worked in San Francisco, Al worked in Los Angeles, Al worked in Santa Barbara, . . .

In what follows, let us use the following abbreviating notation for this set of alternatives:

(27) $\mathcal{A}$LT(Al worked in California) = All worked in τ

It should be noted that Pervasiveness doesn't predict that a sentence like *Al worked in California* always comes with these alternatives; in contexts in which the city-level is not relevant (or some other alternatives are more relevant), the alternatives derived from the specificity scale might simply not be active at all. The crucial point is that the pervasiveness hypothesis excludes cases in which $\mathcal{A}$LT(Al worked in California) is given by the singleton set {Al worked in San Francisco}.

Now we can check the consequences of the pervasiveness hypothesis for the example in (23), repeated below:

(28) Al only worked in California

Since by assumption the sentence was uttered in a context in which the city-level is relevant, $\mathcal{A}$LT(Al worked in California) will be defined as the set of *pervasive* alternatives Al worked in San Francisco, Al worked in Los Angeles, Al worked in Santa Barbara, etc., ie., Al worked in τ. For simplicity, consider a model M in which there are only four cities, so that the alternatives which *only* in (28) quantifies over will be the following:

(29) {San Francisco, San Diego, Santa Barbara, San Jose}

$\mathcal{A}$LT(Al worked in California) = {Al worked in San Francisco, Al worked in San Diego, ... Santa Barbara, ... San Jose}

Given this alternative set, what are the maximal subsets $Max \in \mathcal{A}LT$ which *only* can exclude? Above I quoted Fox (2007) with the assumption that operators like *only* and EXH are designed contradiction-free. But as we have seen in chapter 3.1, this can mean either of two things:

1. $\mathcal{IE}$ is defined so as to avoid logical, but not contextual contradictions

2. $\mathcal{IE}$ is defined so as to avoid both logical and contextual contradictions

Above we followed Magri (2009) in adopting the first option; more generally, we assumed that the grammatical computation of implicatures by EXH takes place in a module which has access only to logical, but not to contingent external facts or common beliefs. Here I suggest that blindness extends to *only* since both operators make reference to the set of excludable alternatives.[4] This is the blindness hypothesis stated in its most general form (see also section 3.1 of Chapter 3).

[4]It is of course conceivable that *only* and EXH differ with respect to blindness to non-logical facts. However, the facts presented above and independent facts reported in **??** suggest that both operators are defined strictly logically.

Given the theoretical choices above, the blindness hypothesis would of course translate into the first option:

(30) BLINDNESS

The set $\mathcal{IE}$ is defined so as to avoid logical, but not contextual contradictions

What does this mean for (28)? If *only* is blind to the fact that San Francisco, Santa Barbara etc. are cities in California, there will be exactly one maximal excludable subset, which constitutes the set $\mathcal{IE}$ by definition:[5]

(31) Max_1 = {Al worked in San Francisco, Al worked in San Diego, ... Santa Barbara, ... San Jose} = $\mathcal{IE}$

[5] I would like to point out an additional problem for the hypothesis that specificity-based inferences are derived as implicatures, and in particular, by blind exclusion through EXH. If EXH is indeed blind to the fact that San Francisco is in California, a sentence of the form EXHϕ[California] – in contexts where the city-level is relevant – will entail $\neg\phi$[San Francisco] and generally, $\neg\phi[\tau]$, τ being the names of the cities which happen to be in California in the actual world. This is because implicature calculation will be blind to the fact that negating all statements of the form $\phi[\tau]$, in conjunction with ϕ[California] is a contextual contradiction – once we take into consideration that τ is actually located in California, it becomes apparent that nothing can take place in California but not in any city in California, at least not if California is bounded, if furthermore all of California is divided into cities and lastly, if nothing can be located on a boundary. However, it would seem that by the same logic, blind exclusion by EXH will exclude less specific alternatives, so that EXH ϕ[Califonia] will, among others, entail $\neg\phi$[USA]. While the former result is desired given the facts observed above, the latter needs to be ruled out: We will have to stipulate that alternatives of lower-level specificity simply do not enter blind exclusion, e.g. by excluding them from the set $\mathcal{ALT}$.

Given this set of innocently excludable alternatives, (28) is predicted to have the following denotation:

(32) ⟦ Al only worked in California ⟧

-$\mathcal{A}$LT(Al worked in California) = {Al worked in San Francisco, Al worked in San Diego, ... Santa Barbara, ... San Jose}

-= $\mathcal{IE}$

= Al worked in California

$\wedge$ Al didn't work in San Francisco $\wedge$ Al didn't work in San Diego $\wedge$ Al didn't work in Santa Barbara $\wedge$ Al didn't work in San Jose $=_M \perp$

But once we take into account the contextual knowledge that all these cities are in California, this denotation will be recognized as being contradictory: Al cannot possible work in California but not in any city in California (see fn. 5).

At this point, then, the explanation why *Al only worked in California* cannot mean that he didn't work in San Francisco is clear: Given the pervasiveness of specificity-based alternatives on the one hand, and blind exclusion on the other hand, excluding *Al worked in San Francisco* is only possible if all other alternatives of the form *Al worked in* τ are excluded, too. This, however, will result in a contextual contradiction, thus ruling out this particular reading.

4.2.1.3 Remaining Case 1: Intervening *know*

We now also have an explanation for why specificity-based alternatives can associate with *only* in examples like (24), repeated below:

(33) a. I only know that Al worked in California

$\rightsquigarrow$ I don't know if he worked in San Francisco

Pervasiveness predicts that $\mathcal{A}$LT(I know that Al worked in California) will be the set of alternatives *I know that Al worked in* τ, at least in contexts in which city-level specificity is required. To find the subset $\mathcal{IE}$ of (logically) innocently excludable alternatives for (33), we will again have to identify maximal excludable subsets in $\mathcal{A}$LT. Going back to our four-city model from above, again there is just one maximal excludable subset, which by definition will provide the set $\mathcal{IE}$:

(34) Max_1 = {I know that Al worked in San Francisco, I know that Al worked in San Diego, ... Santa Barbara,... San Jose} = $\mathcal{IE}$

With this set of innocently excludable alternatives, B's response in (15) will end up having the following denotation:

(35) ⟦ I only know that Al worked in California ⟧ =
I know that Al worked in California &
I don't know that Al worked in San Francisco &

I don't know that Al worked in San Diego, ... Santa Barbara, ...

= I know that Al worked in California & $\neg$(I know that Al worked in τ)

But this time, the denotation is consistent: My epistemic state may well entail that Al worked in California, but at the same time there does not have to be a specific city τ such that my epistemic state entails that Al worked in τ. But what about the intuition that in the context of a question like *Did Al work in San Francisco?*, the only negated alternative seems to be the one which involves San Francisco? As shown in (35), the grammatical level the sentence excludes all more specific alternatives; post-grammatically, however, the hearer may of course assign special status to one of the excluded alternatives. The impression that only one alternative is excluded is thus due the fact that hearers in a particular context may zoom into that part of the grammatical meaning which is salient due to previous discourse. As the example without intervening *know* in (28) showed, however, this zooming in cannot be done in the grammar. Following Singh (2008), I proposed the pervasiveness hypothesis to captured this particular property of specificity-scales.

What remains to be done now is to explain the curious contrast between the availability of weak implicatures and the categorical absence of scalar implicatures with specificity scales.

4.2.1.4 Remaining Case 2: Specificity Scales and EXH

One of the main claims of this thesis is that all implicatures are derived through the use of EXH, and that the difference between weak and scalar implicatures reflects the scope of the Matrix K operator relative to the exhaustivity operator. Given this hypothesis, the explanation of the different behavior of specificity scales with respect to weak and scalar implicatures receives a very natural explanation: The absence of scalar implicatures is due to the same reason why *only* cannot exclude more specific alternatives in *Al only worked in California*, while the availability of weak implicatures is due to the same reason why *I only know that Al worked in California* can exclude more specific alternatives, as shown above.

To see first how unattested scalar implicatures are accounted for, let us go back to the example in (39), repeated below:

(36) A: In which city does Al work?
  B: He worked in California
  $\not\rightsquigarrow$ K ¬(Al worked in San Francisco)

To get this scalar implicature, the LF of B's answer would have to be the following:

(37) K exh [Al worked in California]

It follows from Pervasiveness that $\mathcal{A}$LT(Al worked in California) will be the set {Al worked in San Francisco, Al worked in Los Angeles, Al worked in Santa Barbara, ...} (abbreviated as before as {Al worked in τ}). Given this set of alternatives, and the blindness of EXH, the exhaustivity operator in (37) will again exclude all of these alternatives, as shown in (32):

(38) ⟦ K exh Al worked in California ⟧

-$\mathcal{A}$LT(Al worked in California) = {Al worked in τ}

-= $\mathcal{IE}$

= Al worked in California

$\wedge$ Al didn't work in San Francisco $\wedge$ Al didn't work in Los Angeles $\wedge$ Al didn't work in Santa Barbara $\wedge \ldots$

$=_C \perp$

Once we factor in the contextual knowledge that San Francisco, Los Angeles, etc. are cities in California, this denotation becomes a contextual contradiction. This means that the only LF which could in principle exclude *Al worked in San Francisco*, i.e., the only LF that could in principle derive the missing scalar implicature in (36), yields a contextual contradiction and is therefore ruled out.

Let us finally turn to something that *is* possible, namely, what we hypothesized to be a weak implicature (repeated from (6)):

(39) A: In which city does Al work?

B: He worked in California

$\leadsto$ $\neg$K (Al worked in San Francisco)

To get this implicature, the sentence has to be disambiguated as follows:

(40) EXH K [Al worked in California]

With $\mathcal{A}$LT(K[Al worked in California]) = {K[Al worked in τ]}, what is the set $\mathcal{IE}$ of alternatives which EXH can negate? As we try to form maximal excludable subsets, again we find that there is only one:

(41) Max_1 = {K[Al worked in San Francisco], K[Al worked in Los Angeles], K[...Santa Barbara], K[...San Jose], K[...San Diego], ...}
$= \mathcal{IE}$

With this set of innocently excludable alternatives, the LF in **??** will have the following denotation:

(42) K(Al worked in California) $\wedge$
$\neg$K(Al worked in San Francisco) $\wedge$
$\neg$K(...Los Angeles) $\wedge$
$\neg$K(...Santa Barbara) $\wedge$
$\neg$K(...San Jose) $\wedge \ldots$

$= K(\text{Al worked in California}) \;\&\; \neg K(\text{Al worked in } \tau)$

Just as was the case for *I only know that Al worked in California*, we find that this denotation is consistent, too: I may well be sure of the fact that Al worked in California and at the same time be uncertain about any more specific claim.

In sum, we saw that specificity scales are special in that they can give rise to weak implicatures, but not to scalar implicatures. The explanation for this peculiarity comes from:

- The definition of $\mathcal{IE}$ in terms of the blind, logically innocent exclusion
- The pervasiveness hypothesis in (25) according to which either all, or none of the alternatives of higher specificity levels form $\mathcal{A}\mathrm{LT}$

One question that remains is the role of the principle of Epistemic Transparency (ET). We saw above that specificity scales are special in that they can give rise to weak, but not always to scalar implicatures (cf. Hirschberg (1985); Matsumoto (1995)). Following a proposal of Singh (2008), I argued that this special behavior is due to the pervasiveness of specificity scales, a property which distinguishes them from logical and evaluative scales. Pervasiveness means that, if one alternative of a given specificity level is part of $\mathcal{A}\mathrm{LT}$, then all other alternatives of the same specificity level have to be included in $\mathcal{A}\mathrm{LT}$as well. In effect, this excludes the possibility of EXH 'zooming in' to some contextually relevant subset of

$\mathcal{A}$LTwhile ignoring other alternatives of the same level of specificity. This analysis predicts that implicatures based on specificity scales should behave just like other implicatures, except in environments where pervasiveness, together with blind exclusion, leads to a contextual contradiction, as was the case in (32) and (38) above.

Recall now that an LF is licensed in the Matrix K theory only if it satisfies the principle of Epistemic Transparency, which requires the LF to entail the speaker's state of mind about the alternatives of (the overt part of) his statement. Since we argued that $\mathcal{A}$LT(Al worked in California) = {Al worked in τ}, we seem be committed to the view that an assertion like (43-a) is necessarily parsed as (43-b), and thus necessarily associated with the weak implicature that the speaker is not sure about which city Al worked in:

(43) a. Al worked in California

b. EXH K [Al worked in California]

It seems like the LF in (43-b) is the only possible LF in accordance with ET, because parsing EXH with scope below K results in a (contextually) contradictory meaning, as we saw above, and leaving it out seems to violate ET. This prediction however seems empirically wrong; (43-a) can certainly be asserted without conveying that the speaker is not sure about the city or cities Al worked in.

What is missing here are considerations of relevance; the set $\mathcal{A}$LT behaves just like other domains of quantification in being context-sensitive (cf. von Fintel

(1994)). Hence, the equation $\mathcal{A}$LT(Al worked in California) = {Al worked in τ} is only valid in contexts in which naming a city would be relevant. But an assertion like (43-a) is often made in contexts which don't require this level of specificity. In these contexts, the sentence might have alternatives varying by state, or no alternatives at all. What this shows us is that Epistemic Transparency makes reference to the set $\mathcal{A}$LT as defined by contextual relevance. In other words, context-sensitivity of implicature computation is to be located in the set $\mathcal{A}$LT, which is defined relative to the contextually given relevance and level of specificity. In contexts in which the cities which Al has worked in are simply not relevant, Epistemic Transparency therefore does not predict obligatory weak implicatures.

4.3 Back to Hurford

Let us now go back to the question of how to account for (44) without invoking Hurford's constraint:

(44) #Jean worked in France or in Paris

In what follows, I will show how the Matrix K theory accounts for the infelicity of these examples. The argumentation will proceed in the by now familiar fashion: I will show that there is no licensed LF which would yield a consistent meaning for a surface structure like (44). As a reminder, for an LF to be licensed in the Matrix K system means that the structure has to satisfy Epistemic Transparency on the one hand and Efficiency on the other hand (see Chapter 2).

4.3.1 Defining the Alternatives

In Chapter 2, we saw that there are three different LFs for a disjunction which satisfy Epistemic Transparency (ET). Being a disjunction, the same is of course true for the original Hurford sentence. The ET-licensed LFs are given schematically below. I will use the abbreviations F and P for the disjuncts *Jean worked in France* and *Jean worked in Paris*, respectively. The results generalize to all cases in which P and F are specificity-based alternatives such that P is more specific than F and P contextually and asymmetrically entails F (see 3.1 in Chapter 3 for a definition of contextual entailment and equivalence).

(45) a. EXH K [F or P]

b. EXH K exh [F or P]

c. EXH K [*exh* F or P]

To compute the denotation of these LFs, it will first be necessary to establish the alternatives which the topmost EXH operator quantifies over. We will start doing this for the first LF:

(46) $\mathcal{A}$LT(K[F or P])

Before introducing the pervasiveness hypothesis for specificity-based alternatives, we would simply have used Katzir's algorithm to derive the following set of alternatives:

(47) $\mathcal{A}LT(K[F \text{ or } P]) = \{KF, KP, K[F \text{ and } P]\}$

For our particular example, the first two alternatives are of course short for K[Jean works in France] and K[Jean works in Paris], i.e., alternatives of the form ϕ[France] and ϕ[Paris]. Given that these are specificity-based alternatives, Pervasiveness has to be factored in – there cannot be just one alternative of specificity level $n+1$, but all alternatives of the same specificity level as ϕ[Paris] have to be included in the set, too. Thus, (47) has to be extended to include minimally:

(48) $\mathcal{A}LT(K[F \text{ or } P]) = \{KF, KP, K[F \text{ and } P], KT, KM, KS, \ldots\}$

Where T = *Jean worked in Toulouse*, M = *Jean worked in Marseille*, S = *Jean worked in Strasbourg*, and so on and so forth for all French cities. As before, let us introduce the following abbreviation for these city-level alternatives:

(49) $\mathcal{A}LT(K[F \text{ or } P]) = \{KF, K\tau, K[F \text{ and } P]\}$

Of course, the consequences of Pervasiveness carry over to the alternatives of the topmost exhaustivity operator in (45-b) and (45-c) too, as shown below:

(50) a. $\mathcal{A}$LT(K exh [F or P]) = {K exh F, K exh P, K exh [F and P], K exh T, K exh M, K exh S, ...}

b. $\mathcal{A}$LT(K [*exh* F or P]) = {K exh F, K P, K [*exh* F and P], K exh T, K exh M, K exh S, ..., KT, KM, KS, ...}

The next step is to calculate the denotation of these alternatives – not a trivial task since these alternatives contain exhaustivity operators themselves. This raises the question as to what the alternatives of the alternatives are. In other words, what is the definition of the set $\mathcal{A}$LTwhich the exhaustivity operator in alternatives like [K exh F] quantifies over?

One hypothesis which is highly relevant to this question goes back to Kratzer and Shimoyama (2002), and concerns the alternatives of the disjuncts in the context of interpreting a disjunction. One version of their hypothesis can be stated as follows:[6]

[6]This hypothesis is only implicit in Kratzer and Shimoyama (2002)'s analysis of Free Choice sentences, and is also (implicitly) adopted in Fox (2007a)'s account. Both proposals only discuss cases in which the alternatives of the disjuncts are *just* the other disjunct, i.e., cases which satisfy a stronger version of (51). These are cases where, for the interpretation of *You may have the cake or the ice cream*, the only relevant alternative of the disjunct *You may have the cake* is the other disjunct *You may have the ice cream*. However, in some contexts there might be a third relevant alternative (cf. Zimmermann (2000)), e.g. *You may have a grappa*, so that $\mathcal{A}$LT(You may have the cake) will be the set {You may have the ice cream, You may have a grappa}. This is allowed by the formulation in (51). In order for the entire disjunction *You may have the cake or the ice cream* to exclude the grappa, however, the set $\mathcal{A}$LT(You may have the cake or the ice cream) will also have to include the alternative *You may have a grappa*.

(51) THE KRATZER-SHIMOYAMA ASSUMPTION

In a structure [A or B], the alternatives of the disjuncts A and B have to include the other disjunct

To see the consequences of the Kratzer-Shimoyama hypothesis, let's start calculating the denotation of the first alternative in (50-a) and (50-b):

(52) $[\![\text{K } exh \text{ F}]\!] = ?$

The first step is again to establish the set $\mathcal{A}\text{LT}(\text{F})$. The Kratzer-Shimoyama hypothesis in (51) predicts that the set will include the other disjunct, i.e.:

(53) $\text{P} \in \mathcal{A}\text{LT}(\text{F})$

Importantly, due to the pervasiveness of specificity-based alternatives, all other alternatives of the same specificity level as P will have to be added now, too:

(54) $\text{T} \in \mathcal{A}\text{LT}(\text{F})$

$\text{M} \in \mathcal{A}\text{LT}(\text{F})$

$\text{S} \in \mathcal{A}\text{LT}(\text{F})$

...

Together, then, the alternatives used to calculate (52) will be the following:

(55) $\mathcal{A}\text{LT}(F) = \{P, T, M, S, \ldots\} = \{\tau\}$

Given the blind exclusion of the exhaustivity operator, the alternative in (52) will get the following denotation:

(56) $[\![\text{K exh F}]\!]$

$-\mathcal{A}\text{LT}(F) = \{P, T, M, S, \ldots\}$

$-\mathcal{IE} = \{P, T, M, S, \ldots\}$

$= K(F \wedge \neg P \wedge \neg T \wedge \neg M \wedge \neg S \wedge \ldots)$

$= K(F \wedge \neg \tau)$

Let us continue with the second alternative listed in (50-a), namely:

(57) $[\![\text{K exh P}]\!] = ?$

Again, since the relevant context is the interpretation of a disjunction [F or P], the Kratzer-Shimoyama hypothesis will necessitate the following:

(58) $F \in \mathcal{A}\text{LT}(P)$

And just like in the previous case, the pervasiveness hypothesis predicts that the set of alternatives will have to be extended as follows (I depart from my previous practice and include P itself in $\mathcal{A}\text{LT}(P)$ for the sake of clarity):

(59) $\mathcal{A}\mathrm{LT}(P) = \{F, P, T, M, S, \ldots\}$

Based on this set of alternatives, the denotation of the second alternative is therefore the following:[7]

(60) $[\![\text{K } exh \text{ P}]\!] = \text{K}(P \wedge \neg T \wedge \neg M \wedge \neg S \wedge \ldots)$

Lastly, note that the denotation of the conjunctive alternative in (50-a) is straightforward since there will be no logically stronger alternative which EXH can exclude here, making its occurrence vacuous in this alternative:

(61) $[\![\text{K } exh \text{ [F and P]}]\!] = \text{K}(F \wedge P)$

Let us briefly sum up what we did so far. We have established the set of formal alternatives which will be used to calculate the LFs in (45), taking into consideration the effects of the pervasiveness hypothesis for specificity-based alternatives on the one hand, and the Kratzer-Shimoyama hypothesis for alternatives of alternatives in disjunction on the other hand. The set of alternatives for all three

[7] Recall from footnote 5 that exclusion of the higher-level alternative F (=*Jean worked in France*) will have to be banned for independent reasons; the following denotation is calculated on the basis of this stipulation; however, the results of this section do not hinge on this decision and would be equivalent if F were innocently excludable, i.e., if $[\![exh \text{ P}]\!]$ were equivalent to the contextual contradiction $\text{K}(P \wedge \neg F \wedge \neg T \wedge \neg M \wedge \ldots$

LFs are repeated below:

(62) EXH K [F or P]

$\mathcal{A}$LT(K[F or P]) = {KF, KP, K[F and P], KT, KM, KS, . . . }

(63) EXH K exh [F or P]

$\mathcal{A}$LT(K exh [F or P]) = {K exh F, K exh P, K exh [F and P], K exh T, K exh M, K exh S, . . . }

(64) EXH K [*exh* F or P]

$\mathcal{A}$LT(K [*exh* F or P]) = {K exh F, KP, K [*exh* F and P], K exh T, K exh M, K exh S, . . . , KT, KM, KS, . . . }

Secondly, and again taking into account the effects of pervasiveness and the Kratzer-Shimoyama hypothesis on Katzir's algorithm, we have derived the meaning of those alternatives which themselves contain exhaustivity operators. Again, these are repeated below:

(65) $[\![$ K exh F $]\!]$ = $K(F \wedge \neg P \wedge \neg T \wedge \neg M \wedge \neg S \wedge \ldots)$

$= K(F \wedge \neg \tau)$

(66) $[\![$ K exh P $]\!]$ = $K(P \wedge \neg T \wedge \neg M \wedge \neg S \wedge \ldots)$

(67) $[\![$ K exh [F and P] $]\!]$ = $K(F \wedge P)$

We now have all the necessary background to be able to calculate the denotation of the three LFs in (45).

4.3.2 Deriving Infelicitous Hurford Disjunctions

4.3.2.1 First LF: EXH K [F or P]

Deriving the denotation of this LF involves only a relatively simple calculation, the most important part of which is the derivation of the alternatives for the top-most exhaustivity operator:

(68) EXH K [F or P]

The relevant set of alternatives were given in (62) above (repeated below):

(69) $\mathcal{A}$LT(K [F or P]) = {KF, KP, K[F and P], KT, KM, KS, ...}
= {KF, K[F and P], Kτ}

The denotation of the sister node of EXH is $[\![$ K[F or P] $]\!]$ = K(F $\vee$ P). It is therefore easy to see that all these alternatives are innocently excludable – more precisely, their exclusion is *logically* innocent. The LF in (68) will thus end up denoting the following proposition:

(70) $[\![\,\text{EXH K [F or P]}\,]\!] =$

$[\![\,\text{K [F or P]}\,]\!] \wedge \forall\alpha \in \mathcal{IE} : \neg\alpha$

-$\mathcal{A}\text{LT}(\text{K[F or P]}) = \{\text{KF, K[F and P], K}\tau\}$

-$\mathcal{IE} = \{\text{KF, K[F and P], K}\tau\}$

$= \text{K}(\text{F} \vee \text{P}) \wedge \neg\text{K}(\text{F}) \wedge \neg\text{K}(\text{F} \wedge \text{P}) \wedge \neg\text{K}(\tau)$

While this might look innocent from a logical point of view, once this denotation is interpreted against the background of contextually given common beliefs (or knowledge), this becomes inconsistent. To see why, note first that that $(F \vee P)$ is contextually equivalent to F:

(71) $(\text{F} \vee \text{P}) \equiv_{CB} \text{F}$

Given this contextual equivalence, the denotation in (70), though logically consistent, ends up ascribing the following doxastic state to the speaker:

(72) $\text{K}(\text{F} \vee \text{P}) \wedge \neg\text{K}(\text{F}) \wedge \neg\text{K}(\text{F} \wedge \text{P}) \wedge \neg\text{K}\tau$

$\vDash_{CB} \text{K}(\text{F}) \wedge \neg\text{K}(\text{F}) \ldots \lightning$

In other words, the LF in (70) expresses that the speaker (i) is sure that Jean worked in France and that (ii) he is not sure that Jean worked in France.

Quite generally, I assume that this inconsistent speaker state which the LF denotes is enough to rule out the corresponding LF. The question of whether or not inconsistent beliefs can sometimes be justified is not touched by this assumption; when it comes to believes about the workplace of the individual Jean, I assume that the hearer will reject an LF which ascribes inconsistent beliefs about Jean's workplace to the speaker. This leaves open the possibility that the entirety of a person's belief may be inconsistent.[8]

Being contextually inconsistent, then, the first LF will be rejected and the search for a better parse of the Hurford disjunction will have to continue.

4.3.2.2 Second LF: EXH **K** $\mathtt{exh}$ [**F or P**]

The next parse that we will have to check is the one below:

(73) EXH K $\mathtt{exh}$ [F or P]

In order to calculate the denotation of this LF, it is best to start with an intermediate calculation, namely, the denotation of the sister node of the topmost exhaustivity operator:

(74) K $\mathtt{exh}$ [F or P]

[8]For a justification of inconsistent beliefs , see e.g. Makinson (1965); Kyburg (1961); Foley (1979). Following Knight (2002), we might also say that the LF in (37) expresses an unacceptably high degree of inconsistency, as it concerns the same $\mathcal{QUD}$.

Above we saw that Pervasiveness and the Kratzer-Shimoyama hypothesis work together to derive a wider set of alternatives for a disjunction like [F or P] (see (48)). For (74), then, the alternatives of the embedded exhaustivity operator exh will not only include the disjuncts *Jean worked in Paris* and *Jean worked in France*, but all alternatives of the form *Jean worked in Toulouse, Marseille, etc.*. Schematically:

(75) $\mathcal{A}\mathrm{LT}(\mathrm{F\ or\ P}) = \{\mathrm{F, P, [F\ and\ P], T, M, S}, \ldots\}$

$= \{\mathrm{F, [F\ and\ P]}, \tau\}$

Given this set of alternatives, and given the blindness of the exhaustivity operator, the denotation of (74) will be the following:

(76) $[\![\mathrm{K\ exh\ [F\ or\ P]}]\!]$

-$\mathcal{A}\mathrm{LT}(\mathrm{F\ or\ P}) = \{\mathrm{F, P, [F\ and\ P], T, M, S}, \ldots\}$

-$\mathcal{IE} = \{\mathrm{[F\ and\ P], T, M, S}, \ldots\}$

$= \mathrm{K}(\mathrm{F} \vee \mathrm{P}) \wedge \mathrm{K}\neg(\mathrm{F} \wedge \mathrm{P}) \wedge \mathrm{K}(\neg \mathrm{T}) \wedge \mathrm{K}(\neg \mathrm{M}) \wedge \ldots$

Having calculated the meaning of the sister node of the highest EXH, we can now proceed to the matrix level and calculate the meaning of the entire LF:

(77) $[\![\mathrm{EXH\ K\ exh\ [F\ or\ P]}]\!]$

The alternatives of the topmost exhaustivity operator were given in (50-a) above. Given Pervasiveness and the Kratzer-Shimoyama hypothesis, this set looked as follows – note that the set includes not only ϕ[Paris], but all city-level alternatives:

(78) $\mathcal{A}LT(K\ exh\ [F \text{ or } P]) = \{K\ exh\ F, K\ exh\ P, K\ exh\ [F \text{ and } P], K\ exh\ T, K\ exh\ M, K\ exh\ S, \ldots\}$

In order to establish which of these alternatives is (logically!) innocently excludable – given $[\![K\ exh\ [F \text{ or } P]]\!]$ as shown in (76) – we will have to first calculate their denotation. For those alternatives whose denotation is not obvious, this was done above (see (65)-(67)); the meaning of the first alternative is repeated from above:

(79) $[\![K\ exh\ F]\!]$

$= K(F \wedge \neg P \wedge \neg T \wedge \neg M \wedge \neg S \wedge \ldots)$

$= K(F \wedge \neg \tau)$

For the second alternative, the denotation was given in (66) above:

(80) $[\![K\ exh\ P]\!] = K(P \wedge \neg T \wedge \neg M \wedge \neg S \wedge \ldots)$

Lastly, in (67) we saw that the meaning of the conjunctive alternative was the following:

(81) $[\![\text{K } exh \text{ [F and P]}]\!] = K(F \wedge P)$

The denotation of all other alternatives can be calculated completely parallelly to these ones, which is why I will skip their calculation here.

Given now the meaning of the prejacent in (76), which of the alternatives in (78) can the topmost EXH negate without causing a logical contradiction? In fact, the set of innocently excludable alternatives will be the entire set (78). The computation of the denotation of our second LF will thus proceed as follows:

(82) $[\![\text{EXH K } exh \text{ [F or P]}]\!]$

$= [\![\text{K } exh \text{ [F or P]}]\!] \wedge \forall \alpha \in \mathcal{IE} : \neg\alpha$

$= [K(F \vee P) \wedge K\neg(F \wedge P) \wedge K\neg T \wedge K\neg M \wedge \ldots] \wedge \forall \alpha \in \mathcal{IE} : \neg\alpha$ (see (76))

-$\mathcal{A}LT$(K exh [F or P]) = {K exh F, K exh P, K exh [F and P], K exh T, K exh M, K exh S, ...} = $\mathcal{IE}$ (see (78))

$= [K(F \vee P) \wedge K\neg(F \wedge P) \wedge K\neg T \wedge K\neg M \wedge \ldots]$

$\wedge \neg K(F \wedge \neg\tau) \wedge \neg K(P \wedge \neg T \wedge \neg M \wedge \neg M \wedge \ldots) \wedge \neg K(F \wedge P) \wedge \ldots$

Though the calculation is not complete, i.e., not all innocently excludable alternatives have been negated, we can stop at this point. This is because the (partial) denotation in (82) will become inconsistent once we factor in contextual information. To see this, let us first simplify (82) a bit; the conjunct $\neg K(F \wedge \neg\tau)$ expresses a contextual tautology and can therefore be omitted. The simplified meaning is given below:

(83) $K(F \vee P) \wedge K\neg(F \wedge P) \wedge K\neg T \wedge K\neg M \ldots$

$\wedge \neg K(P \wedge \neg T \wedge \neg M \wedge \neg M \wedge \ldots) \wedge \neg K(F \wedge P)$

Taking into account contextual equivalences and entailments, again this will yield an inconsistent speaker state:

(84) $K(F \vee P) \wedge K\neg(F \wedge P) \wedge K\neg T \wedge K\neg M \ldots$

$\wedge \neg K(P \wedge \neg T \wedge \neg M \wedge \neg M \wedge \ldots) \wedge \neg K(F \wedge P)$

$\vDash_{CB} K(F) \wedge K(\neg P) \wedge K(\neg T) \wedge K(\neg M) \wedge \ldots$

The meaning of this LF, when interpreted using contextual information, will express that the speaker is certain that Jean worked in France, and that he is certain that he did not work in Paris, Toulouse, Marseille, Strasbourg, and so on and so forth for all French cities. Again, this is an inconsistent doxastic state and the LF which expresses it will be ruled out on these grounds.

In fact, we could have established the contextual inconsistency of this LF already when we were calculating the meaning of EXH's prejacent in (76): It is already here that the inconsistency arises, since the denotation of the topmost EXH's prejacent is itself inconsistent (repeated from (76)):

(85) $K(F \vee P) \wedge K\neg(F \wedge P) \wedge K(\neg T) \wedge K(\neg M) \wedge \ldots$

$\vDash_{CB} K(F) \wedge K(\neg P) \wedge K(\neg T) \wedge K(\neg M) \wedge \ldots$

$= K(F) \wedge K(\neg \tau) \ldots \lightning$

The prejacent expresses that (i) the speaker is sure that Jean works in France and that (ii) he is sure that Jean doesn't work in Pairs, Toulouse, Marseille, Strasbourg, etc. for all French cities. As we have seen above, this is an inconsistent belief state and the corresponding LF will therefore be ruled out.

4.3.2.3 Third LF: EXH K [*exh* F or P]

What remains to be done now is to calculate the meaning of the last LF. Since this structure involves mostly the same alternatives as the previous LF, this derivation will be simple at this point. As before, let's first compute the meaning of the sister node to the topmost exhaustivity operator:

(86) K [*exh* F or P]

Note that the exhaustivity operator is adjoined locally within the first disjunct. The only intermediate step necessary to compute the denotation of (86) is therefore to take into account the following, by now well-known denotation (cf. (65) above):

(87) $[\![\, exh \, \mathrm{F} \,]\!] = \mathrm{K} \wedge \neg\tau$

The denotation of (86) is therefore the following:

(88) $[\![\, \mathrm{K} \, [exh \, \mathrm{F} \text{ or } \mathrm{P}] \,]\!] = \mathrm{K}[(\mathrm{F} \wedge \neg\tau) \vee \mathrm{P}]$

Now we can already proceed to the matrix level to compute the denotation of the entire LF:

(89) EXH K $[exh$ F or P$]$

The alternatives which the topmost exhaustivity operator quantifies over were given in (64) and are repeated below:

(90) $\mathcal{A}$LT(K $[exh$ F or P$]$) = {K exh F, KP, K $[exh$ F and P$]$, K exh T, K exh M, K exh S, ..., KT, KM, KS, ...}

Given the denotation of EXH's prejacent in (88), all of these are innocently excludable. The computation of the entire LF will thus proceed as follows:

(91) $[\![$ EXH K $[exh$ F or P$]$ $]\!]$

$= [\![\text{K} [exh \text{ F or P}]]\!] \wedge \forall\alpha \in \mathcal{IE} : \neg\alpha$

$= \text{K}[(\text{F} \wedge \neg\text{T}) \vee \text{P}] \wedge \forall\alpha \in \mathcal{IE} : \neg\alpha$ (see (88))

-$\mathcal{A}$LT(K $[exh$ F or P$]$) = {K exh F, KP, K $[exh$ F and P$]$, K exh T, K exh M, K exh S, ..., KT, KM, KS, ...} = $\mathcal{IE}$ (see (90))

$= \text{K}[(\text{F} \wedge \neg\text{T}) \vee \text{P}] \wedge \neg\text{K}(\text{F} \wedge \neg\text{T}) \wedge \neg\text{K}(\text{P}) \wedge \neg\text{K}[(\text{F} \wedge \neg\text{T}) \wedge \text{P}]$
$\wedge \neg\text{K}(\text{T} \wedge \neg\text{P} \wedge \neg\text{M} \wedge \neg\text{S} \wedge \ldots) \wedge \ldots$

Again, this is more than enough to establish that the LF will denote an inconsistent speaker state, given contextual information. To uncover this inconsistency, we can first simplify (91) by leaving out the contextual tautologies $\neg K(F \wedge \neg \tau)$ and $\neg K[(F \wedge \neg \tau) \wedge P]$. The first part of (91) will then be (contextually) equivalent to:

(92) $K[(F \wedge \neg \tau) \vee P] \wedge \neg K(P)$

But as is easy to see by now, this will again end up denoting inconsistent speaker beliefs:

(93) $[(K \wedge \neg \tau) \vee P] \wedge \neg K(P)$

$\models_{CB} K(P) \wedge \neg K(P) \ldots \lightning$

Again, I argue that an LF which denotes that the speaker (i) is sure that Jean worked in Paris and that he (ii) is not sure that Jean worked in Paris will be ruled out.

4.3.3 Summary

In sum, we have seen that all otherwise licensed LFs for the sentence *Jean worked in France or in Paris* express inconsistent beliefs about the very same state of affairs: Under the first LF, it expresses that that the speaker is sure that Jean worked in France and that he is not sure that Jean worked in France. The second LF expresses that the speaker is sure that Jean worked France and that he is sure that he didn't work in Paris, Toulouse, Marseille, Strasbourg, and so on for all French cities again, a contradiction given common beliefs. The last possible LF, as we have just seen, expresses that the speaker is sure that Jean is from Paris and that he is not sure that Jean is from Paris.

Having already derived the only attested LFs of felicitous surface redundant disjunctions like SOME or ALL without Hurford's constraint in Chapter 2, we now derived the infelicitous surface redundant disjunctions FRANCE or PARIS without Hurford's constraint as well. Inconsistency has been argued to be the underlying cause of oddness in a number of independent phenomena (e.g., von Fintel (1993); Gajewski (2003); Fox and Hackl (2006); **?**), and we can now add Hurford disjunctions to the list of these phenomena. The only additional assumption necessary to derive these results was the pervasiveness hypothesis for specificity scales. As we saw, this assumption is needed independently: The difference in availability between scalar and weak implicatures on the one hand, and the interaction with *only* on the other hand provides strong evidence in favor of this assumption. Secondly, we followed Fox (2000); Gajewski (2003); Magri (2009) and others in assuming that certain modules involved in semantic computation are blind to external facts and common beliefs. In the Matrix K system, these assumptions fully account for the infelicity of surface redundant disjunctions in which the disjuncts are ordered by specificity: The meaning derived in grammar will invariably ascribe inconsistent beliefs to the speaker.

Chapter 5

Implicature Suspension

5.1 The Problem of Implicature Suspension

In the literature on implicature, including the current contribution, most of the ink is spilled on explaining how implicatures occur. But the absence of implicatures needs to be explained, too. This is because both in the grammatical and in the pragmatic theory of implicatures, any assertion for which there is a stronger competitor will ipso facto be subjected to pragmatic reasoning.

Recently, Fox (2013) has drawn attention to one context in which implicatures seem to be suspended: A quiz show. Let us call the host of the quiz show the speaker and the contestant, the hearer. I propose the following general definition of these kinds of contexts:

(1) Let α be a sentence containing a scalar item. A Quiz Show is a context in which

1. For all $\alpha' \in \mathcal{A}LT(\alpha)$: $K_S\alpha' \vee K_S\neg\alpha'$
2. The hearer knows that 1. holds

Let us look at Fox's scenario to illustrate. Contestants of this particular quiz show can win one million dollars if they correctly guess where the money is hidden. There are 100 boxes, five of which contain a million dollars. The host knows which boxes are winners and the contestants knows that he knows. Now the contestants are in the process of narrowing down the boxes in which, according to the partial information they are given by the host, the money could be. The host tells them about a certain pair of boxes:

(2) Ladies and gentlemen, I will give you a hint:
There is a million dollars in box A or in box B

The crucial observation here is that no ignorance inferences will arise (let's again use A and B as abbreviations, for *There is a million dollars in box A/B*; I use the subscript qs to indicate the Quiz Show context):

(3) A or B

$\not\rightsquigarrow$ not $K(A) \wedge \neg K(\neg A)$

$\not\rightsquigarrow \neg K(B) \wedge \neg K(\neg B)$

Now the first question to answer is why we would expect any ignorance implicatures to arise in the first place. This question becomes particularly pressing in view of definition (1): The hearers in the Quiz Show context of (3) are aware that the speaker is certain about the truth value of A, B, and (A and B), so why would they go into the trouble of deriving an implicature which contradicts this contextual knowledge?

Fox's answer to this question is this: The relevant factor which the Quiz Show manipulates is the Gricean maxim of QUANTITY, which he interprets as the (violable) requirement to make maximally strong assertions. As long as this requirement is active, we expect the hearer to look for reasons why the speaker asserted a relatively weak sentence. Fox's claim is that in the particular quiz show context, the speaker is no longer required to say as much as he knows, and therefore, a weak assertion like that in **??** does not trigger any pragmatic reasoning about the stronger alternatives he could have asserted instead.

Before we look at the consequences of this hypothesis, viz., that QUANTITY is deactivated in Quiz Shows, for Fox's grammatical theory of scalar implicatures, let's see what the consequence are for the pragmatic theory. Recall that in a pragmatic system, both ignorance and scalar implicatures are derived on the basis of Grice's cooperative principle (see (5) in section (80)), of which *quantity* is one part: The speaker is required to assert the *strongest* relevant sentence which she is sure of. Fox's hypothesis is that in a Quiz Show, she is no longer required to assert the strongest alternative; she only needs to assert something relevant which she is sure of.

Within the pragmatic theory, this obviously predicts scalar implicatures to be suspended in Quiz Shows, too, since they are derived from the cooperative principle, and that principle is no longer fully active in these contexts.

As Fox observes, however, this prediction seems to be empirically wrong. Even in Quiz Shows, hearers may conclude that (the speaker is sure that) *A and B* is false when what he asserted was *A or B*. Fox quotes the following case as evidence that this scalar implicature may still be computed in a Quiz Show. Recall the silly game show from above and consider again the speaker's utterance:

(4) There is a million dollars in box A or in box B

Now, if the boxes are uncovered and there are a million dollars in *both* boxes, a chronic nagger might find the following objection:

(5) You gave us wrong information, mister! There was money both in box A and in box B.

I agree with Fox that this is sufficient evidence to conclude that a scalar implicature may be calculated even in Quiz Shows. Together with the first observation about the absence of ignorance implicatures, the full generalization about implicature suspension in Quiz Shows is thus the following:

(6) THE QUIZ SHOW GENERALIZATION

In a Quiz Show in which the speaker asserts *A or B*, the only inference that the hearer may draw is $K_S \neg(A \wedge B)$

If we agree with Fox about the premises, then (6) is indeed a problem for the pragmatic theory. The grammatical theory, on the other hand, would have no problem accounting for (6), since scalar implicatures are not derived from any pragmatic principles to begin with, but rather, by the operator EXH.[1]

However, it is worth looking at these premises in some more detail. One of the premises is that QUANTITY is de-activated in quiz show contexts. As stated above, by this he means the requirement to make a maximally informative assertion. As a reminder, Grice's original QUANTITY maxim with its two sub-maxims are repeated below (cf. Grice 1975):

(7) Grice's Maxim of QUANTITY

QUANTITY-1

Make your contribution as informative as is required for the current pur-

[1] Note however that in the system proposed in Fox (2007), the insertion of EXHis guided by something like the following principle: Given two LFs ϕ, ϕ[EXH] which differ only with respect to the presence of EXH, the hearer will chose ϕ[EXH] when the pragmatic ignorance implicatures which would be derived from ϕ contradict contextual information about the speaker. Of course, in a context in which ignorance implicatures do not arise by definition, the rationale for choosing the more complex parse ϕ[EXH] has to be something else.

pose of exchange

QUANTITY-2

Do not make your contribution more informative than is required for the current purpose of exchange

Sensitivity to context is thus already hard-wired into the Gricean maxim: The requirement is to be as informative *as currently needed*, for example, for the quiz show you happen to be hosting. What is the purpose of exchange in a Quiz Show? One purpose is clearly to make the game more interesting, which can only be achieved by *not* telling the hearers where exactly the money is. Another purpose is not to leave them completely at chance level, which presumably would make the show rather tedious. Given the maxim in (7), then, it seems at the very least unnecessary to say the maxim is de-activated, since it was designed specifically to deal with different informational needs in contexts like Quiz Shows. Moreover, given the existence of QUANTITY-2, it seems like the reason why the speaker is avoiding a stronger statement is precisely because he is obeying QUANTITY: For the purpose of the Quiz Show, anything stronger than *A or B* would be more informative than required. The relevant factor that the Quiz Show manipulates is thus not the requirement to make an assertion whose informational strength corresponds to the current conversational purpose, but rather, it is this purpose itself that has changed: In the Quiz Show, the purpose is precisely to *not* be fully informative.

Note incidentally that the Quiz Show may also shed light on another question:

It has sometimes been suspected that having both the maxims of QUANTITY-2 and RELEVANCE may introduce redundancy into Grice's system, and that they are empirically hard to distinguish, the idea being that too much information instantiates irrelevant information by definition (cf. Horn (1984); Sperber and Wilson (1986); Matsumoto (1995)). However, it seems like Fox's Quiz Show is a good example of a context in which the two maxims can clearly be told apart: While the stronger alternatives are clearly relevant, they still constitute too much information for the current conversational purpose (which even requires that they not be asserted).

Having argued that the relevant factor the Quiz Show manipulates is not the contextual validity of Grice's maxim of QUANTITY as spelled out in (7), we can now check whether this has any favorable consequences for the pragmatic theory, which under Fox's premises had a problem accounting for the presence of scalar implicatures and the absence of ignorance implicatures simultaneously.

Recall that in the pragmatic system, both kinds of implicatures are derived from weak inferences of the form $\neg K\alpha$. The mechanism by which these weak inferences are derived is one of exclusion: As stated in the introductory chapter (see section 1.2.1), the cooperative principle requires the speaker to assert a sentence (i) which is relevant, (ii) of which is sure, and (iii) which is stronger than any sentence in $\mathcal{A}$LTfor which (i)-(ii) hold. As the preceding discussion showed, in the Quiz Show context it is important to specify the last point, which represents the maxim of QUANTITY. More specifically, then, we should say the cooperative principle states that the speaker is required to assert a sentence for which (i) and (ii) hold and which (iii') is as strong as the current conversational purpose requires.

With this specification, we adjusted the underlying pragmatic principle on which the pragmatic theory operates to the conclusion of the previous discussion. Based on this adjustment, the idea might be to argue that the elements in the set $\mathcal{A}$LT(A or B) differ with respect to this last criterion (iii'). Specifically, one would have to argue that criterion (ii) could be the only reason why *A and B* was not asserted, thus yielding a weak inference of the form $\neg K(A \wedge B)$. Furthermore, one would have to show that for the disjuncts themselves, the only possible reason why these were not asserted is because they don't satisfy criterion (iii'), i.e., because they are too strong for the purposes of the current exchange. By blaming the non-assertion of A, B on criterion (iii') (specifically, on QUANTITY-2), rather than on criterion (ii) (specifically, QUALITY-2), the inferences $\neg K(A)$, $\neg K(B)$ could thus be avoided, depriving us of the necessary basis to derive the unattested ignorance inferences $\neg K(A) \wedge \neg K \neg (A)$ (and similarly for B).

But unfortunately, such a manoeuvre is bound to fail. This is because the following is a valid argument:

(8) P1 A is too strong for the current purpose of conversation

P2 $[\![(A \text{ and } B)]\!] \subset [\![A]\!] \wedge \neg([\![A]\!] \subset [\![A \text{ and } B]\!])$

$\therefore$ (A and B) is too strong for the current purpose of conversation

This means that if it assumed that the disjuncts themselves were not asserted because this would constitute too much information, by necessity the same is true of the conjunctive alternative. But as stated above, to get to the weak inference $\neg K(A \wedge B)$ as a basis for the attested scalar implicature $K\neg(A \wedge B)$, it is necessary to have criterion (ii) as the *only* possible reason why the conjunction wasn't asserted. Now we see that this premise is not satisfied: As soon as we blame the non-assertion of the disjuncts on (iii'), we allow the same criterion to explain the non-assertion of the conjunction, too. Again, this may obviate the derivation of the weak inference $\neg K(A \wedge B)$ which this time is an undesired outcome, since it deprives us of the basis for the attested scalar implicature $K\neg(A \wedge B)$.[2]

[2] A last attempt might be to argue that we have overlooked a relevant alternative, namely, the symmetric alternative *A or B and not both.* This will not work for two reasons. On the theoretical side, we saw above that the pragmatic system relies on the restriction of alternatives to the formally defined set $\mathcal{A}$LT, which excludes symmetric alternatives like *A or B and not both* (=($A \triangledown B$). On the empirical side, even if ($A \triangledown B$) were an active alternative in the pragmatic theory, telling the hearers that the money is in box A or in box B but not in both cannot be too much information, given Fox's observation that the scalar implicature is attested in Quiz Shows. This rules out criterion (iii') for the non-assertion of ($A \triangledown B$). The only criterion left would be (ii) (=QUALITY-2), so the inference would be $\neg K(A \triangledown B)$. This could be strengthened into a scalar implicature of the form $K\neg(A \triangledown B)$. Together with the assertion *A or B*, this would have the devastating consequence of leading to the inference that the speaker is sure that the money is on both boxes. Formally:

(9)
$$
\begin{aligned}
& K(A \vee B) \wedge K\neg(A \triangledown B) \\
& \equiv K(A \vee B) \wedge K\neg[(A \vee B) \wedge \neg(A \wedge B)] \\
& \equiv K(A \vee B) \wedge K[\neg(A \vee B) \vee (A \wedge B)] \\
& \equiv K(A \vee B) \wedge K(A \wedge B) \\
& \equiv K(A \wedge B)
\end{aligned}
$$

5.1.1 Intermediate Summary

Let us sum up the results so far. We saw that implicature suspension in Quiz Shows follows an interesting pattern: While ignorance implicatures are fully suspended, scalar implicatures may still arise. Fox argues that a simplified version of QUANTITY-1 is de-activated in Quiz Shows. Under the grammatical system, this assumption is needed to explain the suspension pattern: If QUANTITY-1 is de-activated, no ignorance implicatures will be derived, while scalar implicatures may still be derived by a covert EXHoperator. The pragmatic theory, on the other hand, has problems explaining the suspension pattern in Quiz Shows regardless of whether or not QUANTITY is assumed to be active or not. As the previous discussion revealed, however, the relevant factor distinguishing Quiz Shows from standard contexts is probably not the requirement to be as informative as is required *for purposes of the current exchange*. This is because non-assertion of any stronger alternative should be explained precisely in terms of the speaker's faithfulness to the maxim of QUANTITY, and specifically, the combination of QUANTITY-1 and QUANTITY-2.

In what follows, I will show how the Matrix K system can account for the suspension patterns in Quiz Shows.

5.2 Implicature Suspension in the Matrix K Theory

Before presenting my own own account of the facts, below I repeat the main ingredients of the theory:

(10) THE MATRIX K THEOREM

Assertion of ϕ is parsed as $K\phi$ at LF

(11) EXHAUSTIFICATION

The operator EXH can be inserted at any node $\nu_{\langle s,t \rangle}$

(12) EPISTEMIC TRANSPARENCY

An LF of the form $[\ldots K_S \phi]$ is licensed iff it entails S's state of mind about every $\psi \in \mathcal{A}LT(\phi)$

States of mind are: (i) $K\psi$ (ii) $\neg K\psi$

I suggest that the relevant factor that distinguishes Quiz Shows from normal contexts is the fact that the host does not have to be completely open about his epistemic state. In other words, it is the principle of Epistemic Transparency which is suspended during Quiz Shows.[3]

[3]For the relation between Grice's QUANTITY and Epistemic Transparency, see section (80).

If Epistemic Transparency is suspended, the following LF will now be licensed:

(13) K[A or B]

$[\![\ ]\!] = K(A \vee B)$

This LF would normally be ruled out by Epistemic Transparency because it doesn't tell us what the speaker believes about the other members of $\mathcal{A}$LT(A or B) – it is not epistemically transparent in this sense. It is however the main characteristic of the quiz show context that the speaker doesn't have to be transparent. The hearer can thus decide to parse the assertion of *A or B* as in **??**. Under this parse, the host literally only says that he is sure the money is in box A or in box B. He does *not* say that he isn't sure that it is in A or that he isn't sure that it is in B.

In the current system, Fox's observation that scalar implicatures may still arise in quiz show contexts can easily be accounted for. With Epistemic Transparency being suspended, hearers have the choice to parse either (13), or the following LF, which contains the equivalent of the scalar implicature observed by Fox:

(14) LF2 = Kexh[A or B]

$[\![\text{LF2}]\!] = K(A \vee B) \wedge K\neg(A \wedge B)$

Thus, the system correctly predicts the availability of the attested LFs and is in this respect superior to the pragmatic theory. What seems to be missing, however, is an explanation for why the other possible LFs are not licensed in the Quiz

Show – after all, just because Epistemic Transparency isn't active doesn't mean LFs which happen to satisfy the principle are ruled out. The explanation for this is simple. Let's start with the following LF and its denotation:

(15) LF3 = EXH K[A or B]

$[\![\text{LF3}]\!] = K(A \vee B) \wedge \neg K(A \wedge B) \wedge \neg KA \wedge \neg K\neg A \wedge \neg KB \wedge \neg K\neg B$

Recall first the definition of a Quiz Show, repeated below in (16):

(16) Let α be a sentence containing a scalar item. A Quiz Show is a context in which

1. For all $\alpha' \in \mathcal{A}LT(\alpha)$: $K_S\alpha' \vee K_S\neg\alpha'$
2. The hearer knows that 1. holds

In the current scenario the speaker has asserted *A or B*. Given the definition in (16), in the Quiz Show it will be the case that $K_S\alpha' \vee K_S\neg\alpha'$ for all $\alpha' \in \mathcal{A}LT(A or B)$ = {A, B, (A and B)}. Compare this to the the denotation of LF3 in **??**. All conjuncts of the form $\neg K\phi$ contradict this. Since the definition of a Quiz Show furthermore includes the fact that the hearer is aware that $K_S\alpha' \vee K_S\neg\alpha'$ for all $\alpha' \in \mathcal{A}LT(\alpha)$, she will rule out LF3 in any Quiz Show context. The same is true of the last possible LF:

(17) LF4 = EXH K exh[A or B]

$$[\![\,\text{LF4}\,]\!] = K(A \vee B) \;\wedge\; K\neg(A \wedge B) \;\wedge\; \neg KA \;\wedge\; \neg K\neg A \;\wedge\; \neg KB \;\wedge\; \neg K\neg B$$

Again, all of the $\neg K\phi$ conjuncts contradict the contextual information that the game show host is informed about all alternatives, and the hearer, knowing that this is so, will rule out LF4 as well.

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