Neg-Raising Modals and Scaleless Implicatures

by

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Abstract

This dissertation explores the phenomenon of 'scaleless implicatures', which are semantic enrichments from existential quantificational meanings to universal ones. Scaleless implicatures are like scalar implicatures in that they are sensitive to the polarity of the environment and the QUD in the context; they distinguish themselves from them in that they are triggered by expressions that lack a scalar alternative.

I present a cross-linguistic study of 14 neg-raising root modals, and claim that their neg-raising behavior is due to their potential to trigger scaleless implicatures. They come in several types. First, scaleless implicature triggers can come in two quantificational forces. There are existential scaleless implicature triggers that can strengthen to universal quantification. There are also universal scaleless implicature triggers that, when negated, have the expression strengthened to the equivalent of a wide scope universal. Second, scaleless implicature triggers can strengthen obligatorily or optionally. I claim that this behavior depends on whether an appropriate scalemate is present in the lexicon of the language. I show how the typology and distribution of these phenomena can naturally be analyzed in existing grammatical theories of scalar implicatures (Fox, 2007; Bar-Lev and Fox, 2020).

Based on the data from the languages observed, I propose a new theory of scalar alternatives. The behavior of scaleless implicature triggers depends on the presence of 'lexical scalar alternatives', which originate at the level of the lexical item and are highly sensitive to the morphosyntax and semantics of the item and its scalemate. However, lexical scalar alternatives cannot

explain all instances of scalar implicatures, thus revealing the existence of 'clausal scalar alternatives', derived at the level of the clause, consequently less sensitive to the morphosyntax and semantic restrictions of the scalemates.

I then discuss how scaleless implicatures can be blocked when they license actuality entailments, how this provides empirical support for a unification of all observed scaleless implicature triggers, and how this behavior is predicted by the theory.

Finally, I motivate a crucial assumption underlying the scaleless implicature analysis of neg-raising modals. Namely, that they originate below negation, and cannot undergo any interpretable syntactic movement. This effectively argues against previous analyses of the behavior of neg-raising modals as raising above negation due to their positive polarity sensitivity (Homer, 2011, 2015; Iatridou and Zeijlstra, 2013).

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CHAPTER 1

Introduction

1.1 The story

Some modals are neg-raising. That is, they appear to be interpreted above negation even though they are in its scope. This is the case for example for the Spanish necessity modal *deber*.

(1) a. Isidora **debe** ir.
Isidora must go
'Isidora must go.' □

b. Isidora **no debe** ir.
Isidora neg must go
'Isidora mustn't go.' □ > ¬

Assumed structure: [NEG [DEBER [GO]]]

In this dissertation, I give a novel account for *deber* and others of its kin as triggering 'scaleless implicatures' (SLIs), a strengthening from (the equivalent of) an existential interpretation to (the equivalent of) a universal interpretation. For example, *deber* is a necessity modal and triggers a SLI, meaning that under negation, the weak negated necessity reading (¬□) will be strengthened to a strong wide scope necessity reading (□¬).

Other apparent neg-raising necessity modals will receive a different analysis. Take Ecuadorian Siona *ba'iji*. On the surface, it looks like *deber*: it is interpreted as a necessity modal when non-negated, and as a wide scope necessity modal when negated.

(2) a. Saiye **ba'iji**.
go must
'One must go.' $\Box$

b. Saiye **beoji**.
go must.neg
'One mustn't go.' $\Box > \neg$

Assumed structure: [NEG [BA'IJI [GO]]]

I argue that *ba'iji* is a SLI trigger like *deber*, but that it differs from it in that it is underlyingly a possibility modal. When non-negated, it will strengthen to a necessity interpretation. When negated, a SLI is not licensed, and therefore the interpretation will remain that of a negated possibility, which is equivalent to a wide scope necessity ($\neg\Diamond \equiv \Box\neg$).

What is a scaleless implicature? When is it licensed? I argue that a SLI is an implicature, as its name suggests, and should be accounted for on a par with scalar and Free Choice implicatures. The licensing conditions of the three types of implicatures are comparable, displaying sensitivity to the monotonicity properties of the environment, to the syntactic distance from a monotonicity breaking operator, and to the QUD in the context. The main difference between a scalar and a scaleless implicature trigger lies in whether or not it has a scalar alternative. Whenever an item lacks a scalar alternative (and has subdomain alternatives), it can trigger a SLI. With these ingredients, all three types of implicatures, and their distribution, can be derived in a grammatical system for implicatures, as proposed by Fox (2007); Bar-Lev and Fox (2020).

There have been a number of recent accounts of items analyzed as triggering SLIs (Bowler, 2014; Bar-Lev and Margulis, 2014; Magri, 2014; Meyer, 2015; Singh et al., 2016; Bassi and Bar-Lev, 2016; Oikonomou, 2016; Staniszewski, 2019, 2020; Bar-Lev, 2020; Jeretič, 2021a,b; Newkirk, 2021). In this dissertation, I enlarge the known empirical landscape of SLIs with 14 new examples from 7 languages, and record systematicities in their licensing conditions. I focus

on root modals, which are a good place to look, because they originate below sentential negation, and don't undergo any interpretable movement (two assumptions that I argue for on independent grounds in Chapter 5). This creates a configuration to observe clear cases of neg-raising.

I also uncover a new typology of SLI triggers. Previously, SLI triggers have only involved underlyingly existential operators. However, the analyses given to SLIs predict that is that there should exist universal SLI triggers as well, which trigger SLIs when negated. In this work, I show that many SLI triggers are of the second type, namely they are universal quantifiers, whose SLI triggering properties are visible under negation.

There is another dimension to the typology that has not been previously discussed: SLI triggers can be either obligatory or optional. In unembedded environments, and in neutral QUD contexts, an obligatory SLI trigger will obligatorily trigger a SLI, while an optional SLI trigger will trigger either a SLI or a scalar implicature. Optional SLI triggers are analyzed as having a scalar alternative that can be pruned.

Thus, all four types of SLI triggers are accounted for under a unified theory. They are further unified empirically by the particularity that SLIs are consistently blocked when the modal licenses an actuality entailment, a phenomenon I analyze in Chapter 4.

Obligatory and optional SLI triggers differ in their having or lacking a scalar alternative. This distinction begs the question: what is the nature of scalar alternatives?

Scalar implicatures, as they long have been analyzed in the Gricean tradition, arise from the possibility of having uttered a stronger linguistic expression, and therefore depend on the availability of that particular linguistic expression as an utterance (Grice, 1975; Gazdar, 1979; Horn, 1972, 1969; Katzir, 2007; Fox and Katzir, 2011; Rooth, 1985; Gamut, 1991 a.m.o.). However, as many theories depart from original Gricean pragmatics to explain scalar implicatures, several proposals have been made in which alternatives are divorced from the lexicon of the language, as purely conceptual objects (Chemla, 2007; Buccola et al., 2021; Buccola and Chemla, 2019; Charlow, 2016).

In this dissertation (Chapter 3), I provide evidence for the view that scalar alternatives are lexicon-dependent. I do so by comparing SLI triggers and their potential scalemates, and show

that under the right definition of scalematehood, obligatory SLIs have no scalemate in the lexicon, while optional SLIs do.

The new definition of scalemates, grounded in the empirical data from obligatory vs optional SLIs, differs from previous theories, namely those of Rooth (1985); Horn (1972); Katzir (2007); Fox and Katzir (2011). It calls for a more narrow conception of scalemates, where they have to have a perfect match in both syntactic, and have to be able to be used in all contexts of use. These restrictions suggest that the scalemate is derived at the level of the lexicon. However, this new definition of scalar alternatives does not cover all cases: more well-known cases of scalar implicatures (arising from non-SLI triggers) appear to involve items which lack a lexical scalar alternative in the lexicon. I thus propose that scalar alternatives can be derived at two levels: at the level of the word, and at the level of the clause. The particularities of the definition of lexical scalar alternatives, as well as the presence of clausal alternatives, suggest that lexical scalar alternatives are an approximation of pragmatically derived scalar alternatives, grammaticalized to reduce processing cost.

1.2 Overview of the chapters

In Chapter 2, I present the phenomenon of scaleless implicatures. I review representative previous literature that has given analyses of items as scaleless implicature triggers, and introduce the empirical distinction between obligatory and optional scaleless implicatures. I then present the framework proposed by Fox (2007) in which scalar implicatures are computed in the compositional semantics, and show that it predicts scaleless implicatures, as long as a quantificational item projects subdomain alternatives, and no scalar alternative. I lay out my additional assumptions on how the system works, which allow to predict the behavior of scaleless implicature triggers in embedded environments, and the difference between obligatory and optional scaleless implicatures. Finally, I discuss how scaleless implicatures can or cannot be accounted for in other theories.

Chapter 3 represents the core empirical and theoretical contribution of the dissertation. In the first part of the chapter, I give a number of root modal items from various languages that can

receive a scaleless implicature analysis, based on the predicted pattern established in Chapter 2. These are of four types, differing along two dimensions: existential or universal, obligatorily or optionally SLI triggering. In the second part of the chapter, I give empirical arguments on how the obligatoriness of the SLI correlates with the absence of a scalemate, and propose a theory of lexical scalar alternatives as being derived bottom-up and blind to semantic information introduced later in the derivation. In addition, I argue that lexical scalar alternatives are not enough to explain the broader landscape of scalar implicatures, and propose the existence of clausal scalar alternatives, which cannot participate in the computation of scaleless implicatures. Finally, I discuss the role of subdomain alternatives in the typology of modal items, arguing that they are lexically specified. When an item projects subdomain alternatives, it is a scaleless implicature trigger, and will be able to trigger a scalar implicature only in the presence of a lexical scalar alternative. When it doesn't project subdomain alternatives, it is not a scaleless implicature trigger, and may associate with either lexical or clausal alternatives to produce a scalar implicature.

In Chapter 4, I show that various types of scaleless implicatures find support for their existence in their unification under a particular phenomenon: blocking by actuality entailments, licensed by perfective-marked modals. I argue that as long as actuality entailments are also present in the alternatives of the modal item, the theory in Fox (2007) predicts that scaleless implicatures will be blocked.

Chapter 5 discusses the syntax of the interaction of modals and negation. In the first part of the chapter, I argue for a fixed position of interpretation of any root modal, below a fixed position of interpretation of sentential negation, arguing against previous work or extensions of previous work in which some root modals originate above negation. In the second part of the chapter, I argue in joint work with Gary Thoms that it is implausible for modal verbs and auxiliaries to undergo interpretable syntactic movement past negation. This view goes against previous accounts of necessity modals that achieve a wide scope interpretation via syntactic movement due to their positive polarity, in particular Homer (2011, 2015); Iatridou and Zeijlstra (2013). The results of this chapter are crucial in removing a confound for analyzing modals as scaleless implicature triggers,

because the predictions of polarity sensitive movement above the modal and polarity sensitive in-situ strengthening are very similar.

In Chapter 6, I conclude the dissertation, and discuss extensions of the theory of scaleless implicatures to other neg-raisers.

CHAPTER 2

Scaleless Implicatures

2.1 Introduction

In this chapter, I give initial empirical and theoretical arguments for the existence of 'scaleless implicatures' (henceforth, SLIs). In broad terms, I call a SLI a semantic strengthening of an expression equivalent to an existential quantificational claim to the equivalent of a universal one. Following previous work, I propose that SLIs arise whenever the expression lacks a stronger scalar alternative. This assumption allows to derive SLI strengthening within existing theories of scalar implicatures.

Let's begin with the well-known phenomenon of scalar implicature. A standard example of a scalar implicature is the strengthening from an existential expression, e.g. a possibility modal claim, to its conjunction with a corresponding negated universal expression, e.g. a necessity modal claim, as in example (3).

(3) a. She can leave. $\rightsquigarrow$ *'She can but doesn't have to leave.'*

Scalar implicatures have been argued to arise due to the presence of a stronger alternative utterance obtained by replacing a word in the utterance with its scalemate, an item whose semantics

is related to that of the word by asymmetric containment (Horn, 1972, 1989). For example, in (5), the alternative utterance is obtained from replacing *can* with *have to*. Horn's theory of scalar implicatures (as well as other prominent theories; notably Katzir (2007)) crucially depends on the presence of a lexical item in the lexicon of a given language that can serve as a scalemate. In this dissertation, I will argue that this insight proves to be correct, and that the absence or presence of a scalemate has direct implications on the interpretation of a quantificational item.

For example, imagine a language English$*$ that differs from English in that it lacks an expression with the necessity meaning *have to*; in consequence, its word for 'can', *kan*, does not form a Horn scale with a universal quantifier. And a scalar implicature will not be licensed. Furthermore, under the right conditions, an item like *kan* will not only be unable to trigger a scalar implicature, but instead trigger a *scaleless* one, which corresponds to a semantic strengthening to a universal interpretation. This is shown below.

(4) She kan leave. $\rightsquigarrow$ *'She has to leave.'* [English$*$]

A common characteristic of scalar and scaleless implicatures is that they are sensitive to the monotonicity of their environment. For example, if we embed (5) under negation (where *cannot* is analyzed as $not > can$, the scalar implicature is not computed.

(5) She cannot leave. $\not\rightsquigarrow$ *'It's not the case that she can but doesn't have to leave.'*

As we will see, SLIs are also generally not computed under negation, in contrast with upward-entailing environments, in which they are by and large obligatory. For example, if we embed scaleless *kan* under negation, we expect it to have the same meaning as the corresponding English expression with scaleful *can*.

(6) She kannot leave. $\not\rightsquigarrow$ *'She doesn't have to leave.'* [English$*$]

Both scalar and scaleless implicature are observed not only with existential items, but negated universals. In English, *not have to* has *cannot* as an alternative, which licenses the im-

plicature *can*; in English$**$, necessity modal *haf to* has no scalar alternative, therefore when it is negated, it strengthens to the meaning *cannot*.

(7) a. She doesn't have to leave. $\rightsquigarrow$ *'She doesn't have to but can leave.'* [English]

b. She doesn't haf to leave. $\rightsquigarrow$ *'She cannot.'* [English$**$]

There have been a few descriptions and analyses of items that trigger SLIs due to the lack of a scalemate. In this chapter, I present two: Bowler (2014) observes the strengthening of a disjunction to a conjunction in Walpiri, and Bar-Lev and Margulis (2014) give an analysis of a strengthened existential quantifier to a universal quantifier; in both cases, the lexicon lacks a scalemate (i.e. there is no dedicated item for conjunction in Walpiri, nor a dedicated item for a universal quantifier in Hebrew). Then, in Chapter 3, I will considerably enlarge the known typology of SLIs by showing many examples observed with modal items, similar to to *kan* from English$*$ and *hafto* from English$**$. I will also argue for the existence of related items of another type which had not been previously observed – 'optional SLI triggers', that can trigger optionally either a scalar implicature or a SLI.

In this chapter, I lay the ground for analyses of specific modal SLI triggers, by providing some initial support for the claim that SLIs exist in language. In section 2.2, I give examples from the literature of phenomena that have been characterized as SLIs, and describe the environments in which they arise. In particular, I will argue that they are obligatory in unembedded contexts, and optional or absent in non-upward-entailing ones. This pattern will serve as a basis for identifying SLIs elsewhere.

Then, in section 2.3, I show that a grammatical theory of scalar implicatures (Fox, 2007; Bar-Lev and Fox, 2020) predicts the existence of SLIs. I argue that the licensing conditions of scalar and scaleless implicatures are empirically similar, and follow from the same set of assumptions. I also show how the theory predicts that there should exist SLI triggers among both existential and universal items. In section 2.4, I present the phenomenon and analysis for optional SLIs.

In section 2.5 I conclude, and appendices are in 2.6.

2.2 Scaleless implicatures: a preliminary empirical landscape

In the literature, we can find several analyses of SLIs, where an item strengthens to the equivalent of a universal quantification that arises through implicature calculation from the lack of a scalemate: Bowler (2014); Bar-Lev and Margulis (2014); Magri (2014); Meyer (2015); Singh et al. (2016); Bassi and Bar-Lev (2016); Oikonomou (2016); Staniszewski (2019, 2020); Bar-Lev (2020); Jeretič (2021a,b); Newkirk (2021). Not all of the above-cited works derive the strengthening in the exact same way; in section 2.3, I lay out my version of the analysis. These works range across connectives, quantifiers over individuals and quantifiers over worlds. While I do not necessarily commit to all of these accounts, their diversity suggests the versatility of a scaleless implicature analysis to explain neg-raising phenomena. All of these analyses (except for Jeretič 2021a) involve a weak item, i.e. an existential quantifier or disjunction, that can be strengthened in appropriate environments to a strong item, i.e. a universal quantifier or conjunction. In this dissertation, I present a typology in which SLIs can be triggered by both existential and negated universal quantifiers. To my knowledge, none of the above works has attempted to characterize the distribution of SLIs as a general empirical phenomenon, nor have many suggested systematic ways of favoring the SLI analysis over other analyses. This dissertation is meant to do exactly that.

2.2.1 Examples

I give two examples of items that appear to be representatives of SLI triggers in the way I analyze them in this dissertation: the Walpiri connective *manu*, from Bowler (2014), and the Hebrew nominal quantifier *kol*, from Bar-Lev and Margulis (2014). Both of these have a pattern that I will take to be the characteristic pattern of SLIs, which I will use to identify them elsewhere, namely a strong interpretation (conjunctive or universal) when unembedded, a weak one when negated (disjunctive or existential), and are ambiguous between the two in non-upward entailing contexts. Another important detail about both *manu* and *kol* is that they are scaleless, meaning that

they do not have strong counterpart in the lexicon of their language. In other words, there is no unambiguous conjunction in Walpiri, and no unambiguous universal quantifier in Hebrew.

2.2.1.1 Walpiri *manu* (Bowler, 2014)

I begin with Walpiri *manu*, from Bowler (2014). In unembedded contexts, *manu* is unambiguously interpreted as 'and' (8).

(8) Cecilia **manu** Gloria=pala yanu tawunu-kurra.
Cecilia manu Gloria=3DU.SUBJ go.PAST town-ALL
'Cecilia and (/*or) Gloria went to town.'

Under negation, *manu* is unambiguously interpreted as 'or' (9a).

(9) a. Cecilia **manu** Gloria kula=pala yanu tawunu-kurra.
Cecilia manu Gloria NEG=3DU.SUBJ go.PAST town-ALL
'Neither Cecilia nor Gloria went to town.'

∗'Cecilia and Gloria didn't both go to town.'

b. Kula=rna yunparnu **manu** wurntija jalangu. Lawa.
NEG=1SG.SUBJ sing.PST manu dance.PST today nothing
'I didn't sing or dance today. I did nothing.'

Bowler reports that speakers are uncomfortable using *P manu Q* under negation in contexts in which they consider it possible that only one of *P* and *Q* is false, suggesting that *P manu Q* is unambiguously disjunctive under negation. So far, this fact is perhaps not surprising if *manu* is a conjunction – it could be seen as a plural-forming predicate, in which case it would pattern with plurals. It could also have this strong reading if it takes unambiguous wide scope TP conjunction. However, the behavior of *manu* in other environments cannot be explained by plural predication or wide scope.

In particular, in antecedents of conditionals and *wh*-questions, the interpretation of *manu* is ambiguous between a disjunction and a conjunction. I report below the Walpiri examples, as cited in Bowler (2014).

(10) a. Kaji=npa kuyu **manu** mangarri ngarni ngula kapu=npa
IRR=2SG.SUBJ meat manu food eat.NPST that AUX.FUT=2SG.SUBJ
pirrjirdi-jarrimi.
strong-become.NPST
'If you eat meat and vegetables, you will become strong.' [Bowler (2014)]

b. Kaji=npa jarntu pakarni **manu** window luwarni, ngula=ju
IRR=2SG.SUB dog hit.NPST manu window shoot.NPST that-TOP
Nungarrayi-rli kapi=ngki jirna-wangu-mani.
Nungarrayi-ERG AUX.FUT=2SG.NSUBJ scold.NPST
'If you hit the dog or break the window, then Nungarrayi will scold you. [Bowler (2014)]

(11) a. Ngana-ngku ka mardarni ngaya **manu** jarntu?
who-ERG AUX have.NPST cat manu dog
'Who has a cat and a dog?' [Bowler (2014)]

b. Ngana yanu Juka Juka-kurra **manu** Wakulpa-kurra?
who yanu Juka Juka-ALL manu Wakulpa-ALL
'Who has been to Juka Juka or Wakulpa?' [Bowler (2014)]

The data as it is currently presented strikingly matches the SLI pattern that will be observed with the items presented in Chapter 3.[1]

2.2.1.2 Hebrew *kol* (Bar-Lev and Margulis, 2014)

I now describe the behavior of Hebrew nominal quantifier *kol*, based on data in Bar-Lev and Margulis (2014), that I complete with my own data collection. Bar-Lev and Margulis (2014) report unambiguous readings of *kol* when unembedded, where it is only interpreted as universal.

(12) **Kol** yeled higi'a.
kol boy arrived.
Every boy arrived.

[1]The data comes from a short paper where the data description had to be kept to a minimum. To be convinced of the ambiguity of *manu* in non-UE environments, one would have to see more examples in more contexts, and more information about the fieldwork conducted.

When negated, it is interpreted as ambiguous between existential and universal, at least for some speakers (Bar-Lev and Margulis (2014) only report the existential reading, since it was the reading of interest for their purposes).

(13) Ha-mu'amad lo kibel **kol** tSuva.
the-candidate NEG received kol response
The candidate did not receive any response.

The following data comes from my own informal data collection (Moshe Bar-Lev and Itamar Kastner p.c.) In other non-upward-entailing contexts, such as questions, conditional antecedents, and negated *think*, both existential and universal readings are available. I tested sentences (15)-(17) in two contexts, one that would elicit the existential reading, the other the universal reading, shown here:

(14) a. Context 1: we can move on with our work if 3 out of 3 responses were received.

b. Context 2: we can move on with our work if at least 1 out of 3 responses was received.

For one of the speakers, the sentences were good in both contexts, i.e. both existential and universal readings were available, as reflected in the translations below.

(15) Haim hitkabla **kol** tSuva? efSar lehamSix?
Q was.received KOL answer possible to.continue
'Has any/every response been received? Can we proceed?'

(16) {Im hitkabla **kol** tSuva / im **kol** tSuva hitkabla} efSar lehamSix.
if was.received KOL answer / if KOL answer was.received possible to.continue
'If any/every response has been received, we can move on.'

(17) Ani lo xoSev Se-hitkabla **kol** tSuva, az i efSar lehamSix.
I NEG think that-was.received KOL answer so not possible to.continue
'I don't think that any/every response has been received, so we can't move on.'

The other speaker only accepted existential readings in these contexts (and under negation, with example (13)). This starkly contrasted with the first, who reported that existential *kol* is in fact

associated with formal register.[2] My goal here is not to provide a fully-fledged picture of this data; instead simply present what the distribution of an item that has already received a SLI analysis might look like.

2.2.2 Summary

In summary, obligatory SLIs appear to follow the following distribution. They are obligatory in unembedded contexts, optional in non-upward-entailing contexts, e.g. conditional antecedents and questions, and unavailable in a subset of these cases, generally under sentential negation. In what follows, I present an analysis of SLIs that captures this distribution.

2.3 Scaleless implicatures as a theoretical prediction

SLIs are directly predicted by some existing theories of scalar implicatures, in particular those proposed by Fox (2007) and its updated version in Bar-Lev and Fox (2020). These are part of a recent wave of theories proposing that scalar implicatures are semantic enrichments resulting from the insertion of operators in the syntax (see Chierchia et al. (2012) for an overview), rather than computed as purely pragmatic, post-compositional operations, in line with their original conception stemming from the Gricean tradition (Grice, 1975).

In section 2.3.1, I start by presenting Fox's (2007) framework for scalar inferences, and how it derives scalar implicatures free choice inferences. In section 2.3.2, I say how this framework predicts SLIs when a quantificational item has a specific set of alternatives, namely one that lacks a scalar alternative and contains subdomain alternatives. In section 2.3.3, I show how scalar, free choice and scaleless implicatures pattern in a similar way, and lay out a set of assumptions on the distribution of the exhaustivity operator, and the pruning of alternatives, that captures this pattern. Finally, in 2.3.4, I explicitly present universal SLI triggers, and explain how their distribution differs from existential ones.

[2] This may be a sign that *kol* is being reinterpreted as universal for some speakers, following the diachronic evolution of existential SLI triggers discussed in Chapter 3.

2.3.1 Fox 2007

In this section, I lay out the details of Fox's (2007) framework for scalar reasoning, and say how this framework accounts for scalar implicatures and Free Choice effects. For Fox, scalar implicatures are derived in the compositional semantics as the result of the application of an exhaustivity operator EXH to a sentence S and its associated set of alternatives $Alt(S)$. Below is an example in (18) from English.

(18) Scalar implicature:

a. S = some students left

b. $Alt(S)$ = {some students left, all students left}

c. $\text{EXH}(Alt(S))(S) \equiv$ some students left and not all students left

In addition, this theory can account for the Free Choice effect as an implicature. When applied (recursively) to a disjunction under a existential modal, it derives the Free Choice effect, as in (19).

(19) Free Choice:

EXH EXH you can eat ice cream or cake $\equiv$ you can eat ice cream and you can eat cake (but not both)

2.3.1.1 Exhaustification

Fox's (2007) exhaustivity operator EXH is defined to negate as many alternatives of the sentence as possible, in a non-arbitrary way, as long as they do not yield a contradiction (based on the procedure proposed by Sauerland (2004) used to derive implicatures in a neo-Gricean framework). This operator EXH is defined in (20): it applies to a proposition p and a set of alternatives C, and yields an expression equivalent to the conjunction of p and the negations of the 'innocently excludable alternatives' from C relative to p, defined in (21).

(20) $[\![\text{EXH}]\!](C_{<st,t>})(p_{st})(w) \equiv p(w) \wedge \forall a \in Alt_{IE}(p, C)[\neg[\![a]\!](w)]$

(21) $Alt_{IE}(p, C) = \bigcap\{C' \subseteq C : C' \text{ is a maximal subset of } C, \text{ s.t. } \{\neg[\![a]\!] : a \in C'\} \cup \{p\} \text{ is consistent}\}$

Innocently excludable alternatives correspond to the intersection of all maximal sets of alternatives whose negation is consistent with the prejacent. The work of EXH, stated in (20), is to assert the original proposition, strengthened by the negation of each of the members of innocently excludable alternatives.

I assume (standardly) that when EXH applies to a syntactic phrase P, it applies to $[\![\text{P}]\!]$ and P's set of alternatives $Alt(\text{P})$.

(22) $[\![\text{ EXH P }]\!] = [\![\text{EXH}]\!](Alt(\text{P}))([\![\text{P}]\!])$

I adopt the following set of assumptions on EXH application.

(23) Assumptions on EXH application:

a. EXH must apply when it makes the utterance or the utterance's alternatives globally stronger relative to the non-exhaustified version

b. EXH can adjoin to any TP, and nowhere else[3]

Condition (23a) is similar but differs slightly to what has been proposed in the literature. Implicatures are taken to be generally obligatory, with various proposals to explain when they can be suspended (Chierchia et al., 2012; Fox and Spector, 2018; Magri, 2009 a.o.). Condition (23b) does not resemble anything that has been explicitly stated in the literature. I do not attempt a full comparison of the various conditions on EXH application in this work. Rather, I have chosen these conditions as the closest to the data observed with SLIs, and compatible with known cases of embedded scalar implicatures. In this chapter and the next, I will show how these conditions capture the distribution of both known cases of scalar implicatures and new data on SLIs.

[3]There may be variation here, between languages and speakers. For example, there may be speakers for whom EXH can only apply at the level of an entire utterance. This would explain data found for one speaker in Hebrew to account for the absence of a SLI with *kol* in embedded environments altogether.

2.3.1.2 Alternatives

In this section, I lay out my assumptions about alternatives to linguistic expressions containing quantifier items. The alternatives of a linguistic expression E containing a quantifier Q are obtained by replacing Q in E with each of Q's alternatives.

(24) $Alt([_E ...Q...]) = \{[_E ...Q_i...] | Q_i \in Alt(Q)\}$

What are the alternatives of a quantifier Q? I consider two types: scalar and subdomain alternatives.

Quantifiers like 'some', 'all', 'allowed', 'required', 'or', 'and' (I take connectives to be a type of quantifier) trigger scalar implicatures. In order to account for scalar implicatures, any theory has to adopt the notion of a scalar alternative (Horn, 1972; Gazdar, 1979 et seq.). For the purposes of this dissertation, I assume that a quantifier expression has as a scalar alternative an expression whose meaning corresponds to its dual[4] (which I will simply refer to as the expression's 'dual'). Examples of sets of scalar alternatives for English quantifiers are found below (I also assume, following standard convention, that an quantifier is a scalar alternative to itself; this has no bearing on the derivations).

(25) a. (i) $ScalarAlt$(or) = {or, and}

(ii) $ScalarAlt$(and) = {or, and}

b. (i) $ScalarAlt$(some) = {some, all}

(ii) $ScalarAlt$(all) = {some, all}

c. (i) $ScalarAlt$(allowed) = {allowed, required}

(ii) $ScalarAlt$(required) = {allowed, required}

[4]In previous theories, duals are always part of the set of alternatives of a quantifier, but are not always its only members. In Horn's (1972) seminal work, the set of scalar alternatives (popularly known as 'Horn scales') are sets of lexical items whose meanings are related by asymmetric containment. As a result, 'some' has as a scalar alternative 'many', in addition to its dual expression 'all'. The question as to whether 'many' is indeed a scalar alternative to 'some' is not trivial, and I will at this point not commit to an answer.

Therefore, for any linguistic expression containing a quantifier, its set of scalar alternatives can be defined as the following.

(26) For an expression E containing a quantifier expression Q,

$ScalarAlt(E) = \{A|A$ is obtained by replacing Q in E with itself or its dual$\}$

Examples of scalar alternatives of full sentences with quantifiers are found below.

(27) a. ScalarAlt(Zoe talked to Yann **or** Wynn)

= {Zoe talked to Yann **or** Wynn, Sue talked Yann **and** Wynn}

b. ScalarAlt(Zoe talked to Yann **and** Wynn)

= {Zoe talked to Yann **or** Wynn, Zoe talked Yann **and** Wynn}

(28) a. ScalarAlt(Zoe talked to **some** students)

= {Zoe talked to **some** students, Sue talked to **all** students}

b. ScalarAlt(Zoe talked to **all** students)

= {Sue talked to **some** students, Sue talked to **all** students}

The other type of alternatives I consider are subdomain alternatives. Subdomain alternatives have been proposed to account for more specific phenomena, e.g. implicatures embedded under disjunction (Sauerland, 2004), Free Choice with disjunction and indefinites (Kratzer and Shimoyama, 2002; Fox, 2007), polarity sensitive items (Krifka, 1995; Chierchia, 2013). The definition I adopt has subdomain alternatives as expressions formed by replacing the domain of the quantification by each of its subdomains, available for any quantificational expression.[5]

(29) For an expression E containing a quantifier Q over a domain D,

$SubdomainAlt(E) = \{A|A$ is obtained by replacing D with D', such that $D' \subseteq D\}$

[5]Note that the structural alternative account by Katzir (2007); Fox and Katzir (2011) only predicts subdomain alternatives for connectives, and therefore calls for some kind of amendment to allow for subdomain alternatives for quantifiers, if one is to use that theory.

I give examples of these alternatives below (for connectives, the domain of quantification is the set formed by each member of the coordination).

(30) $SubdomainAlt$(Zoe talked to **Yann, Xorr or Wynn**)
= {Zoe talked to **Y, X or W**, Sue talked to **Y or X**, Sue talked to **Y or W**, Sue talked to **X or W**, Sue talked to **Y**, Sue talked to **X**, Sue talked to **W**}

(31) $SubdomainAlt$(Zoe talked to all students [in **{Yann, Xorr, Wynn}**])
= {Zoe talked to all students [in **{Y,X,W}**], Sue talked to all students [in **{Y,Z}**], Sue talked to all students [in **{Y,W}**], Sue talked to all students [in **{X,W}**], Sue talked to all students [in **{Y}**], Sue talked to all students [in **{X}**], Sue talked to all students [in **{W}**]}

I will assume that a given quantifier may or may not have scalar alternatives, and may or may not have subdomain alternatives. I will argue in Chapter 3 that the presence of a dual as a scalar alternative depends on available expressions in the lexicon, while the presence of subdomain alternatives will be an arbitrary lexical specification.

Finally, in order to account for the data, I assume that a quantifier's alternatives project up to a TP boundary, and are then by default closed off. This means that the alternatives of an item in an embedded clause will not be made available to an exhaustivity operator present in the matrix clause. I summarize these assumptions below for ease of reference.

(32) Assumption on alternative projection:

a. An item's alternatives must project until a TP boundary

b. Alternatives are by default closed off at the TP boundary

2.3.1.3 Deriving Scalar Implicatures

The EXH operator proposed by Fox derives scalar implicatures in a straightforward way: the scalar alternative is innocently excludable, and therefore negated, yielding the scalar implicature.

I show this for the exclusive inference triggered by unembedded disjunction, but the same derivation can easily be replicated for quantifiers.

(33) a. $S =$ 'Zoe talked to Yann or Wynn.'

b. $S = \text{y} \vee \text{w}$

The set of alternatives of the disjunction crucially contains the conjunctive alternative. We can also assume it contains subdomain alternatives (i.e. each of the disjuncts), though their presence does not have any effect on the computation. We have the following alternative set for S.

(34) $Alt(S) = \{(\text{y} \vee \text{w}), \text{y}, \text{w}, (\text{y} \wedge \text{w})\}$

We derive the set of innocently excludable alternatives (defined in (21)) as the intersection of the maximal sets of alternatives whose negation is consistent with the prejacent. We find that the only innocently excludable (IE) alternative, i.e. an alternative which can be negated non-arbitrarily without yielding contradiction, is the conjunctive alternative.

(35) $Alt_{IE}(S)(Alt(S)) = \bigcap\{\{\text{y}, \text{y} \wedge \text{w}\}, \{\text{w}, \text{y} \wedge \text{w}\}\} = \{\text{y} \wedge \text{w}\}$

The exhaustifier excludes this alternative and produces the desired result.

(36) $S' = \text{EXH}\ [Alt(S)][S] \equiv (\text{y} \vee \text{w}) \wedge \neg(\text{y} \wedge \text{w})$

EXH can apply again, but yields a trivial result, as shown below.

(37) $Alt(S') = \{\ (\text{y} \vee \text{w}) \wedge \neg\ (\text{y} \wedge \text{w}), \text{y} \wedge \neg\ \text{w}, \text{w} \wedge \neg\ \text{y}, \text{y} \wedge \text{w}\ \}$

(38) $Alt_{IE}(S') = \{\ \text{y} \wedge \text{w}\ \}$

(39) $S'' = \text{EXH}\ [Alt(S')][S'] \equiv (\text{y} \vee \text{w}) \wedge \neg(\text{y} \wedge \text{w})$

This inference is obligatory according to (23a), because it is stronger than the non-exhaustified version of the sentence.

2.3.1.4 Deriving Free Choice Implicatures

Free Choice effects are examples of strenghtening a disjunction to a conjunctive meaning when it is found under an existential operator. A typical example is found below.

(40) $S =$ Zoe is allowed to talk to Yann or Wynn. (Base LF: $\Diamond$(y $\vee$ w))

$\rightsquigarrow$ *Zoe is not allowed to talk to both.* (Exclusivity: $\neg\Diamond$(y $\wedge$ w))

$\rightsquigarrow$ *Zoe is allowed to talk to Yann and is allowed to talk to Wynn.* (Free Choice: $\Diamond$y $\wedge\Diamond$w)

The exhaustivity operator proposed by Fox (2007) captures the Free Choice effect as an implicature (following previous analyses of Free Choice is as an implicature, e.g. Kratzer and Shimoyama (2002); Alonso-Ovalle (2005)).

I present the Free Choice derivation below. We start in (41) with the schematized LF of (40) before exhaustification.

(41) $S = \Diamond$(y $\vee$ w)

S has the following set of alternatives projected by the disjunction (those projected by $\Diamond$ can be ignored for our present purposes).

(42) $Alt(S) =$ {$\Diamond$(y $\vee$ w), $\Diamond$y, $\Diamond$w, $\Diamond$(y $\wedge$ w)}

The exclusivity inference arises in the first round of exhaustification, in a parallel way to the scalar implicature derived in the previous section, by negating the conjunctive alternative. This is shown in (43).

(43) $S' =$ EXH $[Alt(S)][S] \equiv \Diamond$(y $\vee$ w) $\wedge\ \neg\Diamond$(y $\wedge$ w)

Since S' is stronger than the original, this operation is obligatory. EXH can apply again; alternatives of once exhaustified S are the following.

(44) $Alt(S') = Alt(\text{EXH}\ [Alt(S)][S])$

$= \{\ \text{EXH}\ [Alt(S)][\Diamond(\text{y} \vee \text{w})], \quad \equiv \{\ \Diamond(\text{y} \vee \text{w}) \wedge \neg\Diamond(\text{y} \wedge \text{w}),$

$\text{EXH}\ [Alt(S)][\Diamond\text{y}], \qquad \Diamond\text{y} \wedge \neg\Diamond\text{w},$

$\text{EXH}\ [Alt(S)][\Diamond\text{w}], \qquad \Diamond\text{w} \wedge \neg\Diamond\text{y},$

$\text{EXH}\ [Alt(S)][\Diamond(\text{y} \wedge \text{w})]\ \} \qquad \Diamond(\text{y} \wedge \text{w})\ \}$

In contrast with a typical case of a scalar implicature (e.g. with an unembedded disjunction shown in the previous section), the exclusivity inference is not equivalent to the conjunction of the other alternative (i.e. the alternatives of S are not closed under conjunction[6]). This will allow subdomain alternatives, exhaustified with respect to each other, to be innocently excludable at the second round of exhaustification. Specifically, the exhaustified subdomain alternatives will be of the sort 'Zoe was allowed to talk to one person but couldn't talk to the other'. Applying EXH negates these alternatives, which amounts to saying 'Zoe was not allowed to talk to only one person', or 'Zoe was allowed to talk to either no person or both people'. Since the utterance asserts that she is allowed to talk to at least one person, this means she is allowed to talk to both people. This results in a Free Choice inference. I show the formal derivation of this inference below, with EXH applying to S', the once exhaustified sentence.

(45) $S'' = \text{EXH}\ [Alt(S')][S'] \equiv \Diamond\ (\text{y} \vee \text{w}) \wedge \neg\Diamond\ (\text{y} \wedge \text{w})$

$\wedge\neg(\Diamond\text{y}) \wedge \neg\Diamond\text{w}) \wedge \neg(\Diamond\text{w} \wedge \neg\Diamond\text{y})$

$\equiv \Diamond\ (\text{y} \vee \text{w}) \wedge \neg\Diamond\ (\text{y} \wedge \text{w}) \wedge (\Diamond\text{y} \leftrightarrow \Diamond\text{w})$

$\equiv \Diamond\text{y} \wedge \Diamond\text{w} \wedge \neg\Diamond\ (\text{y} \wedge \text{w})$

Since this second round yields a non-trivial result, it is obligatory (according to (23a)).

[6]Lack of closure under conjunction is a sufficient property of a set of alternatives that can lead to strengthening (Fox, 2007; Bar-Lev and Fox, 2020).

2.3.2 Predicting scaleless implicatures

In this section, I show that SLIs are a type of implicature predicted by Fox's (2007) theory of implicatures. In particular, SLIs arise when a quantifier has subdomain alternatives, but no scalar alternative. I first show in 2.3.2.1 the derivation of a SLI triggered by a scaleless disjunction (I call 'scaleless' an element that lacks a scalar alternative (other than itself)), then in 2.3.2.2 I show that this derivation is generalizable to a quantifier over a domain of any size.

2.3.2.1 SLIs with a scaleless disjunction

A weak expression such as a disjunction can trigger a SLI and be interpreted as a conjunction, if it lacks a scalar alternative and projects its subdomain alternatives. An actual example of such a disjunction is found in Walpiri, according to Bowler (2014), shown in section 2.2.1.1. I repeat Bowler's example in (8) below in fake Walpiri.

(46) $S =$ Cecilia manu Gloria went to town.
$\approx$ 'Cecilia and Gloria went to town.'

Despite S having a conjunctive interpretation of S, the connective *manu* is underlyingly a disjunction, as shown below.

(47) $S = c \vee g$

Furthermore, this disjunction has as a set of alternatives its subdomain alternatives (i.e. the disjuncts), shown in (48).

(48) $Alt(S) = \{c \vee g, c, g\}$

We then apply EXH to S. At the first round of exhaustification, none of these alternatives are innocently excludable: one cannot exclude both c and g at once without yielding a contradiction.

Excluding only one of c and g would be arbitrary and therefore disallowed. In other words, the maximal sets of excludable alternatives are $\{c\}$ and $\{g\}$, and their intersection is the empty set.

(49) $Alt_{IE}(S)(Alt(S)) = \bigcap\{\{c\},\{g\}\} = \varnothing$

Therefore, exhaustifying this utterance once has no effect on truth conditions.

(50) $S' = \text{EXH}\ [Alt(S)][S] \equiv c \vee g$

It is at the second round of exhaustification that there is an effect. Like with Free Choice, the set of alternatives of S is not closed under conjunction. We can see this by conjoining alternatives c and g, yielding $c \wedge g$, which is not an alternative of S. As noted in Fox (2007); Bar-Lev and Fox (2020), the lack of closure under conjunction is a sufficient property of a set of alternatives for strengthening to a conjunctive interpretation (if c and g are logically consistent).

The alternatives of this exhaustified sentence look like the following.

(51) $Alt(S') = \{[Alt(S)][c \vee g], [Alt(S)][c], [Alt(S)][g]\}$
$\equiv \{c \vee g, c \wedge \neg g, g \wedge \neg c\}$

The exhaustified subdomain alternatives are IE, and their exclusion is responsible for the strengthening to a conjunctive meaning (as what is observed in the Free Choice derivation). Taking both subdomain alternatives exhaustified with respect to each other corresponds to saying 'the relevant property holds of only one subdomain'. Negating them corresponds to saying either no subdomain is true, or both are. Since the original utterance asserted that at least one was true, we get the result that both are true. And the conjunctive interpretation, i.e. the SLI, is derived. I show the formal version of this second EXH application below.

(52) $S'' = \text{EXH}\ [Alt(S')][S'] \equiv (c \vee g) \wedge \neg(c \wedge \neg g) \wedge \neg(g \wedge \neg c)$
$\equiv (c \vee g) \wedge c \leftrightarrow g \equiv c \wedge g$

A scaleless disjunction that projects its subdomain alternatives is thus predicted to be strengthened to a conjunctive meaning, after recursive application of Fox's (2007) operator.

This operation is obligatory following the assumptions stated in (23a). The first EXH strengthens the utterance's alternatives (despite it not strengthening the utterance itself), and therefore is obligatory. The second EXH application strengthens the utterance itself, and is therefore also obligatory.

2.3.2.2 SLIs with a scaleless quantifier over a domain of any size

The same operation can be done on any kind of domain, no matter how large. This means that nominal and modal quantifiers can be SLI triggers. An example of a SLI-triggering nominal quantifier is Hebrew *kol*, presented in 2.2.1.1, which is taken to be an existential quantifier in Bassi and Bar-Lev (2016), but is interpreted as universal in unembedded contexts.

Take a sentence S that existentially quantifies over a domain D, and its corresponding set of alternatives, which contains subdomain alternatives, but no scalar alternative.

(53) a. $S = \exists x \in D.P(x)$

b. $Alt(S) = \{\exists x \in D'.P(x) : D' \subseteq D\}$

Like with the simpler disjunction case, the conjunction of the subdomain alternatives of this sentence is equivalent to the universal quantification over D, which is not an alternative of S. This lack of closure under conjunction will allow strengthening to the universal meaning.

Indeed, since no alternative is equivalent to the conjunction of the alternatives (i.e. the universal meaning), it will never be excluded in the first round of exhaustification. This corresponds to the absence of a scalar implicature. Furthermore, at this first round of exhaustification, none of the subdomain alternatives can be excluded non-arbitrarily: for example, the alternative over a subdomain $\exists x \in D'.P(x)$ for any given $D' \subseteq D$ cannot be excluded together with $\exists x \in D \backslash D'.P(x)$, because that would contradict the assertion. At the second round of exhaustification, alternatives are exhaustified with respect to each other. Each of the alternatives will correspond a sentence

of the type: '$P(x)$ is true for some x in this subdomain but false in the rest of the domain'. The exclusion of these alternatives delivers a statement in which for any subdomain, it is false that P is true for some x in that subdomain alone. This leaves us with two options: either P is true for no x in D, or P is true for all x in D. Since the original sentence states that P is true for some x in D, we conclude that P is true for all x in D.

The main steps of this derivation are found below, and formal proofs for each of the claims made in (54) and (55) can be found in the appendix to this chapter (section 2.6.2).

(54) a. $S = \exists x \in D.P(x)$

b. $Alt(S) = \{\exists x \in D'.P(x) : D' \subseteq D\}$

c. $Alt_{IE}(S)(Alt(S)) = \varnothing$

(55) a. $S' = \text{EXH}\ [Alt(S)][S] \equiv \exists x \in D.P(x)$

b. $Alt(S') = \{\exists x \in D'.P(x) \wedge \neg\exists x \in D\backslash D'.P(x) : D' \subseteq D\}$

c. $Alt_{IE}(S')(Alt(S')) = \{\exists x \in D'.P(x) \wedge \neg\exists x \in D\backslash D'.P(x) : D' \subset D\}$

(56) a. $S'' = \text{EXH}\ [Alt(S')][S']$

b. $\equiv \exists x \in D.P(x) \wedge \bigwedge\{\neg(\exists x \in D'.P(x) \wedge \neg\exists x \in D\backslash D'.P(x)) : D' \subset D\}$

c. $\equiv \exists x \in D.P(x) \wedge \bigwedge\{\neg\exists x \in D'.P(x) \vee \exists x \in D\backslash D'.P(x) : D' \subset D\}$

d. $\equiv \exists x \in D.P(x) \wedge \bigwedge\{\exists x \in D'.P(x) \rightarrow \exists x \in D\backslash D'.P(x) : D' \subset D\}$

e. $\equiv \exists x \in D.P(x) \wedge \bigwedge\{\exists x \in D'.P(x) \leftrightarrow \exists x \in D\backslash D'.P(x) : D' \subset D\}$

(because $\exists x \in D\backslash D'.P(x) \rightarrow \exists x \in D\backslash(D\backslash D').P(x)$, and $D\backslash(D\backslash D') = D'$)

f. $\equiv \forall x \in D.P(x)$

The universal quantification is thus derived, for a domain of any size. This also means that it applies for quantification over any type of domain, whether it be individuals or worlds.

Again, the derivation is obligatory, because the result is stronger than the non-exhaustified version.

2.3.3 The distribution of implicatures

In this section, I present the distribution of implicatures, and claim that their licensing (in presence of an implicature-triggering item) is sensitive to various factors. I go over the empirical distribution of implicatures, how the theory captures it, and what this means for scaleless implicatures.

In embedded environments, an implicature may be obligatory, optional or unavailable depending on the monotonicity properties of the operator, and how far syntactically the implicature trigger is from this operator. In both unembedded and embedded environments, implicature licensing is sensitive to the QUD present in the context.

2.3.3.1 Polarity sensitivity in embedded environments

Take an expression E capable of triggering an implicature: scalar, free choice, or scaleless. I give examples of the three types below.

(57) a. Scalar implicature:

'Zoe talked to Yann or Wynn.' $y \vee w \rightsquigarrow \neg(y \wedge w)$

b. Free choice implicature:

'Zoe is allowed to talk to Yann or Wynn.' $\Diamond(y \vee w) \rightsquigarrow \Diamond y \wedge \Diamond w$

c. Scaleless implicature:

'Zoe talked to Yann manu Wynn.' $y \vee w \rightsquigarrow y \wedge w$

Consider embedding these expressions under an operator O. I discuss two options for exhaustifying the resulting sentence. The first involves EXH application above the O operator, as in (58a), and the second corresponds to deriving an implicature under the operator O, as in (58b).

(58) a. EXH (EXH) OE

b. O EXH (EXH) E

I break down the observations and predictions for the licensing of implicatures below for different types of operators O. The predictions follow from the assumptions stated in (23), repeated below.

(23) Assumptions on EXH application:

a. EXH must apply when it makes the utterance or the utterance's alternatives globally stronger relative to the non-exhaustified version

b. EXH can adjoin to any TP, and nowhere else

2.3.3.1.1 No implicatures under clausemate negation. We don't observe any implicatures under clausemate negation, as shown below for the three types considered. First, a scalar implicature embedded under negation does not seem to be available in a context that would make it available.

(59) *Context: I am wondering who Zoe talked to out of Yann and Wynn. I then realize that Yann and Wynn are inseparable, and Zoe couldn't have talked to only one.*

'Zoe didn't talk to Yann or/OR Wynn.' $\not\equiv \neg((y \vee w) \wedge \neg(y \wedge w))$

... #She can only have talked to neither or both.[7]

Similarly, Free Choice is very difficult to get.

(60) *Context: I think Zoe is allowed to talk to either director, Yann or Wynn. You disagree and say:*

'Zoe is not allowed to talk to Yann or Wynn.' $\not\equiv \neg(\Diamond y \wedge \Diamond w)$

... #She is only allowed to talk to Yann.

(61) 'Zoe didn't talk to Yann manu Wynn.' $\not\equiv \neg(y \wedge w)$

[7]Some authors have argued for the presence of an embedded scalar implicature when disjunction is stressed: 'Zoe didn't talk to Yann OR Wynn, she talked to both.' However, this sentence could be explained by 'or' taking wide scope, or as a case of contrastive metalinguistic negation (contrasting 'or' and 'and'). A reason that it is not to be taken to be a scalar implicature is the fact that even with a stressed disjunction, one cannot seem to follow up with the full embedded scalar implicature 'she talked to neither or both'.

The lack of implicatures under clausemate negation is predicted by the theory. First, we consider the configuration in (58a), corresponding to EXH applying to the entire negated expressions. In these cases, there is never an effect on truth conditions because the expressions are maximally strong (i.e. there is no consistent conjunction of the expression with any combination of the operators involved). Second, the configuration in (58b) is not available with the clausemate negation cases, because EXH applies at the TP level only, according to (23b), but the syntactic position of negation is below the TP, in English and many other languages.[8] Therefore EXH cannot apply in between negation and expression.

The reason for why this is a syntactic restriction is that one can observe embedded scalar implicatures under extra-clausal negation.

(62) a. *Context: I am wondering who Zoe talked to out of Yann and Wynn. I realize that Yann and Wynn are inseparable, and Zoe couldn't have talked to only one.*
'I don't think Zoe talked to Yann OR Wynn.'
... She can only have talked to neither or both.

b. *Context: I think Zoe is allowed to talk to either director, Yann or Wynn. You disagree and say:*
'I don't think Zoe is allowed to talk to Yann or Wynn.'
... She is only allowed to talk to Yann.

These implicatures are available, because EXH can apply at the TP level, between the extra-clausal negation and the implicature triggering expression. However, they are not obligatory, because they do not globally strengthen the utterance (following assumption (23a)).

2.3.3.1.2 O is downward-entailing. In (58a), exhaustification applies to $O(E)$, and its subdomain alternatives. Since subdomain alternatives of an existential expression E are stronger than the expression itself, the subdomain alternatives of $O(E)$ are weaker than the expression itself, when

[8] Here we might expect cross-linguistic variation in the availability of scalar implicature depending on whether sentential negation is below or above the TP, which has been observed as a point of variation (Zanuttini, 1997).

O is downward-entailing. Weaker alternatives are not innocently excludable, and therefore EXH application is trivial. With a downward-entailing operator O, EXH (EXH) E is stronger than E, and therefore O EXH (EXH) E is weaker and $O(E)$, since O as a downward-entailing operator reverses entailment relations. Therefore, EXH application is weaker in this case, therefore not stronger – this means that if it is possible in the first place, (58b) is optional.

In sum, when O is downward-entailing, the expression is ambiguous between one without implicature, and one with an embedded implicature, if there is a TP boundary in between O and E for EXH to apply. I show below an example of an optional scalar implicature in a conditional antecedent.

(63) a. If you can go, that means you don't have to. (SI computed)

b. If you can go, that doesn't mean you don't have to. (SI not computed)

Such embedded implicatures, often referred to as 'intrusive', have been often noted in the literature (Fox, 2007; Levinson, 2000; Recanati, 2003; Horn, 1989; Schlenker, 2016 see). I make the empirical claim that this distribution holds for SLIs. From section 2.2, we know that SLIs are observed to be optional in conditional antecedents and other environments. This will also be the case in the examples of SLI triggers presented in Chapter 3.

2.3.3.1.3 O **is non-monotonic.** With a non-monotonic operator, the case in (58b) is going to be similar to the case of a downward-entailing operator. This is because a non-monotonic operator removes entailment inferences, which means that $O(\text{EXH EXH } E)$ is not stronger than $O(E)$. Therefore, if EXH application is possible in that configuration, it is optional.

With regards to the unembedded exhaustification configuration, the result will depend on the effect of O on the innocent excludability of alternatives. If EXH application is not trivial, since it is unembedded, it strengthens the utterance. It will therefore be obligatory, at least in case an implicature has not been derived in the embedded position.

While the effect of a wide scope EXH is to be determined on a case by case basis, an embeddded implicature will always be available, as long as a TP boundary is present, deriving optionality in such cases.

2.3.3.1.4 O **is upward-entailing.** When O is upward-entailing, it preserves entailment relations, so embedded exhaustification as in (58b) will be globally stronger than a non-exhaustified utterance. Therefore, if exhaustification is possible in such a configuration, it is obligatory.

If it is obligatory, it means that (58a) will never have to arise, since EXH will have already applied. However, it might still arise in configurations in which EXH was not possible embedded (i.e. when O cannot be separated from E by a TP boundary). In this case, we have to consider unembedded EXH, in which case the result will depend on the semantics of O. I give two examples of how an upward entailing operator affects the exhaustification procedure for a SLI triggering disjunction.

An existential quantifier doesn't disrupt the derivation, since alternatives at the first round remain non-excludable. This means that the second round proceeds as usual, and the result is a conjunction, that differs from the embedded SLI only in that it takes wide scope over the existential operator.

(64) a. $S = \exists x.(p \vee q)$

b. $Alt(S) = \{\exists x.(p \vee q), \exists x.p, \exists x.q\}$

(65) $S' = \text{EXH}\ [Alt(S)][S] \equiv \exists x.(p \vee q)$

(66) $Alt(S') = \{[Alt(S)][\exists x.(p \vee q)], [Alt(S)][\exists x.p], [Alt(S)][\exists x.q]\}$
$\equiv \{\exists x.(p \vee q), \exists x.p \wedge \neg\exists x.q, \exists x.q \wedge \neg\exists x.p\}$

(67) $S'' = \text{EXH}\ [Alt(S')][S'] \equiv \exists x.(p \vee q) \wedge \exists x.p \leftrightarrow \exists x.q \equiv \exists x.p \wedge \exists x.q$

In contrast, a universal quantifier does disrupt the excludability of the alternatives in the first round. The alternatives from the second round are not innocently excludable anymore, and therefore the result stays at this, and thus a SLI is not observed.

(68) a. $S = \forall x.(p \vee q)$

b. $Alt(S) = \{\forall x.(p \vee q), \forall x.p, \forall x.q\}$

(69) $S' = \text{EXH}\ [Alt(S)][S] \equiv \forall x.(p \vee q) \wedge \neg\forall x.p \wedge \neg\forall x.q$

2.3.3.2 QUD sensitivity

The licensing of scalar implicatures in unembedded contexts is known to be sensitive to discourse conditions, and in particular the Question Under Discussion (Question Under Discussion, Roberts (1996)) (see Hulsey et al. (2004); Gualmini et al. (2008); Zondervan et al. (2008); Benz and Salfner (2011); Magri (2009) for relevant discussion). One observation that is present in all of these works (though stated in a variety of ways) is that scalar implicatures are suspended whenever the non-strengthened reading is equivalent to a complete answer to the QUD.

I illustrate this with the following example. Take the implicature of non-necessity triggered by *allowed*. In (538a), the implicit QUD is about general rules related to covid restrictions. The use of *allowed* under this QUD triggers a scalar implicature, shown by the felicitous continuation commenting on the implicature.

(70) *Context: A teacher announces daily covid-related rules about going to school.*

Teacher: Today, kids are allowed to go to school.

Kid: Great, I don't have to go, so I won't!

In contrast, in (71), the QUD, stated in an explicit question, is whether or not it is allowed for the kids to go to school. In that case, a scalar implicature is blocked, as shown by the infelicitous continuation uttered by the child.

(71) A: Are the kids allowed to go to school today?

B: Yes they are allowed to, finally.

Kid: #Wait so I don't have to go?

The QUD sensitivity of SLIs has not been discussed in previous literature. However, it is available for the cases discussed in Chapter 3, where SLI licensing displays similar QUD sensitivity in unembedded contexts. In particular, whenever a QUD of the type $\{\exists, \neg\exists\}$ is made explicit in the context, an existential SLI trigger can be uttered in its non-strengthened reading (i.e. interpreted as $\exists$ instead of $\forall$). Similarly, whenever a QUD of the type $\{\forall, \neg\forall\}$ is made explicit in the context, a negated universal SLI trigger can be uttered in its non-strengthened reading (i.e. interpreted as $\neg\forall$ instead of $\forall\neg$).

I choose to capture this QUD sensitivity by the following constraint on pruning.

(72) Constraint on pruning:
Prune all members of $A \subseteq Alt(S)$ if the result of exhaustification with $Alt(S)\backslash A$ is equivalent to a possible answer to the QUD.

I discuss how this constraint differs from previous proposals in the literature in 2.4.2.2.

2.3.4 Scaleless existentials and scaleless universals

2.3.4.1 Strengthening expressions containing scaleless universals

If an existential quantification can be strengthened via a SLI, then a negated universal quantification can also. By De Morgan's law, a negated universal quantification ($\neg\forall$) is equivalent to an existential one, scoping above a negation ($\exists\neg$), as stated in (73a). Similarly to a SLI triggering existential, a SLI triggering universal projects subdomain alternatives, but no scalar alternatives. This set of alternatives is analogous to that of an existential quantifier over a negation, as shown in (73b).

(73) a. $\neg\forall x.p \equiv \exists x.\neg p(x)$

b. $Alt(\neg\forall x \in D.p(x)) = \{\neg\forall x \in D'.p(x) | D' \subseteq D\}$
$\equiv \{\exists x \in D'.\neg p(x) | D' \subseteq D\} \equiv Alt(\exists x.\neg p(x))$

The SLI derivation can then proceed in exactly the same way as was derived for a SLI triggering existential in section 2.3.2. And the equivalent of a wide scope universal utterance is derived, as shown in (74).

(74) $\text{EXH EXH } \neg\forall \equiv \text{EXH EXH } \exists\neg \equiv \forall\neg$

Of course, one can also derive the strengthening directly without appealing to the equivalence to an existential quantifier, by showing subdomain alternatives of the negated universal utterance, a derivation I show in 3.2.2.2 for modals.

While there have been a number of accounts of strengthened scaleless existentials in the literature, there is no analysis in the literature that derives strengthening with scaleless universals in DE environments. There is a mention in Singh et al. (2016) of this prediction and a study that appears to bear it out, namely that children appear to interpret negated conjunctions as wide scope conjunctions, just as they interpret disjunction as conjunction. To my knowledge, this dissertation is the first work examine crosslinguistic evidence of this kind of strengthening (in Chapter 3).

2.3.4.2 Universal SLI triggers in other environments

2.3.4.2.1 Without negation A universal SLI trigger, when it is not negated, is maximally strong, and therefore no implicature is computed.

2.3.4.2.2 Under higher negation Consider a configuration in which a universal SLI trigger is embedded under extraclausal negation. Following the assumptions on projection properties of alternatives stated in (32), the alternatives of the SLI trigger project up to the TP boundary, by default. Therefore, if a negation is found beyond the TP boundary, the SLI is optional (with the lack of strengthening being the default).

2.3.4.2.3 In any quantificational environment In any quantificational environment, including quantificational downward-entailing environments like the scope of 'no-one' and 'few', as well as upward entailing ones like the scope of 'many', the subdomain alternatives of a universal SLI

trigger are innocently excludable at the first round of exhaustification, and therefore the implicature is of a different type, comparable to a Free Choice inference.

For example, take the negative DP 'no birds', taking scope above a scaleless conjunction.

(75) a. $S =$ No birds ate grains and worms.

b. $Alt(S) =$ {no birds ate grains and worms, no birds ate grains, no birds ate worms}

c. EXH$[Alt(S)][S] \equiv$ no birds ate grains and worms and ¬(no birds ate grains) and ¬(no birds ate worms)

$\equiv$ no birds ate grains and worms and some birds ate grains and some birds ate worms

Note that this inference is the same if a scalar alternative were present (since the negated subdomain alternatives together ($\exists x.P(x) \wedge \exists x.Q(x)$) are stronger than the negated scalar alternative ($\exists x.P(x) \vee Q(x)$)).

This means that no SLI should be observed when a universal SLI trigger is found the scope of a quantificational operator. Note however that in the case of negative indefinites, the scope can be split to yield a configuration of the type $\neg > \forall > \exists$, in which a SLI would be derived in a standard way; I discuss this in Chapter 3.

2.3.4.3 Disentangling scaleless existentials and scaleless universals

Existentials and negated universals that trigger SLIs are on the surface very similar. In fact, in unembedded and negated contexts, they are indistinguishable, as both have universal interpretations when unembedded, and wide scope universal interpretations when negated. The results for each case are summarized below.

(76) Scaleless existential:

a. Unembedded: EXH EXH $\exists \equiv \forall$ (SLI)

b. Negated: EXH EXH $\neg\exists \equiv \neg\exists$ (no effect)

(77) Scaleless universal:

a. Unembedded: EXH EXH $\forall \equiv \forall$ (no effect)

b. Negated: EXH EXH $\neg\forall \equiv \neg\exists$ (SLI)

In order to distinguish between them, one must look at the behavior of these items in other contexts. In particular, in non-upward entailing contexts other than clausemate negation, e.g. a conditional antecedent, we should observe differences. If the item is non-negated, then an existential reading should be available for a scaleless existential item but not a universal one. If the item is negated and embedded in a non-UE context, then a negated universal meaning should be available for a scaleless universal, but not an existential one: this follows from the fact that EXH cannot apply between clausemate negation and the existential quantifier.

Another environment in which they are distinguished is in specific QUD contexts. If the QUD $\{\exists, \neg\exists\}$ is made explicit, then an existential reading $\exists$ should be made available if the SLI trigger is existential, but not universal. On the flip side, if the QUD $\{\forall, \neg\forall\}$ is made available, the negated universal reading $\neg\forall$ should arise if the SLI trigger is universal, but not existential.

In Table 2.1, I summarize these facts, highlighting how the distributions of the two types of items compare. The top half of the table shows environments in which scaleless existentials and universals cannot be distinguished, while the bottom shows environments in which they can be.

	scaleless existential	scaleless universal
[ ]	$\forall$	$\forall$
$\neg$[ ]	$\neg\exists$	$\forall\neg$
O^* [ ]	$O^*(\exists)/O^*(\forall)$	$O^*(\forall)$
$O^*\neg$[ ]	$O^*(\neg\exists)$	$O^*(\neg\forall)/O^*(\forall\neg)$
[ ]; QUD $= \{\exists, \neg\exists\}$	$\exists$	$\forall$
$\neg$[ ]; QUD $= \{\forall, \neg\forall\}$	$\neg\exists$	$\neg\forall$

O^* is a non-UE operator separated from the item by a TP boundary.

Table 2.1: Comparing available readings of scaleless existentials and universals in different environments

2.4 A new phenomenon: optional scaleless implicatures

In Chapter 3, I will presented several examples of what I claim is a phenomenon that hasn't yet been described as such in the literature: optional SLIs. I will argue that optional SLI triggers can be set apart from obligatory SLI triggers, examples of which I presented in section 2.2.

2.4.1 The data: a brief overview

Optional SLI triggers have the same distribution of obligatory SLIs, except for their behavior in unembedded contexts, in which they will be fully optional.

I give an example from Swedish root modal *få* (see Chapter 3 for more complete and motivated data). Unembedded, it is ambiguous between a possibility and necessity modal.

(78) a. Isac får betala en bot.
Isac far pay a fine
Isac has to pay a fine.

b. Isac får ha glass.
Isac far have icecream
Isac can have ice cream.

Embedded in non-UE contexts, it is again ambiguous.

(79) a. Om Isac får betala böter bör han gå online.
if Isac far pay the.fine should he go online
If Isac has to pay the fine, he should go online.

b. Om Isac får ha glass är han glad.
if Isac far have icecream is he happy
If Isac is allowed to have ice cream, he is happy.

(80) a. Får Isac betala böter?
far Isac pay the.fine
Does Isac have to pay the fine?

b. Får Isac ha glass?
can isac have ice cream
Can Isac have ice cream?

However, under negation, only the 'can' reading is available.

(81) Isac får inte betala böter.
Isac far NEG pay the.fine
Isac isn't allowed to pay the fine.

Furthermore, in contrast with obligatory SLIs, the SLI trigger does not lack a scalemate in the lexicon, as I will argue in Chapter 3 for *få*.

2.4.2 Analysis

In this section, I present the assumptions needed to account for the distribution of optional SLIs. Optional SLI triggering items present a systematic ambiguity between a SLI and a scalar implicature.

2.4.2.1 Optional SLIs have a scalar alternative

I assume that optional SLI triggers have both subdomain alternatives and scalar alternatives. With that set of alternatives, applying EXH results in a scalar implicature, as shown in (82).

(82) a. $S = p \vee q$

b. $Alt(S) = \{p \vee q, p, q, p \wedge q\}$

c. EXH $[Alt(S)][S] \equiv p \vee q \wedge \neg(p \wedge q)$

However, if the scalar alternative is pruned, and not the subdomain alternatives, a scaleless implicature arises.

(83) a. $S' =$ EXH $[Alt(S) \backslash \{p \wedge q\}][S]$

b. $Alt(S') = \{\text{EXH}[Alt(S) \backslash \{p \wedge q\}][a] : a \in Alt(S) \backslash \{p \wedge q\}\} = \{p \vee q, p \wedge \neg q, q \wedge \neg p\}$

c. EXH $[Alt(S')][S'] \equiv p \wedge q$

This way of accounting for the difference between obligatory and optional SLIs is the basis for the investigation into the nature of scalar alternatives in Chapter 3. The systematic comparison between obligatory and optional SLIs, and the items available in the lexicon, provides solid empirical ground for describing what makes a potential scalemate not appropriate, and what does.

One important question that arises is why we don't observe an optional SLI with English *or*. It is known to have subdomain alternatives, needed in particular to derive free choice implicatures (as shown in 2.3.1.4), as well as SLIs in English child language (Singh et al., 2016), and a type of SLI in particular constructions where *and* is blocked (Meyer, 2015). We therefore expect *or* to sometimes be able to be interpreted as conjunction by pruning its scalar alternative *and*. However, this is not what we observe. I will only briefly speculate here about why this should be the case. There is a sense in which having *or* mean *and* is useless when *and* is freely available, because the interpretations are exactly equivalent. In the case of modals, choosing a SLI with one item instead of using another may not be useless, because they have the power to reduce the interpretations available. For example, we may choose to prune the possibility alternative "kan" of a necessity optional SLI trigger "hafto" because the strengthened reading of "not hafto" has less interpretations than "not kan". This is in fact often true, whenever "kan" can express ability: "not kan" can express the absence of ability, while "hafto not" cannot; therefore using the latter reduces ambiguity, and pruning is licensed. I leave integrating this constraint to the system to future work.

2.4.2.2 Pruning

2.4.2.2.1 QUD conditions on pruning As discussed in 2.3.3.2, pruning alternatives is subject to contextual conditions. In particular, I assume that one can prune alternatives only if the result of exhaustification corresponds to a cell of the QUD. I repeat this constraint below.

(84) Constraint on pruning:

Prune all members of $A \subseteq Alt(S)$ if the result of exhaustification with $Alt(S) \backslash A$ is equivalent to a possible answer to the QUD.

Based on this assumption, one can prune a an optional SLI trigger's scalar alternative if there is an appropriate licensing QUD.

I summarize the different readings available to obligatory and optional SLI triggers and their corresponding QUD conditions in the following Table 2.2.

		default	scalar alt pruned	all alts pruned
Possibility	obligatory	$\Box$	na	$\Diamond$
	optional	$\Diamond \wedge \neg\Box$	$\Box$	$\Diamond$
licensing QUD		none	$\{\Box, \neg\Box\}$	$\{\Diamond, \neg\Diamond\}$
Necessity	obligatory	$\Box\neg$	na	$\neg\Box$
	optional	$\neg\Box \wedge \Diamond$	$\Box\neg$	$\neg\Box$
licensing QUD		none	$\{\Box\neg, \Diamond\}$	$\{\neg\Box, \Box\}$

Table 2.2: Readings of obligatory and optional SLI triggers in unembedded contexts, according to which alternatives are pruned, and in which licensing conditions

One empirical observation that is left to address is one that emerges from the data in Chapter 3, namely the fact that the SLI reading of an optional SLI appears to be more easily accessible than the unstrengthened readings of any implicature trigger (i.e. the weak reading of a scalar implicature trigger, or the readings in the right-hand column of Table 2.2). More specifically, no explicit QUD is needed to access the SLI reading of an optional SLI trigger, while the unstrengthened readings of obligatory SLI triggers need explicit contextual support.

I will not answer this question in full here. However, there are reasons to not be worried about this difference. One could assume a general dispreference in out-of-the-blue contexts for readings that are not maximally strong (i.e. readings equivalent to existential quantification, which could be made stronger by conjoining the universal reading or its negation). This would set apart SI and SLI-strengthened readings on one hand (which cannot be further strengthened), and unstrengthened readings on the other.[9]

[9] Another solution would be that there is a higher cost of pruning many, often uncountably many alternatives, versus just one. This solution makes different predictions than the one blocking unstrenghtened readings: the weak reading of a scalar implicature trigger would therefore be just as available as the SLI reading of an optional SLI trigger, because both would involve pruning only the scalar alternative. Furthermore, both would be more readily available than the unstrengthened readings of SLI triggers. My experience with this data suggests that this is not the case; however, experimental data would be needed to decide between these two hypotheses.

Furthermore, the SLI reading of an optional SLI triggering modal corresponds to either a necessity or an impossibility. There is an intuition that such meanings (whether or not they are expressed by a SLI trigger) are easily utterable out of the blue. For example, all that is needed contextually for one to utter an obligation or a prohibition is for one to be an authority figure. Using the terms of the constraint on pruning stated above, pruning the scalar alternative of an optional SLI triggering modal is licensed in out-of-the-blue contexts, because it is easy to accommodate the relevant QUD from the target readings.

2.4.2.2.2 How this constraint compares to Magri's (2009) The QUD sensitivity of SLIs has been discussed in Magri (2009). Magri assumes that alternatives can be pruned only if they are contextually irrelevant. I formulate a constraint on pruning based on Magri's (2009) proposal.

(85) Constraint on pruning (Magri, 2009):
Prune alternative $A \in Alt(S)$ if A is irrelevant.

Magri's (2009) constraint has the same effect as the QUD-based constraint adopted in this work for typical scalar implicatures. In other words, when a reading unstrengthened by an SI answers the QUD, it is because the scalar alternative is irrelevant (which can be formulated according to that same QUD). I repeat example (71) below in (547b) to illustrate. The QUD in this example is $\{\Diamond, \neg\Diamond\}$. According to Magri's constraint on pruning, this QUD makes the $\Box$ alternative is irrelevant: it is therefore pruned, and no scalar implicature is licensed.

(86) A: Are the kids allowed to go to school today?
B: Yes they are allowed to, finally.
Kid: #Wait so I don't have to go?

This constraint, however, does not carry over well to understanding the behavior of optional SLIs. Take for example an optionally SLI triggering conjunction *A or B*. If one prunes its scalar

alternative *A and B* (but not its subdomain alternatives *A* and *B*), the result of exhaustification is equivalent to $a \wedge b$, the meaning of the pruned alternative, as schematized below.

(87) a. $S = p \vee q$

b. $Alt(S) = \{p \vee q, p, q, p \wedge q\}$

c. EXH EXH $[Alt(S) \backslash \{p \wedge q\}][S] \equiv p \wedge q$

Interestingly, the pruning of the scalar alternative for optional SLIs appears to be directly at odds with Magri's (2009) central proposal to account for 'blind implicatures'. Blind implicatures are implicatures which render a sentence odd, because their computation makes the sentence contradict the common ground (while not computing them would result in no contradiction).

(88) a. #Some Italians come from a warm country. [Magri (2009)]

b. *Context: I bring an empty platter with cake crumbs on it.*
#Look, I ate some of the cake!

Example (88a) appears to be odd because it triggers the implicature 'not all Italians come from a warm country', which contradicts the common ground that all Italians come from the same country. Similarly, (88b) can be taken to be odd because it also triggers a 'not all of the cake' implicature, which is clearly false given the evidence produced. Magri proposes that these scalar implicatures must be computed because the alternatives 'all Italians come from a warm country' or 'I ate all of the cake' cannot be ignored because they are contextually equivalent to the assertion being made, and assertions are by definition relevant (following Grice's Maxim for utterances 'Be relevant!'). Furthermore, Magri assumes that if EXH application creates a contextual contradiction, then it results in oddness.

According to this reasoning, the SLI reading of optional SLI triggers should not be available, since it is exactly equivalent to the alternative pruned. How then can one account for the oddness of the Magri sentences and the possibility of triggering SLIs with optional SLI triggers? We could capture this by ensuring that notion of equivalence used in the constraint on pruning

is logical rather than contextual. The formulation in terms of logical equivalence is admittedly strange, since the constraint is formulated in terms of conversational goals, and what matters in conversation is contextual equivalence. Another solution would simply be to adopt an alternative explanation to Magri sentences, as in e.g. Katzir and Singh (2015). I leave exploring this question to future work.

Note that the constraint adopted by Magri depends on the relevance of alternatives to be pruned, rather than the result of EXH once the alternatives are pruned. Such a constraint makes sense from the point of view of a pragmatic approach to scalar implicatures: alternative utterances should be taken into account if relevant. However, once alternatives are lexically encoded, relevance is not a necessary constraint anymore, and pruning may as well be focused on actual conversational goals, i.e. answering the QUD.

2.5 Conclusion

In this chapter, I have presented the phenomenon of scaleless implicatures. On the one hand, we see that empirically, there exists a class of phenomena that can be described as polarity-sensitive strengthenings. On the other, we can see that these polarity sensitive strengthenings are predicted by existing theories of grammatical scalar implicatures, namely Fox (2007) and Bar-Lev and Fox (2020). If an expression has a stronger scalar alternative, it will trigger a scalar implicature. If an expression lacks a scalar alternative, and has subdomain alternatives, it will trigger a SLI. Both scalar and scaleless implicatures have licensing conditions sensitive to the polarity of the environment and the QUD in the context. Furthermore, optional SLIs arise when an expression has both subdomain and a stronger scalar alternative, which can be optionally pruned, deriving the optional behavior.

2.6 Appendices to Chapter 2

2.6.1 A1: SLIs in other scalar implicature frameworks

The analysis presented above is an attempt to reduce the phenomenon of SLI to a consequence of language's mechanism that generates scalar implicatures. This works in the theory of implicatures proposed by Fox (2007). How generalizable is this prediction to other scalar implicature theories? In this appendix, I show that SLIs can be derived with Bar-Lev and Fox (2020) (an updated version of Fox (2007)), but not in a neo-Gricean framework such as that proposed by Sauerland (2004). This provides support for the existence a grammatical theory of scalar reasoning.

2.6.1.1 Deriving SLIs with Innocent Inclusion (Bar-Lev and Fox, 2020)

Bar-Lev and Fox (2020) is essentially an update to Fox's (2007) theory, and is similar enough that SLIs are still predicted, as I will show here. The difference between the two theories lies in the nature of the exhaustifier. For Bar-Lev and Fox (2017, 2020), EXH excludes innocently excludable (IE) alternatives, and in addition, includes innocently includable (II) ones.

I repeat the definition of IE alternatives, and state the definition of II alternatives below.

(89) a. $Alt_{IE}(p, C) = \bigcap\{C' \subseteq C : C'$ is a maximal subset of C, s.t. $\{\neg q : q \in C'\} \cup \{p\}$ is consistent$\}$

b. $Alt_{II}(p, C) = \bigcap\{C'' \subseteq C : C''$ is a maximal subset of C, s.t. $\{r : r \in C''\} \cup \{p\} \cup \{\neg q : q \in IE(p, C)\}$ is consistent$\}$

We can now define the new EXH operator that essentially negates all IE alternatives, and asserts all II alternatives.

(90) $[\![\text{EXH}]\!]^{IE+II}(C)(p)(w) \equiv \forall q \in IE(p, C)[\neg q(w)] \wedge \forall r \in II(p, C)[r(w)]$

This operator is designed to derive scalar implicatures and free choice. It also derives SLIs, in the absence of a scalar alternative, and the presence of subdomain alternatives. I show how this works for a disjunction.

(91) a. $S = a \vee b$

b. $Alt(S) = \{a \vee b, a, b\}$

Just like we have already seen, the set of IE alternatives of this sentence is empty, because the intersection of maximal sets of excludable alternatives $\{a\}$ and $\{b\}$ is empty.

(92) $Alt_{IE}(S, Alt(S)) = \varnothing$

However, the set of II is not. In fact, the entire set of alternatives of S is a II, since each member can be asserted without creating contradiction.

(93) $Alt_{IE}(S, Alt(S)) = \{a \vee b, a, b\}$

(94) EXH $^{IE+II}[Alt(S)][S] \equiv (a \vee b) \wedge a \wedge b \equiv a \wedge b$

The result is equivalent to a conjunctive utterance; the SLI has thus been derived.

In conclusion, for the purposes of triggering SLIs, both EXH operators, from Fox (2007) and Bar-Lev and Fox (2020) work. We will see in Chapter 4, however, a possible argument to prefer the one from Fox (2007).

2.6.1.2 No SLIs in a neo-Gricean framework (Sauerland, 2004)

In Neo-Gricean frameworks, scalar implicatures are computed post-compositionally, as a result of pragmatic principles. I show below that the neo-Gricean procedure proposed by Sauerland (2004) to derive scalar implicatures does not derive SLIs.

Take a scaleless disjunction utterance $a \vee b$, whose alternatives are a and b. In this theory, the 'primary implicatures' of this utterance are ignorance implicatures about the alternatives, as shown below (K is an epistemic necessity operator):

(95) a. $\neg Ka$

b. $\neg Kb$

As a next step, we derive 'secondary implicatures' (based on Gazdar 1979), which correspond to an epistemic strengthening of the primary implicatures, that arises so long as it is consistent with the utterance and all the primary implicatures. In this case, the epistemic strengthening corresponds to $K\neg a$ and $K\neg b$. However, these two claims together contradict the original utterance, and are therefore blocked. Therefore, the only inferences arising from this procedure are ignorance implicatures for each disjunct (and resulting possibility inferences about them). In sum, Sauerland's (2004) neo-Gricean proposal does not generate the desired SLIs.

2.6.2 A2: SLIs for any quantificational domain

In this appendix, I give proofs for the SLI derivation for a scaleless quantifier projecting subdomain alternatives over a domain of any size. While there now have been several proposals in the literature involving quantification over infinite domains, I am not aware of any proof that strengthening is actually observed for them (only for up to 3 elements in the domain). Therefore, I include the proofs here with EXH from Fox (2007). The proofs can easily be extended to EXH from Bar-Lev and Fox (2020): the step for determining IE alternatives is the same, and determining II alternatives is straightforward, and left to the reader.

We begin with a simple quantificational sentence S, with a quantifier over any non-empty domain D. S's alternatives are subdomain alternatives.

(96) a. $S = \exists x \in D.P(x)$

b. $Alt(S) = \{\exists x \in D'.P(x) | D' \subseteq D\}$

To proceed with the derivation of applying EXH to S and $Alt(S)$, we need to determine the set of IE alternatives. The claim is that this set is empty.

(97) Claim 1: $Alt_{IE}(S)(Alt(S)) = \varnothing$

To prove this claim, we follow the definition of IE alternatives as the intersection of all the maximal sets of alternatives that can be excluded without contradiction. The nature of the set of these maximal sets is $\textsc{Max}(S, Alt(S))$ is in Claim 1a below. From there, we can prove Claim 1b, which is that the intersection of these maximal sets of alternatives is empty.

(98) a. Claim 1a: The set of all maximal sets of excludable alternatives of S relative to $Alt(S)$ can be written as the following:

$\textsc{Max}(S, Alt(S)) = \{Max_{Ex}(y) = \{\exists x \in D'.P(x) : D' \subseteq D \backslash \{y\}\} | y \in D\}$

Claim 1a decomposed: For any $y \in D$,

(i) $\{\neg q : q \in Max_{Ex}(y)\} \cup \{S\}$ is consistent

(ii) $Max_{Ex}(y)$ is maximal

(iii) There is no maximal set not of the form $Max_{Ex}(y)$

b. Claim 1b: $\bigcap \{Max_{Ex}(y) | y \in D\} = \varnothing$

I will prove Claim 1a(i) and 1a(ii); proving Claim 1a(iii) is unnecessary to prove Claim 1b, because the intersection of all sets of type $Max_{Ex}(y)$ is empty; therefore any additional maximal set of IE alternatives would affect the intersection of all maximal sets of IE alternatives.

(99) Proof of Claim 1a(i): $\{\neg q : q \in Max_{Ex}(y)\} \cup \{S\}$ is consistent.

a. Subclaim α: $\{S\} \cup \{\neg q\}$ is consistent for any $q \in Max_{Ex}(y)$. Proof: $\exists x \in D.P(x)$ is consistent with $\neg \exists x \in D'.P(x)$ iff $D \not\subseteq D'$ (and P non-contradictory). We have $D' \subseteq D \backslash \{y\}$, so $D' \subset D$, therefore $\{\neg q : q \in Max_{Ex}(y)\} \cup \{S\}$ is consistent.

b. Subclaim β: $\{\neg q : q \in Max_{Ex}(y)\}$ is consistent. Proof: Take any $D', D'' \subseteq D \backslash \{y\}$. Let $D' \subset D''$ (without loss of generality). We have $\neg \exists x \in D'.P(x) \wedge \neg \exists x \in$

$D''.P(x) = \neg\exists x \in D''.P(x)$. Therefore, $\{\neg q : q \in Max_{Ex}(y)\}$ is closed under conjunction, so the conjunction of all its elements is consistent (if all its elements are consistent, i.e. if P is consistent).

c. The conjunction of subclaims α and β is equivalent to Claim 1a(i).

(100) Proof of Claim 1a(ii): $Max_{Ex}(y)$ is maximal, i.e. there is no $a \in Alt(S)$ such that $a \notin Max_{Ex}(y)$ and $\{S\} \cup \{\neg a\} \cup \{\neg q | q \in Max_{Ex}(y)\}$ is consistent. By contradiction: Assume there is such an a. So there is a $D^* \subseteq D$ such that $D^* \not\subseteq D\backslash\{y\}$ and $\psi = \exists x \in D.P(x) \wedge \neg\exists x \in D^*.P(x) \wedge \bigwedge\{\neg\exists x \in D'.P(x) | D' \subseteq D\backslash\{y\}\}$ is consistent. This means $\exists x \in D\backslash D^*.P(x) \wedge \bigwedge\{\neg\exists x \in D'.P(x) | D' \subseteq D\backslash\{y\}\}$ must be consistent. The claims $D^* \not\subseteq D\backslash\{y\}$ and $D^* \subseteq D$ mean that we have $y \in D^*$, and therefore $y \notin D\backslash D^*$, therefore $D\backslash D^* \subseteq D\backslash\{y\}$. So ψ is inconsistent, which is a contradiction.

(101) Proof of Claim 1b: $\bigcap\{Max_{Ex}(y) | y \in D\} = \varnothing$

a. Subclaim: $\bigcap\{Max_{Ex}(y) | y \in D\} = \varnothing$. Proof by contradiction: Assume $\exists a \in \bigcap\{Max_{Ex}(y) | y \in D\}$. We have $a = \exists x \in D'.P(x)$ where $\varnothing \subset D' \subseteq D\backslash\{y\}$ for any $y \in D$. But $D' \neq \varnothing$ so $\exists z \in D'$, so $a \notin Max_{Ex}(z)$. This is a contradiction.

b. From 1a(i) and 1a(ii), we have $\{Max_{Ex}(y) | y \in D\} \subseteq \textsc{Max}(S, Alt(S))$, so we have $\bigcap\textsc{Max}(S, Alt(S)) \subseteq \bigcap\{Max_{Ex}(y) | y \in D\}$. Since $\bigcap\{Max_{Ex}(y) | y \in D\} = \varnothing$, we have $\bigcap\textsc{Max}(S, Alt(S)) = \varnothing = Alt_{IE}(S, Alt(S))$.

Now that we have determined the set of IE alternatives, we can apply EXH to S and its set of alternatives. Since there are no IE alternatives, the operation is vacuous.

(102) $S' = \textsc{exh}\ [Alt(S)][S] \equiv \exists x \in D.P(x)$

We can now derive the set of alternatives of S'. We do so by proving Claim 2, i.e. what the exhaustification of a given $a \in Alt(S)$ is relative to $Alt(S)$.

(103) a. By definition: $Alt(S') = \{\textsc{exh}[Alt(S)][a] | a \in Alt(S)\}$

b. Claim 2: $Alt(S') = \{\exists x \in D'.P(x) \wedge \neg\exists x \in D\backslash D'.P(x) | D' \subseteq D\}$

c. Equivalently: $\text{EXH}[Alt(S)][a_{D'}] \equiv \exists x \in D'.P(x) \wedge \neg\exists x \in D\backslash D'.P(x)$, where any $a_{D'} \in Alt(S)$ is of the form $a_{D'} = \exists x \in D'.P(x)$ for some $D' \subseteq D$.

This exhaustification picks up on $Alt_{IE}(a_{D'}, Alt(S))$, the set of IE alternatives of $a_{D'}$ relative to $Alt(S)$, which is the intersection of the members of $\text{MAX}(a_{D'}, Alt(S))$, the set of maximal sets of excludable alternatives of $a_{D'}$ relative to $Alt(S)$. I derive this set by proving Claims 2a-c below.

(104) Claim 2a: The set $\text{MAX}(a_{D'}, Alt(S))$ of all maximal sets of excludable alternatives of $a_{D'}$ relative to $Alt(S)$ has the following property: $\{Max_{Ex}(a_{D'})(y) = \{\exists x \in D''.P(x) | D'' \subseteq D\backslash\{y\}\} | y \in D'\} \subseteq \text{MAX}(a_{D'}, Alt(S))$[10]. Proof:

a. Claim 2a(i): For any $y \in D'$, $\{\neg q | q \in Max_{Ex}(a_{D'})(y)\} \cup \{a_{D'}\}$ is consistent. Proof:

(i) Subclaim α: $\{a_{D'}\} \cup \{\neg q\}$ is consistent, for any $q \in Max_{Ex}(a_{D'})(y)$. Proof: $a_{D'} = \exists x \in D'.P(x)$ is consistent with $\neg q = \neg\exists x \in D''.P(x)$ iff $D' \not\subseteq D''$ (and P non-contradictory). We have $D'' \subseteq D\backslash\{y\}$ and $y \in D'$, so $y \notin D''$, so $D' \not\subseteq D''$, therefore $\{\neg q : q \in Max_{Ex}(y)\} \cup \{S\}$ is consistent.

(ii) Subclaim β: $\{\neg q | q \in Max_{Ex}(a_{D'})(y)\}$ is consistent. Same proof as (99b).

(iii) The conjunction of subclaims α and β is equivalent to Claim 2a(i).

b. Claim 2a(ii): For any $y \in D'$, $Max_{Ex}(a_{D'})(y)$ is maximal, i.e. there is no $a \in Alt(S)$ such that $a \notin Max_{Ex}(a_{D'})(y)$ and $\{S\} \cup \{\neg a\} \cup \{\neg q | q \in Max_{Ex}(a_{D'})(y)\}$ is consistent. Proof by contradiction: Assume there is such an a. So there is a $D^* \subseteq D$ such that $D^* \not\subseteq D\backslash\{y\}$ and that $\psi = \exists x \in D'.P(x) \wedge \neg\exists x \in D^*.P(x) \wedge \bigwedge\{\neg\exists x \in D''.P(x) | D'' \subseteq D\backslash\{y\}\}$ is consistent. This means $\exists x \in D'\backslash D^*.P(x) \wedge \bigwedge\{\neg\exists x \in D''.P(x) | D'' \subseteq D\backslash\{y\}\}$ must be consistent. The claims $D^* \not\subseteq D\backslash\{y\}$ and $D^* \subseteq D$ mean that $y \in D^*$, and therefore $y \notin D'\backslash D^*$, therefore $D'\backslash D^* \subseteq D\backslash\{y\}$. Thus ψ is a contradiction, and so $Max_{Ex}(a_{D'})(y)$ is maximal.

(105) Claim 2b: $\bigcap\{Max_{Ex}(a_{D'})(y) | y \in D\} = \{\exists x \in D\backslash D'.P(x)\}$. Proof:

[10] An additional fact, unnecessary to prove for the final result, is that these two sets are equal.

a. Claim 2b(i): $\{\exists x \in D\backslash D'.P(x)\} \subseteq \bigcap\{Max_{Ex}(a_{D'})(y)|y \in D\}$. Proof: Since $\{y\} \subseteq \{D'\}$, we have $D\backslash D' \subseteq D\backslash\{y\}$. Therefore $\exists x \in D\backslash D'.P(x)$ is a member of $Max_{Ex}(a_{D'})(y) = \{\exists x \in D''.P(x)|D'' \subseteq D\backslash\{y\}\}$, for any y, and therefore also of the intersection $\bigcap\{Max_{Ex}(a_{D'})(y)|y \in D\}$.

b. Claim 2b(ii): $\bigcap\{Max_{Ex}(a_{D'})(y)|y \in D\}\backslash\{\exists x \in D\backslash D'.P(x)\} = \varnothing$. Proof by contradiction: Assume there is an element in $\bigcap\{Max_{Ex}(a_{D'})(y)|y \in D\}$ different from $\exists x \in D\backslash D'.P(x)$, i.e. $\exists a \in Max_{Ex}(a_{D'})(y)$ for any $y \in D'$ of the form $\exists x \in D''.P(x)$, where $D'' \subseteq D\backslash\{y\}$ and $D'' \neq D\backslash D'$. This means $D'' = D\backslash D^*$ for some $D^* \subset D'$, therefore $\exists z \in D'$ such that $z \notin D^*$; so $z \in D''$, therefore $a \notin Max_{Ex}(a_{D'})(z)$. This is a contradiction.

(106) Claim 2c: $Alt_{IE}(a_{D'}, Alt(S)) = \{\exists x \in D\backslash D'.P(x)\}$. Proof:

a. 2a(i) and 2a(ii) means that $\{Max_{Ex}(a_{D'})(y)|y \in D'\} \subseteq \textsc{Max}(a_{D'}, Alt(S))$. So $\bigcap\textsc{Max}(a_{D'}, Alt(S)) \subseteq \bigcap\{Max_{Ex}(a_{D'})(y)|y \in D'\}$. Since $\bigcap\{Max_{Ex}(a_{D'})(y)|y \in D'\} = \{\exists x \in D\backslash D'.P(x)\}$, we have $Alt_{IE}(a_{D'}, Alt(S)) \subseteq \{\exists x \in D\backslash D'.P(x)\}$

b. Subclaim: There is no member M of $\textsc{Max}(a_{D'}, Alt(S))$ that does not have $\exists x \in D\backslash D'.P(x)$ as its member. Proof by contradiction. Assume $\exists M = \exists x \in D^*.P(x)$ for some $D^* \subseteq D$, whose negation is consistent with $a_{D'}$ but inconsistent with $\neg\exists x \in D\backslash D'.P(x)$. In other words, $D\backslash D^* \neq \varnothing$, but $D'\backslash D^* \cap D'\backslash(D\backslash D') = \varnothing$, but $D\backslash(D\backslash D') = D'$ and $D'\backslash D^* \cap D' = D'\backslash D^*$. So there is a contradiction.

c. So $Alt_{IE}(a_{D'}, Alt(S)) = \{\exists x \in D\backslash D'.P(x)\}$

We have therefore determined the set of IE alternatives of $a_{D'}$ for any $D' \subseteq D$. Therefore, the exhaustified alternatives of S with respect to each other look like the following.

(107) $\textsc{exh}[Alt(S)][a_{D'}] \equiv \exists x \in D'.P(x) \wedge \neg\exists x \in D\backslash D'.P(x)$

Finally, the set of IE alternatives of S' is formed from the set of alternatives of S' minus the alternative equivalent to the utterance (which is never IE), as shown below.

(108) Claim 3: $Alt_{IE}(S')(Alt(S')) = \{\exists x \in D'.P(x) \wedge \neg\exists x \in D\backslash D'.P(x) | D' \subset D\}$

I prove this claim by showing that the following derivation does not yield a contradiction, and instead yields strengthening (as already shown in 2.3.2.2).

(109) Proof of Claim 3:

a. $S'' = \text{EXH}\ [Alt(S')][S']$

b. $\equiv \exists x \in D.P(x) \wedge \bigwedge\{\neg(\exists x \in D'.P(x) \wedge \neg\exists x \in D\backslash D'.P(x)) | D' \subset D\}$

c. $\equiv \exists x \in D.P(x) \wedge \bigwedge\{\neg\exists x \in D'.P(x) \vee \exists x \in D\backslash D'.P(x) | D' \subset D\}$

d. $\equiv \exists x \in D.P(x) \wedge \bigwedge\{\exists x \in D'.P(x) \rightarrow \exists x \in D\backslash D'.P(x) | D' \subset D\}$

e. $\equiv \exists x \in D.P(x) \wedge \bigwedge\{\exists x \in D'.P(x) \leftrightarrow \exists x \in D\backslash D'.P(x) | D' \subset D\}$

(because $\exists x \in D\backslash D'.P(x) \rightarrow \exists x \in D\backslash(D\backslash D').P(x)$, and $D\backslash(D\backslash D') = D'$)

f. $\equiv \forall x \in D.P(x)$

The strengthening from an existential quantifier with subdomain alternatives to a universal quantification is thus derived, for a quantificational domain of any size.

CHAPTER 3

Scaleless implicatures with modals, and the nature of scalar alternatives

3.1 Introduction

In this chapter, I present a number of specific analyses of 14 root modals from different languages as SLI triggers of four types, varying along two dimensions: possibility or necessity; obligatory or optional. The first part of this chapter provides evidence for these analyses from the items' behavior in characteristic environments. The second part of the chapter shows empirical evidence of a correlate between the SLI type (obligatory vs optional) and the presence of a scalemate in the lexicon of the language. Given that the difference between obligatory and optional SLI triggers is the presence of a scalemate, this type of data will reveal concrete evidence on what scalar alternatives can look like and how they are constrained.

3.1.1 Overview of the chapter

In section 3.2, I give data on 14 items from 7 languages. These items will all be analyzed as SLI triggers, which will be either "obligatory" or "optional", and either possibility or necessity. I list the items below.

(110) a. (i) Possibility obligatory: Ecuadorian Siona *ba'iji*, contemporary Slovenian *moči*, French *avoir (à)*

(ii) Possibility optional: Swedish *få*, obsolete Slovenian *moči*

b. (i) Necessity obligatory: French *falloir*, Spanish *deber*, English *must*, Ewe *ele be*

(ii) Necessity optional: French *devoir*, Spanish *tener que* and *haber que*, Russian *nužno* and *nado*

These four types of modals will follow the characteristic patterns described in Chapter 2, in addition to a new case which I will argue in Chapter 4 is relevant to diagnosing SLI triggering modals, namely when the modal is marked by the perfective.

The full pattern for each type of SLI trigger is summarized in Table 3.1 (there are additional scalar implicatures that I skip here for simplicity reasons).

SLI trigger		unembedded	under local negation	under clausemate non-UE operator	perfective
Possibility	obligatory	$\Box$	$\Diamond$	$\Box$ or $\Diamond$	$\Diamond$
	optional	$\Box$ or $\Diamond$	$\Diamond$	$\Box$ or $\Diamond$	$\Diamond$
Negated necessity	obligatory	$\Box\neg$	$\neg\Box$	$\Box\neg$ or $\neg\Box$	$\neg\Box$
	optional	$\Box\neg$ or $\neg\Box$	$\neg\Box$	$\Box\neg$ or $\neg\Box$	$\neg\Box$

Table 3.1: An overview of the distribution of each type of SLI trigger in characteristic environments

I also discuss additional predictions of the SLI analysis, as well as the diachrony of certain SLI triggers.

In section 3.3, I formulate a proposal on the nature of scalar alternatives by looking at the potential scalemates of each of the SLI triggers analyzed in section 3, and discuss scalar and

SLI trigger		potential scalemate	semantics	syntax	other
obligatory	*ba'iji*	∅			
	moči	*morati*	=	=	infrequent
	·	*treba*	=	≠	
	avoir (à)	*devoir*	=	≠	
	falloir	*pouvoir*	=	≠	
	·	*être possible de*	=	=	*ê.p.d.* not in lexicon
	ele be	*ateŋu*	≠	≠	
	·	*moɖeɖe le be*	≠	=	
	deber	*poder*	≠	=	
	must	*can*	≠	=	
	·	*may*	⊃	=	
optional	†*moči*	*morati*	=	=	*morati* PPI
	få	*behöva*	⊂	=	
	devoir	*pouvoir*	=	=	
	tener que	*poder*	=	=	*t.q.* in lexicon
	haber que	*se-poder*	=	=	*h.q.* in lexicon
	nužno, *nado*	*možno*	=	=	*možno* PPI

Table 3.2: Comparing properties of SLI triggering modals and their potential scalemates

subdomain alternative projection more generally. In particular, I compare each SLI trigger and its potential scalemates, by checking whether they behave alike along a number of syntactic and semantic properties. I give a summary of my findings in Table 3.2.

The table reveals that all of the obligatory SLI triggers have at least one difference in a syntactic or semantic property with potential scalemates found in the language. In contrast, all the optional SLI triggers essentially match in the relevant properties; when they don't, stipulations can be made for certain properties to not matter for scalematehood, in a consistent way. Based on this data, I propose a definition of scalar alternatives that allows to account for the obligatory vs optional behavior of SLI triggers as fully depending on the presence of an appropriate scalemate in the language.

I then argue for a hybrid theory of scalar alternatives, where some are derived at the level of the word, and some at the level of the clause. I also argue for how SLI triggers are lexically specified to be so, i.e. to project subdomain alternatives. These facts are integrated into a theory of alternatives for expressions containing quantifiers.

3.1.2 Why look for scaleless implicatures among modals

Modals are a good place to look for scaleless implicatures. First of all, many have the potential to be SLI triggers: among root modals, analyzed as originating below sentential negation in the clausal spine, we find many (apparent) necessity modals, which appear to have a neg-raising property (De Haan, 1997; Iatridou and Zeijlstra, 2013, 2010). This stands in contrast with root possibility modals, which never take wide scope with respect to sentential negation, and therefore suggests that scope-taking of root necessity modals by interpretable movement is not freely available (in contrast, as is largely assumed, with nominal quantifiers, which can raise freely to produce inverse scope interpretations). In fact, I argue in Chapter 5 (section 5.3) that modals never undergo any interpretable syntactic movement, calling for other ways of explaining the available wide scope interpretations. The rigid narrow scope of modals has a relevant consequence: if inverse scope interpretations of modals are at all useful, there may be functional pressure to utilize non-syntactic ways of achieving this wide scope, like SLIs, in contrast with nominal quantifiers, which can generally achieve that scope by movement.

Moreover, modals display unusually high complexity and diversity in their morphosyntactic behavior and semantic properties. This will provide a very rich working ground to investigate the nature of scalar alternatives, as detailed in the section below.

3.1.3 Background assumptions on modal semantics and syntax

3.1.3.1 Semantics of modals

Modal expressions like *can*, *should*, *must* reflect reasoning over ways the world could be. When we talk about how the world could be according to what we know, we use an epistemic modal. If we want to talk about how the world could be according to an ideal following a particular set of rules, we use a deontic modal. Modals also express ability, desires (bouletic), goals (teleological), among other non-actual ways of representing the world. Modals in English and many other languages generally range across these different flavors of modality, which suggests a common core to these meanings.

Possible world semantics offers a framework to represent modal meanings in a unified way, in which non-actual representation of the world are taken to be linguistic objects (possible worlds) that can enter in different kinds of "accessibility" relations with respect to the actual world (Kripke, 1972; Kratzer, 1981, 1991 a.o.). Being able to characterize possible worlds as accessible in particular ways allows us to quantify over sets of them. In Kratzer's modal semantics, possibility modals are taken to be existential quantifiers over accessible worlds, while necessity modals are universal quantifiers.

According to Kratzer, the set of accessible worlds is determined according to two conversational backgrounds, a modal base $f(w)$ and an ordering source $g(w)$ – these are contextually supplied, and sometimes lexically restricted. Together, they determine the flavor of the modal, thus allowing for a unified characterization of a modal across its different flavors. In Kratzer's original work, there are two types of modal bases, separating two classes of modals: epistemic and circumstantial modal bases. An epistemic modal base picks out the set of worlds compatible with the speaker's knowledge in w, and a circumstantial modal base corresponds to a set of worlds in which certain relevant facts about w hold. The ordering source $g(w)$ imposes an ordering $\leq_{g(w)}$ on this set of worlds given what is "better" according to some standard of evaluation, e.g. a set of rules (for deontic modals). It does so by providing the set of propositions that constitute these rules and orders worlds according to how many propositions provided by g hold in those worlds. For simplicity, I skip the details of Kratzer's original formulation and adopt the Limit Assumption (Stalnaker, 1968; Kaufmann, 2017), that states that we can always identify the best worlds at the intersection of the modal base $f(w)$ according to a particular ordering $\leq_{g(w)}$ – we write $\text{BEST}(\cap f(w))(g(w))$ (Portner, 2009). We can now provide Kratzerian definitions for a possibility modal POSS, e.g. *can*, and a necessity modal NEC, e.g. *must*.

(111) a. $[\![\text{POSS}]\!]^{w,f,g} = \lambda p.\exists w' \in \text{BEST}(\cap f(w))(g(w)).p(w') = 1$

b. $[\![\text{NEC}]\!]^{w,f,g} = \lambda p.\forall w' \in \text{BEST}(\cap f(w))(g(w)).p(w') = 1$

For the purposes of applying a scaleless implicature analysis to possibility and necessity modals, a determining fact is that they correspond to existential and universal quantification. This licenses their duality and entailment relation between each other, necessary to analyze the strengthening from possibility to necessity, and from negated necessity to negated possibility.[1]

Authors do not agree on the exhaustive list of flavors a modal can take. On the one hand, there are epistemic modals that are generally not divided among more classes. On the other, there are root modals, among which we find pure circumstantial, ability, bouletic, teleological, deontic, alethic.

(112)
a. Hydrangeas can grow here. — circumstantial ◊, no subject
b. If dropped, the apple has to fall. — circumstantial □, no subject (physical necessity)
c. Christina can climb the tree. — circumstantial ◊, with subject (ability)
d. Christina has to sneeze. — circumstantial □, with subject (bodily need)
e. (A: I want ice cream.) B: You can go to the store. — bouletic/teleological ◊
f. Josh has to go running. — bouletic/teleological □
g. To go to Harlem, you can/have to take the A train. — teleological ◊/□
h. We can go into this store without a mask. — deontic ◊
i. Employees have to wash their hands. — deontic □
j. A triangle can have equal sides. — alethic ◊ (logical possibility)
k. 2+2 has to equal 4. — alethic □ (logical necessity)
l. The lights are on, Jeff might/has to be at home. — epistemic ◊/□

Some distinctions are debated. Ability modals are often taken to be pure circumstantial modals, but about a particular person. So arguably, the difference between them is not the ordering source but the argument structure. Alethic modals are arguably also simple circumstantial modals. Bouletic and teleological modals both have to do with desires and goals, and they need not be seen as separate flavors. For ease of data collection, I don't attempt to identify bouletic modals,

[1]Note that in the extension section 6.2.2, I present a semantics of modality which uses the same Kratzerian set of worlds but does not (directly) quantify over them.

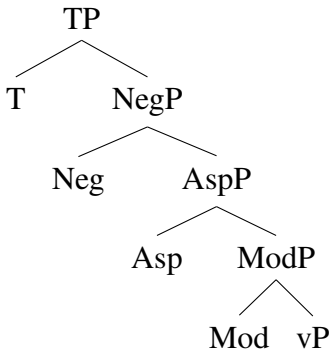
and instead only look at teleological ones. When doing fieldwork on bouletic modals, one has to create a context in which there is an explicitly stated goal anyways – in which case there is no real difference between bouletic and teleological modals. There are a few cases of bouletics that are not obviously teleological, e.g. "I have to have chocolate"– but these seem to be understood as metaphorically circumstantial (as a bodily need).

When reviewing modal flavors, I will systematically look at pure circumstantial, teleological, deontic and epistemic. I will mention others if appropriate.

3.1.3.2 Syntax of modals

In this section I lay out the syntactic assumptions necessary to make the case that the root modals presented in this chapter undergo scaleless implicatures. These assumptions will then be argued for in Chapter 5. I assume that non-epistemic modals, also known as "root" modals, occupy a fixed position in the syntax, below viewpoint aspect and above the vP.

(113)



I take all root modality to scope relatively low among the elements above the vP, namely below aspect and negation. The assumption that root modality obligatorily scopes below negation, and stays there, is crucial for diagnosing a scaleless implicature analysis. If necessity modals had the option of merging above negation, their wide scope could simply be explained in that way.

3.1.4 On the data collection

This chapter contains data from many languages, and my methods for data collection were varied.

3.1.4.1 French, Spanish, English

I collected data from my own native/heritage languages, which are French (standard French), English (standard American) and Spanish (standard Chilean). Data from these languages was initially collected through introspective judgments, then checked with at least one other speaker. In cases of subtle data, or variation, other native speakers were consulted. When appropriate, especially in cases where an expression was ambiguous, I used corpora (google, or specifically designed corpora of spoken speech); I note the source of these cases when they come up.

3.1.4.2 Ecuadorian Siona

Ecuadorian Siona is an autochthonous language spoken in 6 communities in the Sucumbíos province, in the Eastern jungle region of Ecuador. It is in the Western Tucanoan branch of the Tucanoan family. It is in close contact with its dialectal variant Sekoya, and is further related to Columbian Siona. It is highly endangered, spoken by around 300 speakers (sources vary; I report the most recent calculations by Martine Bruil, p.c.). There are varying degrees of vitality across villages: only in Sototsiaya (about 100 people) is the language transmitted to children, who are largely monolingual before going to school. The main descriptive and theoretical linguistic work on Ecuadorian Siona can be found in a dissertation by Martine Bruil (2014).

The large majority of the data on Siona is a result of direct elicitation with Siona speakers, often in collaboration with Justin Case. Spanish is the communication language; most younger speakers we work with learned Spanish in school and use Spanish on a daily basis. The sessions have been conducted during two fieldtrips during the summers of 2018 and 2019, with a large number of speakers of various ages from the community of Sototsiaya, and on video chat and writing from summer 2020 to summer 2021, mostly with two speakers.

3.1.4.3 Slovenian, contemporary and historical

The data on contemporary Slovenian was elicited with primarily one speaker from Ljubljana (31 years old), then checked with 3 other speakers. Relevant data was run through an online questionnaire answered by 27 people.

Data on historical stages of Slovenian was found in historical primary sources (cited on the examples), and in examples cited in Marušič and Žaucer (2016); details are given at the relevant points.

3.1.4.4 Swedish, Ewe, Russian

Data from Swedish, Ewe and Russian was collected by direct communication and by email.

The data from Swedish (standard) primarily comes from one speaker, with subtle data checked with a second. The Ewe data is from the Tongugbe dialect, and was collected from one speaker linguist. The Russian data (Moscow dialect, or equivalent to it in the relevant respects) was elicited from four speaker linguists.

3.2 SLIs with root modals

3.2.1 The type of data to expect in this section

3.2.1.1 Overview

In this chapter, I will give examples of items that trigger SLIs, which will come in two types: "obligatory" and "optional". Among those two types, there will be those analyzed as possibility modals and those analyzed as necessity modals.

These four types of modals will follow the characteristic patterns described and predicted in Chapter 2. In particular, an obligatory SLI trigger shows a strengthened reading when unembedded, unstrengthened reading under a local non-upward-entailing operator, and ambiguous between strengthened and unstrengthened under non-local non-upward-entailing operators. I call "local" an operator is not separated by a TP boundary (the position at which EXH applies) from the SLI

trigger. There are not many operators that can be local: clausemate negation and non-UE low adverbials (such as 'never' and 'rarely'). I assume that subjects can always QR above the TP boundary, and are therefore not necessarily local.

Examples of non-local non-UE operators are of many different types are conditional antecedents, questions, extra-clausal negation, and the restrictor of universal quantifiers and wide scope quantifiers (e.g. of the type *no NP*, *few NP*, *exactly n NP*). I also offer minimal pairs of SLI triggers embedded in UE contexts which do not license lack of obligatory SLIs, where available.

An optional SLI pattern is identical to an obligatory one except in unembedded/UE contexts, where the strengthening behavior is optional (in contrast with obligatory SLIs where it is obligatory).

To this characteristic SLI pattern I add a new environment that will be discussed and analyzed in Chapter 4: the perfective aspect. Whenever the modal can be marked with a dedicated perfective form, no SLI is observed. This SLI blocking by perfective is a useful data point that provides additional independent support for the unification of all these phenomena.

The full pattern for each type of SLI trigger is summarized in Table 6.1.

SLI trigger		unembedded	under local non-UE operator	under non-local non-UE operator	perfective
Possibility	obligatory	$\Box$	$\Diamond$	$\Box$ or $\Diamond$	$\Diamond$
	optional	$\Box$ or $\Diamond \wedge \neg\Box$	$\Diamond$	$\Box$ or $\Diamond$	$\Diamond$
Negated necessity	obligatory	$\Box\neg$	$\neg\Box$	$\Box\neg$ or $\neg\Box$	$\neg\Box$
	optional	$\Box\neg$ or $\neg\Box \wedge \Diamond$	$\neg\Box$	$\Box\neg$ or $\neg\Box$	$\neg\Box$

Table 3.3: Distribution of each type of SLI trigger in characteristic environments, in default contexts

I will present examples from various languages of these items, namely:

(114) a. (i) Possibility obligatory: Siona *ba'iji*, Slovenian *moči*, French *avoir (à)*

(ii) Possibility optional: Swedish *få*, obsolete Slovenian *moči*

b. (i) Necessity obligatory: French *falloir*, Spanish *deber*, English *must*, Ewe *ele be*

(ii) Necessity optional: French *devoir*, Spanish *tener que* and *haber que*, Russian *nužno* and *nado*

3.2.1.2 QUD sensitivity of obligatory SLIs

Obligatory SLIs are generally obligatory in unembedded environments, and in default contexts. However, in virtually all the examples of "obligatory" SLIs, there is an elusively available weak reading. I will show that this weak reading is due to the QUD sensitivity of SLIs, which is in line with the more general observation made in Chapter 2 that implicatures are QUD sensitive.

I will show that a weak reading of an obligatory SLI trigger is only licensed in contexts which makes available an explicit QUD of the type $\{\Diamond, \neg\Diamond\}$ for possibility SLI triggers, or $\{\neg\Box, \Box\}$ for negated universal SLI triggers. Therefore, the obligatoriness of obligatory SLIs is observed in what I call 'QUD-neutral' contexts that make explicit a QUD, i.e. different from the ones mentioned above, or in "out-of-the-blue" contexts (in utterances that initiate a communication between conversation partners; see Bochnak and Matthewson (2020) for a discussion of out-of-the-blue contexts and how they should be used in fieldwork). Out-of-the-blue contexts are designed to be free of explicit QUDs, and therefore weak readings will not be licensed. However, it must also be noted that even in an appropriate context, there is a sense the the weak reading of an obligatory SLI trigger is marked, and alternative expressions are generally preferred.

I show this below, using an explicit question that licenses the weak readings for Siona *ba'iji*, an possibility obligatory SLI trigger, and negated French *falloir*, a necessity obligatory SLI trigger.

I first show that in QUD-neutral contexts, weak readings of *ba'iji* and negated *falloir* are not available.

(115) *Context: We want to get to the other side of the river. I see a way.*

#Tsiaya je'e-ñe ba-'i-ji. De'o-ji.
river cross-INF be-IPF-NONASRT good-3s

a. *int.* We can cross the river. This is good.

b. We must cross the river. This is good.

(116) a. Il ne faut pas porter de masque dehors. #Mais on peut si l'on veut.
it neg must neg wear of mask outside but we can if we want
'We must not wear a mask outside'.

int. 'We don't have to wear a mask outside. But we can if we want.'[2]

However, when a question of the type $\{\Diamond, \neg\Diamond\}$ is explicitly asked, *ba'iji* can be interpreted as a possibility. Similarly, when a question of the type $\{\neg\Box, \Box\}$ is explicitly asked, the narrow scope reading of *falloir* is licensed.

(117) *Context: A and B want to get to the other side of the river.*

A: Tsiaya je'e-ñe ba-'i-quë?
river cross-INF be-IPF-NONASRT
'Can we cross the river?'

B: (Tsiaya je'e-ñe) ba-'i-ji.
river cross-INF be-IPF-NONASRT
(Yes), we can cross the river.[3]

(118) a. Faut-il porter un masque dehors?
must.it wear a mask outside
'Must we wear a mask outside?'

b. – Non, il ne faut pas porter de masque dehors, mais tu peux si tu préfères.
no it neg must neg wear of mask outside but you can if you prefer.
'No, we don't have to wear a mask outside, but you can if you prefer'.

It must be noted that while the weak reading is available in such contexts, it is still relatively marked.

A question arises about the difference between obligatory and optional universal SLI triggers, which differ exclusively in their behavior in out-of-the-blue contexts. The weak reading of

[2]I use the abbreviation '*int.*' to mean 'intended meaning' (when that meaning is not made available by the utterance).

[3]Note: The most natural response here would involve ellipsis. However, 'yes' and 'no' answers to polar questions in Siona always use the positive or negative versions of the verbs. Therefore, there is a potential confound, in which a bare *ba'iji* would only import the meaning of 'yes', and not the entire modal meaning. A complete sentence removes that confound.

optional universal SLI triggers corresponds to $\neg\Box$, i.e. a wide scope negation sentence. Wide scope negation sentences have been argued to be pragmatically marked and associated with higher processing costs in comprehension (Wason, 1961; Clark and Chase, 1972; Xiang et al., 2020; Tian et al., 2010 a.m.o), in particular when uttered out of the blue. Several proposals argue that this effect is due to a contextual requirement, which can remove markedness and some of the processing cost. For example, a negative sentence has been argued to carry a requirement that its affirmative counterpart is expected (Wason, 1961; Horn, 1989; Givón, 2014). Another type of proposal claims that a sentence of the form $\neg p$ presupposes a QUD of the type $\{p, \neg p\}$ (Nordmeyer and Frank, 2015; Xiang et al., 2020). Going back to negated modal utterances, this means that any utterance of the type $\neg\Box p$ will be answering a QUD of the type $\{\Box p, \neg\Box p\}$. How then do we differentiate between the weak readings of an obligatory and optional universal SLI trigger?

Following the QUD-based proposal for the pragmatic requirements of negation, I will argue that the difference between them lies in whether this expectation can be accommodated or not, in contexts in which a QUD is not made explicit: for an optional SLI trigger, a QUD of the type $\{\Box p, \neg\Box p\}$ is naturally accommodated, while for an obligatory SLI trigger, it is not. This can be explained by the fact that negated sentences in general, while pragmatically marked, can trigger the accommodation of the QUD, which nevertheless allows them to be felicitous in an out-of-the-blue context. Optional SLI triggers, in which no pruning of a scalar alternative has occurred, will be of that type. In contrast, obligatory SLI triggers require an explicit QUD in the first place to prune the subdomain alternatives. An out-of-the-blue context provides no explicit QUD, therefore no pruning will occur, making the weak reading unavailable altogether.

I show this in the contrast between obligatory SLI triggers *deber* and *falloir*, and optional SLI triggers *tener que* and *devoir*.

(119) *Context: the speaker just unexpectedly learns that they can take the day off if they want. They go and tell their partner.*

Intended utterance for the next 4 examples: 'I don't have to work today. But they let me go to the office if I want to keep working.'

a. Obligatory SLI triggers:

(i) #**No debo** trabajar hoydía. Pero me dejan ir a la oficina si quiero
neg must work today but 1s.dat let go to the office if want.1s
seguir trabajando.
keep working

(ii) #Il **ne faut pas** que je travaille aujourd'hui. Mais ils me laissent aller
it neg must neg that 1s work today but they 1s.dat let go
au bureau si je veux continuer à travailler.
to.the office if 1s want keep to work

b. Optional SLI triggers:

(i) **No tengo que** trabajar hoydía. Pero me dejan ir a la oficina si quiero
neg must that work today but 1s.dat let go to the office if want.1s
seguir trabajando.
keep working

(ii) Je **ne dois pas** travailler aujourd'hui. Mais ils me laissent aller au
1s neg must neg work today but they 1s.dat let go to
bureau si je veux continuer à travailler.
the office if want.1s keep to work

In these contexts, there is no initial QUD, but one that can easily be accommodated using the continuations. However, this accommodation process is only possible with optional SLI triggers.

We also have to show that obligatory SLI triggers are available in out-of-the-blue contexts at all (with their strong reading). Furthermore, optional SLI triggers are as well, and the strong reading is available.

(120) *Context: The speaker feels sick and determines they shouldn't work. They go and tell their partner.*

a. No debo trabajar hoydía. Me siento mal.
neg must work today 1s.dat feel bad
'I shouldn't work today. I feel sick.'

b. (?)No tengo que trabajar hoydía. Me siento mal.
neg must that work today I feel sick.
'I don't have to work today. I feel sick.'

(121) *Same context.*

a. Il ne faut pas que je travaille aujourd'hui. Je me sens mal.
it neg must neg that 1s work today 1s dat.1s feel bad
'I shouldn't work today, I feel sick.'

b. (?)Je ne dois pas travailler aujourd'hui. Je me sens mal.
1s neg must neg work today I dat.1s feel bad
'I shouldn't work today, I feel sick.'

Note: optional SLI triggers appear marked in their strong reading in these out-of-the-blue contexts. This is expected, if they are a result of pruning the scalar alternative. However, this out-of-the-blue strong reading for optional SLI triggers does not seem as unavailable as the weak reading for obligatory SLI triggers. Additional evidence, for example from experimental work, is needed to confirm whether there is a difference, and also how it compares with the markedness of the cancellation of a typical scalar implicature in an out-of-the-blue context. However, if this difference is indeed present, I propose that it is due to the difficulty of accommodating a QUD from a weak reading (i.e. where all alternatives have been pruned), compared to a maximally strong reading (i.e. where only the scalar, but not the subdomain alternatives have been pruned).

When I present the data for various SLI triggers, I will control for QUD-neutral contexts when showing the obligatory or optional behavior, without systematically showing weak readings of obligatory SLI triggers in contexts with QUDs licensing them.

3.2.1.3 The 'evaluation' test to diagnose root modal force

In this section, I will present a type of test for diagnosing the force of a modal item, and/or its scope with respect to negation, which I use to elicit the apparent force or scope interpretation of modals throughout this chapter. It is also a test that should be useful more generally for fieldworkers working on modal force.

This test consists in specifying the subject's attitude towards a deontic, teleological or pure circumstantial modal utterance. In particular, a negative evaluation (e.g. 'sad') will generally be infelicitous of a possibility utterance, but felicitous of a necessity utterance. The opposite pattern is also observed: a positive evaluation (e.g. 'happy') will generally be felicitous of a possibility

utterance, but infelicitous of a necessity utterance. This fact comes from the assumption that humans like to have the choice – expressed by root possibility, and dislike being constrained or forced into a situation – expressed by root necessity.

I show this below for deontic and teleological modals (unambiguously possibility and necessity).

(122) a. Rachel is allowed to go out, she is happy.
b. #Rachel is allowed to go out, she is sad.

(123) a. Rachel can take a train to go to Milan, she is happy.
b. #Rachel can take a train to go to Milan, she is sad.

(124) a. Rachel is required to go out, she is sad.
b. #Rachel is required to go out, she is happy.

(125) a. Rachel has to take a train to go to Milan, she is happy.
b. #Rachel HAS TO take a train to go to Milan, she is sad.

Note that the example in (125b) is less clear with neutral information. In particular, if the focus of the sentence is on 'train' or 'milan', the sentence is fine; instead, if the focus is on 'has to', the sentence is bad. This suggests that this test works if the modal is not backgrounded information, which makes sense if this test relies on the evaluation of the modal itself.

In the presence of (wide scope) negation, the evaluation of the modal utterance is flipped.

(126) a. Rachel is not allowed to go out, she is sad.
b. #Rachel is not allowed to go out, she is happy.

(127) a. Rachel is not required to go out, she is happy.
b. #Rachel is not required to go out, she is sad.

The felicity conditions of the wide scope of a necessity modal with respect to negation are simply those of a necessity modal with a negated prejacent (or, equivalently, to those of a negated possibility modal). I show this below.

(128) a. Rachel is required to not go out, she is sad.

b. #Rachel is required to not go out, she is happy.

Note that root possibility and necessity modals can also be compatible with a neutral prejacent and evaluation of the modal utterance. What makes the test work is the general incompatibility of possibility modals with negative evaluation of them, and of necessity modals with a positive evaluation of them. This is a test I will often use when

This observed pattern is tightly related to another property often distinguishing possibility and necessity utterances: the desirability of the prejacent of the utterance. In particular, a root possibility reading is generally licensed in contexts in which the prejacent is desirable, and not licensed by a context which makes the prejacent undesirable. A root necessity modal shows the opposite pattern: it is generally licensed in contexts which make the prejacent undesirable, and not in contexts which make it desirable. Dieuleveut et al. (in prep) show that corpus work supports a correlation between the prejacent's (un)desirability and the force of the modal.

We can see contrasts in the following minimal pairs between desirable and undesirable prejacents (under standard desirability conditions), for permission and obligation modals.

(129) a. Rachel is allowed to have a cookie.

b. ??Rachel is allowed to pay the fine.

(130) a. Rachel is required to pay the fine.

b. ??Rachel is required to have a cookie.

Note that mixing the two tests can muddy the waters, in particular because if information structure is not explicit, the evaluation can easily shift to the prejacent, especially in necessity sentences with a desirable prejacent (where the happiness comes from the possibility of actualizing

the prejacent, compatible with both possibility and necessity modals). Again, making information structure explicit does affect felicity as expected.

(131) a. Rachel is required to HAVE A COOKIE, she is happy.

b. ?Rachel is REQUIRED to have a cookie, she is happy.

The examples given in this section are constructed in a way that is useful to diagnosing obligatory SLI triggers. In other words, these examples can be uttered in out-of-the-blue contexts, which do not make available a QUD that would license the weak reading of the obligatory SLI trigger. This explains the choice of placing the evaluation *after* the modal sentence: if placed before, it could favor the introduction of a QUD that would affect the available readings of the obligatory SLI trigger. I show with French *falloir* that the placement indeed can make a difference.

In the following, I will test the effect of the order of the evaluation relative to the modal claim on the available readings of negated *falloir*. I show that when placed before, it licenses the narrow scope of *falloir*, presumably helping the accommodation of the QUD $\{\Box,\neg\Box\}$. However, when placed after the modal claim, it is infelicitous, showing that the QUD cannot be accommodated after EXH has been applied.

(132) a. Je suis contente, il ne faut pas porter de masque ici.
I am happy it neg must neg wear of mask here
'I am happy, we don't have to wear a mask here.'

b. Il ne faut pas porter de masque ici,#je suis contente.
I am happy it neg must neg wear of mask here
(i) *int.* 'We don't have to wear a mask here, I am happy.'

(ii) 'We must not wear a mask here, #I am happy.

3.2.2 Analysis of SLI triggers: a recap

In this section, I recap the analyses of each type of SLI trigger, applied to modals.

Modals are quantifiers, and therefore can be SLI triggers if they have subdomain alternatives. They are obligatory SLI triggers if they don't have a scalar alternative, and optional SLI

triggers if they do. I show sample derivations below for possibility and necessity modals, for triggering both obligatory and optional SLIs.

I have already shown these derivations in Chapter 2 for quantifiers in general; the derivations below serve as a reminder to the reader, and are explicitly applied to the modals from this chapter.

3.2.2.1 Possibility SLI triggers

I will be presenting 5 possibility SLI triggers in this chapter.

3.2.2.1.1 Obligatory possibility SLI triggers The three obligatory SLI triggers among possibility modals are Siona *ba'iji*, contemporary Slovenian *moči* and French *avoir (à)*. I will assume the following derivation for all three. As per section 3.1.3, they are existential quantifiers over their modal base, a set of circumstantially accessible possible worlds, ordered by a contextually supplied, and sometimes lexically restricted ordering source (specific restrictions on ordering sources will be mentioned in the description of each modal). I notate this set as $Acc(w_0)$.

For POSS $\in$ {*ba'iji*, *moči*, *avoir (à)*}, we have the following.

(133) $[\![\text{POSS p}]\!]^{w_0} = \exists w \in Acc(w_0).p(w)$

$[\![\text{POSS p}]\!]^{w_0} = \Diamond_{Acc(w_0)}p$ (simplified notation)

I also assume that POSS has subdomain alternatives, and no scalar alternative. I notate $\text{POSS}_{Acc(w_0)}$p a possibility modal claim whose meaning is an existential quantifier over $Acc(w_0)$.

(134) $Alt(\text{POSS}_{Acc(w_0)}\ \text{p}) = \{\text{POSS}_D\ \text{p} | D \subseteq Acc(w_0)\}$

In other words, POSS has as alternatives existential modal claims over subsets of its modal base.

I now show how SLIs are derived by applying Fox's (2007) EXH, defined in Chapter 2, to a POSS utterance. To illustrate, I assume a toy modal base containing two worlds w_1 and w_2. The

same derivation applies to any infinite domain of quantification (which modals always have), as shown in Chapter 2.

We thus have the following. For simplicity of presentation, I treat linguistic expressions and their logical forms as equivalent.

(135) a. $S = \Diamond_{\{w_1,w_2\}}p$

b. $Alt(S) = \{\Diamond_{\{w_1,w_2\}}p,\ \Diamond_{\{w_1\}}p,\ \Diamond_{\{w_2\}}p\}$

Now we will see that a recursive application of EXH to a proposition of the form POSS(p) yields a SLI, i.e. a strengthening of an existential quantification to the equivalent of a universal one.

$\{\Diamond_{\{w_1\}}p\}$ and $\{\Diamond_{\{w_2\}}p\}$ are the maximal sets of alternatives of $Alt(S)$ that can be negated without yielding a contradiction to S. Their intersection is empty. Therefore, no alternative of S is innocently excludable. This means that an initial application of EXH yields no effect on truth conditions, as shown in (136b).

(136) a. $Alt_{IE}(Alt(S)(S)) = \{\Diamond_{\{w_1\}}p\} \cap \{\Diamond_{\{w_2\}}p\} = \varnothing$

b. $S' = \text{EXH}\ [Alt(S)][S] \equiv \Diamond_{\{w_1,w_2\}}p$

At a second EXH application, the SLI is generated. The set of alternatives of the once exhaustified sentence, again generated by the subsets of the modal base, looks like the following in (137).

(137) $Alt(S') = \{\ \text{EXH}\ [Alt(S)][\Diamond_{\{w_1,w_2\}}p]\ ,\ \text{EXH}\ [Alt(S)][\Diamond_{\{w_1\}}p]\ ,\ \text{EXH}\ [Alt(S)][\Diamond_{\{w_2\}}p]\ \}$

$\equiv \{\ \Diamond_{\{w_1,w_2\}}p\ ,\ \Diamond_{\{w_1\}}p \wedge \neg\Diamond_{\{w_2\}}p\ ,\ \Diamond_{\{w_2\}}p \wedge \neg\Diamond_{\{w_1\}}p\ \}$

This set of alternatives contains innocently excludable members, namely $\Diamond_{\{w_1\}}p \wedge \neg\Diamond_{\{w_2\}}p$ and $\Diamond_{\{w_2\}}p \wedge \neg\Diamond_{\{w_1\}}p$. These alternatives amount to saying that the prejacent can be true only in that subset of the modal base, but not in the complement subset.

Applying the exhaustifier to S' thus results in asserting S' and the negation of these two alternatives. In other words, it amounts to saying the the prejacent is true in at least a world of the modal base, but is not true in only any subset of it. Therefore, it must be true in all.

(138) $S'' = \text{EXH}\ [Alt(S')][S']$

$\equiv \Diamond_{\{w_1,w_2\}}p \wedge\ \neg(\Diamond_{\{w_1\}}p \wedge \neg\Diamond_{\{w_2\}}p) \wedge\ \neg(\Diamond_{\{w_2\}}p \wedge \neg\Diamond_{\{w_1\}}p)$

$\equiv \Diamond_{\{w_1,w_2\}}p \wedge (\Diamond_{\{w_1\}}p \leftrightarrow \Diamond_{\{w_2\}}p) \equiv \Box_{\{w_1,w_2\}}p$

The necessity interpretation of POSS is thus derived.

This SLI is obligatory in unembedded and QUD-neutral contexts. Under clausemate negation, it does not arise. In other non-UE contexts, it is optionally derived. When the context makes explicit the QUD $\{\Diamond p, \neg\Diamond p\}$, the subdomain alternatives are pruned, so that the effect of EXH is trivial, and no SLI is derived. If the modal can be perfective-marked, no SLI is triggered, and the interpretation will be possibility. This distribution is a result of the assumptions of where and when EXH can apply, and when alternatives can be pruned – I discuss how in Chapter 2.

3.2.2.1.2 Optional possibility SLI triggers We have two optional possibility SLI triggers, Swedish *få* and obsolete Slovenian *moči*. They are characterized by the fact that they both have a scalar alternative, i.e. a necessity modal (a universal quantifier over the same modal base), in addition to their subdomain alternatives. Their set of alternatives is the only way they differ from their obligatory counterparts from the previous section. I show this below. Let POSS' $\in \{$*få*, †*moči*$\}$; notations carry over from the previous section.

(139) a. $[\![\text{POSS' p}]\!]^{w_0} = \Diamond_{Acc(w_0)}p$

b. $Alt(\text{POSS'}_{Acc(w_0)}\text{p}) = \{\Diamond_D p | D \subseteq Acc(w_0)\} \cup \{\Diamond_{Acc(w_0)}p, \Box_{Acc(w_0)}p\}$

Applying EXH to a POSS' sentence will yield a scalar implicature. This is because the set of IE alternatives at the first round includes the scalar alternative.

(140) $\text{EXH}\ [Alt(\text{POSS'}_{Acc(w_0)}\text{p})][\text{POSS'}_{Acc(w_0)}\text{p}] \equiv \Diamond_{Acc(w_0)}p \wedge \neg\Box_{Acc(w_0)}p$

The scalar alternative can be pruned, in which case the set of alternatives is the same as for obligatory SLI triggers, therefore a SLI is derived after double EXH application (I simplify the notation below to only include the alternatives relevaant to the first EXH application, with the scalar alternative pruned).

(141) EXH EXH $[Alt(\text{POSS'}_{Acc(w_0)}\text{p})\backslash\{\Box_{Acc(w_0)p}\}][\text{POSS'}_{Acc(w_0)}\text{p}] \equiv \Box_{Acc(w_0)p}$

This pruning is licensed by the QUD $\{\Box, \neg\Box\}$.This QUD can be accommodated with no previous context. As a result, in QUD-neutral contexts, both the scalar and the scaleless implicatures are licensed. Just like for obligatory SLI triggers, no implicature is licensed under clausemate negation. In other non-UE contexts, scalar and scaleless implicatures, as well as the lack of implicature, are licensed. And again, if the modal can be perfective-marked, no SLI is triggered, and the interpretation is possibility.

3.2.2.2 Necessity SLI triggers

I will present 9 necessity SLI triggers. When they are negated, their meanings are equivalent to possibility modals over negation, and therefore, the same results as for possibility SLI triggers can be obtained, as shown in Chapter 2. However, in this section, I show the derivations directly for clarity. Notations follow from the previous section.

3.2.2.2.1 Obligatory necessity SLI triggers The obligatory necessity SLI triggers from this chapter are French *falloir*, Spanish *deber*, English *must* (in some dialects) and Ewe *ele be*.

As per section 3.1.3, they are universal quantifiers over their modal base, a set of circumstantially accessible possible worlds, ordered by a contextually supplied and sometimes lexically restricted, ordering source.

For NEC $\in$ {*falloir*, *deber*, *must*$^{\%}$, *ele be*}, we have the following.

(142) $[\![\text{NEC p}]\!]^{w_0} = \forall w \in Acc(w_0).p(w)$

$[\![\text{NEC p}]\!]^{w_0} = \Box_{Acc(w_0)}p$ (simplified notation)

The set of alternatives of SLI triggers contains subdomain alternatives but no scalar alternative.

(143) $Alt(\text{NEC}_{Acc(w_0)}\ \text{p}) = \{\text{NEC}_D\ \text{p} | D \subseteq Acc(w_0)\}$

When unembedded, a NEC sentence is a universal claim, and is therefore maximally strong, and no implicature can be derived from the alternatives of NEC.

Root modals originate below sentential negation. Therefore, a sentential negation outscopes NEC at the LF. A negated universal quantifier is no longer maximally strong, and will trigger a SLI when the quantifier projects subdomain alternatives. I show the derivation below with a simplified modal base with two worlds. Again, it is generalizable to an infinite modal base.

(144) a. $S = \neg\Box_{\{w_1,w_2\}}p$

b. $Alt(S) = \{\neg\Box_{\{w_1,w_2\}}p, \neg\Box_{\{w_1\}}p, \neg\Box_{\{w_2\}}p\}$

At the first application of EXH, there are no IE alternatives, and therefore no truth-conditional effect.

(145) $Alt(S) = \{\neg\Box_{\{w_1,w_2\}}p, \neg\Box_{\{w_1\}}p, \neg\Box_{\{w_2\}}p\}; Alt_{IE}(S) = \varnothing$

(146) $S' = \text{EXH}\ [Alt(S)][S] = \neg\Box_{\{w_1,w_2\}}p$

At the second EXH application, exhaustified subdomain alternatives are IE, which yields strenghtening to a necessity wide scope interpretation.

(147) $Alt(S') = \{\ \text{EXH}[Alt(S)][\neg\Box_{\{w_1,w_2\}}p]\ ,\ \text{EXH}[Alt(S)][\neg\Box_{\{w_1\}}p]\ ,\ \text{EXH}[Alt(S)][\neg\Box_{\{w_2\}}p]\ \}$

$= \{\ \neg\Box_{\{w_1,w_2\}}p\ ,\ \neg\Box_{\{w_1\}}p \wedge \Box_{\{w_2\}}p\ ,\ \neg\Box_{\{w_2\}}p \wedge \Box_{\{w_1\}}p\ \}$

(148) $S'' = \text{EXH}[Alt(S')][S']$

$\equiv \neg\Box_{\{w_1,w_2\}}p \wedge \neg(\neg\Box_{\{w_1\}}p \wedge \Box_{\{w_2\}}p) \wedge \neg(\neg\Box_{\{w_2\}}p \wedge \Box_{\{w_1\}}p)$

$\equiv \neg\Box_{\{w_1,w_2\}}p \wedge (\Box_{\{w_2\}}p \leftrightarrow \Box_{\{w_1\}}p) \equiv \Box_{\{w_1,w_2\}}\neg p$

In unembedded and QUD-neutral contexts, this SLI is obligatory. This negated necessity expression cannot be embedded under clausemate negation, or any non-UE operator that does not allow for a TP boundary in between it and the expression, therefore, embedded SLIs are always possible. This means that under non-UE operators, the interpretation will be ambiguous between a wide and narrow scope interpretation. When the context makes explicit the QUD $\{\neg\Box p, \Box p\}$, the subdomain alternatives are pruned, so that the effect of EXH is trivial, and no SLI is derived. If the modal can be perfective-marked, no SLI is triggered, and the interpretation will be one of narrow scope necessity.

3.2.2.2.2 Optional necessity SLI triggers The optional necessity SLI triggers in this chapter are French *devoir*, Spanish *tener que* and *haber que*, Russian *nužno* and *nado*. They are characterized by the fact that they have a scalar alternative, i.e. a possibility modal (an existential quantifier over the same modal base), in addition to their subdomain alternatives. Let NEC' $\in \{$*devoir*, *tener que*, *haber que*, *nužno*, *nado*$\}$.

(149) a. $[\![\text{not NEC' p}]\!]^{w_0} = \neg\Box_{Acc(w_0)}p$

b. $Alt(\text{not NEC'}_{Acc(w_0)}\text{p}) = \{\neg\Box_D p | D \subseteq Acc(w_0)\} \cup \{\neg\Box_{Acc(w_0)}p, \neg\Diamond_{Acc(w_0)}p\}$

Applying EXH to a negated NEC' sentence will yield a scalar implicature. This is because the set of IE alternatives at the first round includes the scalar alternative.

(150) EXH $[Alt(\text{not NEC'}_{Acc(w_0)}\text{p})][\text{not NEC'}_{Acc(w_0)}\text{p}] \equiv \neg\Box_{Acc(w_0)}p \wedge \Diamond_{Acc(w_0)}p$

The scalar alternative can be pruned, in which case the set of alternatives is the same as for obligatory SLI triggers, therefore a SLI is derived after double EXH application (I simplify the notation below to only include the alternatives relevant to the first EXH, with the scalar alternative pruned).

(151) EXH EXH $[Alt(\text{NEC'}_{Acc(w_0)}\text{p})\backslash\{\Diamond_{Acc(w_0)p}\}][\text{NEC'}_{Acc(w_0)}\text{p}] \equiv \Box_{Acc(w_0)}\neg p$

This pruning is licensed in contexts which make explicit no QUD, but where the relevant QUD $\{\Box\neg, \Diamond\}$ can be accommodated. Therefore in QUD-neutral contexts, both the scalar and the scaleless implicatures are licensed. In non-UE contexts (always separated by a TP boundary, since the sentential negation slot is occupied), embedded scalar and scaleless implicatures, as well as the lack of implicature, are licensed. If the modal can be perfective-marked, no SLI is triggered, and the interpretation is negated necessity.

3.2.3 Obligatorily scaleless existentials

In this section, I give examples of three modals which can receive analyzes as obligatory possibility SLI triggers: Siona *ba'iji*, (contemporary) Slovenian *moči*, and French *avoir (à)*. I show that they follow the pattern expected for obligatory existential SLI triggers: obligatory SLI in unembedded and QUD neutral contexts, no SLI under sentential negation and when perfective-marked, and optional in non-UE contexts.

3.2.3.1 Siona *ba'iji*

In Ecuadorian Siona, we find a root modal, *ba'iji*, that can be analyzed as an existential obligatory SLI trigger.

3.2.3.1.1 The SLI pattern

Unembedded The modal *ba'iji* has necessity readings in unembedded contexts; it is described in Bruil (2014) as a deontic necessity modal, based on evidence from spontaneous speech and recorded stories. Bruil cites the following example from a corpus.[4]

[4]In all Siona examples, I use the used orthography, which follows IPA symbols except for the following cases: y = [ʤ], j = [h], ' = [ʔ], ë = [ɨ], ñ = [ɲ], V̲ = [Ṽ]. Glossing abbreviations are standard. Non-standard glosses include NONASRT for 'non-assertive'; SS is for the 'same subject' marker in the switch reference system. For most glosses, I ignore some information, in particular assertive clause-typing and present tense.

(152) Ja̲-ë̲-bi tsoa-ye **ba-'i-ji.**
DEM.DST-CLS:ANIM.M-SBJ wash-CLS:GEN be-IPF-3S.M.PRS.ASRT
He has to wash something. (Bruil, 2014 p.217)[5]

The modal *ba'iji* is formed from the impersonal existential copular construction, i.e. the equivalent of 'there is', followed by a clause marked by what Bruil glosses here as CLS:GEN, to refer to 'general classifier'; she also glosses it as 'infinitive' in other places. It is a non-finite verbal marking that applies to an entire vP, including the subject (which is often implicit because of the availability of pro-drop). I will refer to it as infinitive in the rest of this section. The copula in Siona is pronounced 'ba' – the form 'ba'iji' is formed from the imperfective form of the copula, marked with the 3rd singular 'assertive' clause marking ('assertive' is Bruil (2014)'s terminology, which marks utterances). The modal meaning is also found in other clause types, marked by 'non-assertive' morphology, which we will see used in questions (it is also used for reportative and conjectural utterances).

(153) (Yë'ë/Më'ë) sai-ye **ba-'i-ji.**
(1/2S.NOM) go-INF be-IPF-3S
'I/You must go.' (literally, 'there is (for me/you) to go')

This expression contrasts with the possibility expression expressed with *de'oji*, formed from the expression 'it is good', followed by an infinitival clause.

(154) (Yë'ë/Më'ë) sai-ye **de'o-ji.**
(1/2S.NOM) go-INF good-3S
'I/You can go.' (literally, 'it is good (for me/you) to go')

The uncontextualized data above correspond to speakers' translations of *ba'iji* and *de'oji* in simple, unembedded environments, from Siona to Spanish and vice versa.

I first show that *ba'iji* is compatible with a necessity interpretation.

[5]See glossing conventions for this example in Bruil (2014).

(155) *Context: San Pablo is on the other side of the river. A asks a stranger, B, how to get there.*

A: Me ti'añe de'o-quë-ni San Pablo?
how find.INF good-CLS:AN.M-Q San Pablo
'How does one get to San Pablo?'

B: Tsiaya-jã'ã je'e-ñe-je **ba-'i-ji.**
river-PATH cross-INF-? be-IPF-ASRT
'One has to cross the river.' (□).

Unembedded *ba'iji*, when uttered out of the blue, is not compatible with a prejacent favoring a possibility interpretation.

(156) *Context: we're going back to the village. I see a path, I wonder where it goes.*

a. #Iye ma'a-jã'ã ti'añe ba-'i-ji colegio-na... Jare iye ma'aja cuine-je
there path-PATH get be-ipf-3s school-GOAL… that this path-OBL also-ADD
ba-'i-ji ti'añe gaaëyohueña.
be-ipf-3s get soccer.field
#'On this path you have to get to the school... And on this same path you have to also get to the soccer field.'

b. Iye ma'a-ja ti'añe de'o-ji colegio-na... Jare iye ma'a-ja cuine-je
this path-PAATH get good-3s school-GOAL… there this path-OBL also-ADD
de'o-ji ti'añe gaaëyohueña.
good-3s get soccer.field
'On this path you can get to the school... And on this same path you can also get to the soccer field.'

(157) *Context: I meet my friends after three days of stomach ache during which I can't eat. Finally now I can eat.*

a. #Dehue ao aiñe **ba-'i-ji.**
finally food eat.inf be-ipf-3s
'Finally I have to eat.'

b. Dehue ao aiñe **de'o-ji.**
finally food eat.inf good-3s
'Finally I can eat.'

Two *ba'iji* statements whose prejacents are contradictory uttered one after the other are also contradictory, as shown in (158). Crucially, the infelicity of this sequence of statements contrasts with the felicity of a parallel construction with possibility modal *de'oji*, as shown in (158b).

(158) *Context: you have the option to stay or go.*

a. #Sai-ye **ba-'i-ji,** bëa-ye **ba-'i-ji.**
go-INF be-IPF-3S, stay-INF be-IPF-3S.
'You must go, you must stay.' (*int.* you can go, you can stay)

b. Sai-ye **de'o-ji,** bëa-ye **de'o-ji.**
go-INF good-3S stay-INF good-3S
'You can go, you can stay.'

Under negation A *ba'iji* utterance can be negated, by using a negated version of the copula *beoji*. The only reading available is a prohibition reading (a wide scope necessity, or narrow scope possibility).

(159) Sai-ye **beo-ji.**
go-INF NEG.be-3S
'We mustn't go.' ($\Box\neg$)

* 'We don't have to go.' ($*\neg\Box$)

(160) #Tsoaye **beo-ji,** ai sihuayë.
wash-inf neg.cop-3s very happy.1s
int. I don't have to wash, I am very happy.

#I must not wash, I am very happy.

If Siona is like most languages, its root modal scopes below negation. An additional argument specific to this construction comes from the fact that the copular construction, from which *ba'iji* is formed, more generally scopes below negation, as shown in (161).

(161) *Context: We are in the middle of a soccer field.*

Soquëñë **beo-ji.**
tree NEG.be-3S

a. 'There aren't any trees.' ($\neg\exists x.P(x)$)

b. #'There is something that is not a tree.' ($\exists x.\neg P(x)$)[6]

Thus, if *ba'iji* were a necessity modal, we would expect the 'not have to' reading ($\neg\Box$) to arise. However, this is not what we observe. Analyzing *ba'iji* as a SLI-triggering possibility modal solves the problem. Evidence for clear possibility readings in other contexts supports that analysis.

In other non-upward-entailing contexts In non-upward-entailing contexts, such as antecedents of conditionals, extra-clausal negation, and questions, *ba'iji* can be interpreted either as a possibility modal, or a necessity modal.

We can see that in a conditional antecedent, in a context that pragmatically forces a possibility reading for *ba'iji* (by making the prejacent desirable), the sentence is felicitous.

(162) *Context: I am waiting to see if there is going to be a spot for me in the boat. My friend asks me if I want to go.*

a. – Më'ë sai-ye yë-quë?
you go-INF want-NONASRT.2S.M
'Do you want to go?'

b. – Yë-yë. Sai-ye **ba-'i-to**, sa-si-'i.
want-1S go-INF be-IPF-COND go-FUT-OTH
'Yes. If I can (#must) go, I will go.'

[6]Note: this reading is unavailable in this context, but might be available in another.

(i) *Context: we are in the middle of the forest. I see something, I do not know what it is, but I know it is not a tree.*

So̲quëñë **beo-ji.**
tree NEG.be-3S

a. #'There aren't any trees.' ($\neg\exists x.P(x)$)
b. 'It is not a tree.' ?($\exists x.\neg P(x)$)

However, it is unclear whether this LF is due to the wide scope of the existential quantifier. It could very plausibly be analyzed as a silent (pro-dropped) referential third person pronoun scoping below negation.

Whether or not the wide scope LF is available does not matter for the problem raised by the clear availability of its narrow scope, and what that entails for the modal construction.

Minimally changing the context to force a necessity reading in the same string (by making the prejacent undesirable), we can see that *ba'iji* can be interpreted with universal force.

(163) a. – Më'ë sai-ye yë-quë?
you go-INF want-NONASRT.2S.M
'Do you want to go?'

b. – Coe-yë. Sai-ye **ba-'i-to**, sa-si-'i.
neg.want-1S go-INF be-IPF-COND go-FUT-OTH
'No. But if I must go, I will go.'

Below is another example of a possibility meaning in a conditional antecedent.

(164) *Context: real world context, there is a pandemic and borders are closed; I am communicating with my Siona friends online eliciting judgments, and I say:*

Sai-ye **ba-'i-to,** sasi'i ecuardorna.
go-INF be-IPF-COND go ecuador-DAT

'If we can travel, I would like to go to Ecuador.'

Under extra-clausal negation, namely negated *say* (in its non-quotative sense, equivalent to 'claim'),[7] a downward-entailing context, a possibility reading is available, as shown in (165).

(165) *My friend tries to go in the boat without waiting to know whether there is a spot for him. I try to stop him and say:*

Sai-ye **ba-'i-ji** ca-ye ba-huë̲ më'ë-re.
go-INF be-IPF-3S say-INF NEG.be-PST.OTH 2S-OBJ

'He didn't say that you could (#had to) go.'

However, non-negated *say* (in its non-quotative sense), an upward-entailing context, does not license a possibility reading of *ba'iji*.

[7]The verb 'say' is the only verb embedding finite complements in Siona. Evidence from its non-quotative meaning can be found from long-distance dependencies such as wh-extraction from *say*'s embedded clause. [This data is in a notebook not physically with me at the moment.]

(166) *My friend is wondering whether he can go in the boat.*

#Sai-ye **ba-'i-ji** ca-bi më'ë-re.
go-INF be-IPF-3S say-3S.PST 2S-OBJ

'He said that you have to go.'

int. 'He said that you could go.'

A necessity reading is also available for the string in (165), where *ba'iji* is under negated 'say', as shown in (167).

(167) *A child doesn't want to go in the boat. I try to tell him not to worry, that he can stay.*

Sai-ye **ba-'i-ji** ca-ye ba-huë̲ më'ë-re.
go-INF be-IPF-3S say-INF NEG.be-PST.OTH 2S-OBJ

'He didn't say that you had to (#could) go.'

In polar and *wh*-questions, both possibility and necessity interpretations of *ba'iji* are available. In translation tasks between Siona and Spanish, possibility readings of *ba'iji* are freely available in *wh* and polar questions.

(168) *Context: We want to get to the other side of the river.*

Siona to Spanish translation:

a. Tsiaya je'e-ñe **ba-'i-quë?**
river cross-INF be-IPF-NONASRT

b. Hay manera de cruzar el río?
is way of cross the river?
Can we cross the river? [8]

In the opposite translation direction, different consultants asked offered different translations, some with *ba'iji*, others with *de'oji*.

[8]In the Spanish translation of *ba'iji* in questions, in a circumstantial context, speakers often used the Spanish expression 'hay manera', whose literal English translation is closest to 'there is a way', but is better translated as 'it is possible'. This translation is suggestive of the underlying compositional semantics of this expression, which I will talk about in a bit more detail in section 3.2.8.2.

(169) *Context: We want to get to the other side of the river.*

Translation prompt: 'Hay manera de cruzar el río?'

a. Tsiaya je'e-ñe **ba-'i-quë?**
river cross-INF be-IPF-NONASRT

b. Tsiaya je'e-ñe **de'o-quë?**
river cross-INF good-NONASRT

We can also elicit necessity readings in questions. Below is an example, in which crossing the river is made undesirable.

(170) *Context: We want to go see the shaman, but in order to do so we must cross the river by boat. I don't want to.*

Tsiaya je'e-ñe **ba-'i-quë?** Sai-ye coe-yë.
river cross-INF be-IPF-NONASRT go-inf neg.want-1s

'Do we have to cross the river? I don't want to go.'

Below is an example of a possibility reading in a *wh*-question.

(171) *Context: I just arrived in Sototsiaya and I am bored. I ask you:*

Iño que-re yo'o-ye **ba-'i-quë?**
here what-OBJ do-INF be-NONASRT

'What can one do here?'

In (172), I report findings from an elicitation method in which I ask if two sentences can be used to mean the same thing, and compare *ba'iji* and *de'oji* sentences. In unembedded cases, consultants report that the sentences cannot mean the same thing. While in polar and wh-questions, the *ba'iji* and *de'oji* sentences can mean the same thing.[9]

(172) *Prompt: 'Can these two sentences mean the same thing?'* ($\neq$: 'no', $=$: 'yes')

[9]This task on its own is not sufficient to determine possibility readings of *ba'iji*, especially that discourse contexts were not given. I still report the task for its interest in showing the ability of some speakers to compare meanings in this way, and give results consistent with the more standard contextualized elicitation.

a. Sai-ye **de'o-ji.** ≠ Sai-ye **ba-'i-ji.**
go-INF good-3S go-INF be-IPF-3S
'One can go.' ≠ 'One must go.'

b. Sai-ye **de'o-quë**? = Sai-ye **ba-'i-quë**?
go-INF good-NONASRT go-INF be-IPF-NONASRT
'Can I go?'

c. Jero-na sai-ye **de'o-quë**? = Jero-na sai-ye **ba-'i-quë**?
where-GOAAL go-INF good-NONASRT where-GOAL go-INF be-IPF-NONASRT
'Where can I go?'

In conclusion to this section, *ba'iji* is interpreted unambiguously as a necessity modal in unembedded contexts, unambiguously as a possibility under clausemate negation, and is ambiguous between possibility and necessity in other contexts. This pattern is exactly what is expected if *ba'iji* is an existential triggering a scaleless implicature.

3.2.3.1.2 A complication: flavor A complication arises from flavor. Both possibility and necessity readings of *ba'iji* can have pure circumstantial and teleological readings, but possibility *ba'iji* cannot be used in a deontic sense. I first give evidence for this distribution, and then provide a tentative explanation for the extra deontic meanings with necessity *ba'iji*.

Pure circumstantial flavor Circumstantial necessity is generally found for bodily needs, like sneezing, as in the following example.

(173) Co'co **ba-'i-ji.**
sneeze be-IPF-ASRT
I need to sneeze.

Example (169), repeated below, is a good example of circumstantial possibility.

(174) Tsiaya je'e-ñe **ba-'i-quë?**
river cross-INF be-IPF-NONASRT
'Is there a way of crossing the river?'

Teleological flavor Examples with a teleological flavor, with an explicit goal in mind, can be easily constructed, both with necessity and possibility readings. Below is an example with a possibility reading.

(175) *Context: We are walking, and we see two paths. I wonder where they lead.*

Sototsiaya saiye yë-ni iye m'aja saiye **ba-'i-quë**? cuine iye
Sototsiaya go want-COND this path-PATH go be-IPF-NONASRT and this
ma'a-jã'ã saiye **ba-'i-quë**?
path go be-IPF-NONASRT

'If I want to go to Sototsiaya, can I take this path? and (can I take) this path?'

Deontic flavor Deontic readings are attested with the necessity version of *ba'iji*, as well as the negated possibility.

(176) *Context: A child refuses to talk to her father. Her mother obligates her to.*

Më'ë ja'quëre co'ca caye **ba'iji**.
2s father-OBJ word speak cop-ipf-3s

'You have to talk to your father.'

(177) *Context: A child talks badly to his father. His mother scolds him.*

Më'ë ja'quë-re ja̲-je̲ caye **beo-ji**.
2s father-OBJ DEM-like speak NEG.COP-IPF-3S

'You cannot talk to your father like that.'

However, unnegated possibility *ba'iji* cannot receive a deontic reading, in contrast with *de'oji*, that can.

(178) *Context: In school, a child asks the professor to go to the bathroom.*

a. **#Bai-quë** sai-ye coneturihuë-na?
be-nonasrt go-inf bathroom-GOAL
int. Can I go to the bathroom?

b. **Deo-quë** sai-ye coneturihuë-na?
good-nonasrt go-inf bathroom-GOA 1
Can I go to the bathroom?

These examples pose a challenge for the scaleless implicature analysis: if *ba'iji* is an underlying possibility modal that can strengthen to necessity, we would expect it to have the same flavors in its possibility and necessity readings. However, I suggest we can analyze *ba'iji* as a modal that cannot be interpreted deontically at all, but whose deontic meanings can be understood as addressing deontically-relevant goals, for instance the goal of avoiding punishment. However, this appears to be possible only with universal force (including the negated, wide scope universal reading *beoji*), but not existential force, as seen in the following English examples.

(179) a. If you want to avoid getting punished, you must wear a mask indoors.
≈ You are required to wear a mask indoors.

b. If you want to avoid getting punished, you can't enter without a mask.
≈ You are prohibited from entering without a mask.

c. #If you want to avoid getting punished, you can go outdoors without a mask.
$\not\approx$ You are permitted to go outdoors without a mask.

Examples (a) and (b) can clearly express deontic obligation or prohibition, while example (c) cannot express deontic permission. This appears to come from the fact that the prejacent of the teleological modal must be relevant in some way towards achieving the goal. These types of examples are noted in Von Fintel and Iatridou (2005); Condoravdi and Lauer (2016), as conditionals with 'weak consequents', which are 'unremarkably true' (but semantically deviant). If the goal is to avoid punishment, doing something permitted is not enough to achieve this goal. Therefore, if the deontic reading of necessity *ba'iji* is a result of an implicit goal to avoid punishment, then we predict that it is not available for its possibility reading, as is observed in the data. Note that deontic readings are therefore predicted with any teleological modal that expresses a necessity or negated possibility.

3.2.3.2 Contemporary Slovenian *moči*

In this section, I discuss modal *moči* found in many dialects of Slovenian (including standard and Ljubljana dialect). Contemporary *moči* is an obligatory SLI trigger, which shows some evidence of becoming grammaticalized into a full necessity modal.

I argue that contemporary *moči* evolved from an earlier stage of the modal, that I refer to as obsolete *moči*, which I argue was an optional possibility SLI trigger in section 3.2.4.2 until around mid-20th century.

I elicited the data for contemporary *moči* primarily with one native speaker, occasionally checking with some other native speakers. In unembedded contexts, judgments are clear, i.e. *moči* displays a typical neg-raising pattern, which I show below.

Non-negated, *moči* is interpreted as a necessity modal, as seen in (180a), and cannot be interpreted as possibility, as shown in (180b).

(180) a. Tam notri **moremo** nosit maske.
there inside mod.1p wear mask
'We have to wear a mask inside.'

b. #**Mogla** sem it, ampak mi ni bilo treba.
mod.prt aux.1s go but 1s neg cop.past need
(i) *int.* We could go but didn't have to.

(ii) #We had to go but didn't have to.

Under negation, it is unambiguously interpreted as a narrow scope existential, as shown in (181a), and not as a narrow scope universal, as shown in (181b).

(181) a. Tam notri ne **moremo** kadit.
there inside mod.1pl smoke
We are forbidden to smoke in there.

b. #V skladu s pravili ne **morem** it, ampak mi je dovoljeno.
with respect to rules neg mod.1s go but 1s is allowed.
(i) *int.* With respect to the rules, I don't have to go, but I am allowed.

(ii) #With respect to the rules, I can't to go, but I am allowed.

Note that there can be confusion as to the nature of the modal in present tense, where the phonological form of the modal fails to distinguish between *moči* and (formal) necessity modal *morati*. In standard Slovenian, the present inflected forms of *moči* and *morati* sound identical: *more-(m/š/mo/te/jo)* (the orthographic forms of *moči*) and *mora-(m/š/mo/te/jo)* (the orthographic forms of *morati*), are both pronounced as /morə(...)/ (with /ə/ often dropped). In fact, when non-negated, the written form of *moči* is often written as *mora*(...) and confused with *morati*, as per prescriptive rules. However, it becomes clear that the underlyingly nature of the verb is indeed *moči* when inflected for past or future. In the participial forms, used in past and future tenses, *moči* and *morati* verbs diverge phonologically: *mog(e)l-(a/o/i)* for *moči* and *moral-(a/o/i)* for *morati*. In contemporary colloquial speech, the *moči* participial forms follow the SLI pattern. This is why non-negated constructions were all checked in their participial forms to avoid eliciting instances of *morati*.[10]

When embedded in non-upward entailing environments, judgments about the force of *moči* were less clear. A possibility reading was sometimes readily available, but not everywhere. Asking more consultants suggested that there was variation in the judgments. This is why I designed an online questionnaire to elicit possibility readings of *moči* in conditional antecedents and questions.

Questionnaire In the questionnaire, 24 questions were asked, among which 7 controls. Results for 11 target questions are reported here (other questions were for other purposes). Speakers were asked to rate sentences on a Likert scale of 1-5 for their 'naturalness' in everyday speech situations; optional comment boxes were available for each question. In addition, I asked for speakers' age, the region in which they grew up, and the region in which their parents grew up, in order to control for different dialects. I did not consider this a full experiment, and therefore did not randomize questions or varied conditions.

The questionnaire was answered by 27 people. People passed controls if they rated a felicitous control as 4 or 5, and an infelicitous control as 2 or 1. 8 people were removed (7 for failing

[10]Note that *morati* is only used in formal speech, as I show in 3.3.1.2.2, despite it being the only acceptable necessity form in prescriptive grammar. Therefore, if register and prescriptive tendencies could be controlled for, i.e. if the speech were colloquial and uninfluenced by prescriptivism, one could elicit present tense forms as well.

3 or more controls out of 7, and 1 for consistently making prescriptivist comments). The data reported below is therefore from 18 people. I report median, mean and standard deviation from the mean for each question.

I first show data in unembedded and negated contexts, which are expected to elicit unambiguous responses.

(182) Tam notri smo **mogli** nosit maske.
there inside aux.1p mod.prt wear mask
'We had to wear a mask inside.'

(183) #**Mogla** sem it, ampak mi ni bilo treba.
mod.prt aux.1s go but 1s neg cop.past need
int. We could go but didn't have to.

We had to go but didn't have to. median: 2, mean: 2.1, SD: 1

The sentence in (182) unexpectedly received mediocre ratings, i.e. a median of 3 and mean of 3.2. It was expected to be fully accepted, due to its uncontroversially available necessity reading with speakers asked directly. However, this was the first question of the questionnaire, and participants were not familiarized with the task. Therefore I exclude the results and report what I found through direct fieldwork. The sentence in (380) was the second, so the results are probably still be affected by familiarization with the task.

Under negation, *moči* is expected to be unambiguously interpreted as existential, and the ratings confirmed it.

(184) Tam notri nismo **mogli** kadit.
there inside neg.aux.1p mod.pl smoke
We were forbidden to smoke in there. median: 4, mean: 3.9, SD: 1.2

(185) #V skladu s pravili ne **morm** it, ampak mi je dovoljeno.
with respect to rules neg mod.1s go but 1s is allowed.
int. With respect to the rules, I don't have to go, but I am allowed.

#With respect to the rules, I can't to go, but I am allowed. median: 1, mean: 1.7, SD: 0.9

In non-upward-entailing contexts, namely questions and conditional antecedents, the possibility reading of *moči* was sometimes available. I checked sentences compatible with circumstantial and deontic readings.

Below are examples with conditional antecedents.

(186) Če **morem** jaz nest to torbo, lahko kar gremo.
If mod.1s I carry this bag can that go.1sg
If I can carry this bag, I can go. median: 4, mean: 3.7, SD: 1.2

(187) Če **morem** vstopiti brez maske, grem.
if mod.1s go.in without mask go.1s
If I can go in without a mask, I will. median: 2, mean: 2.7, SD: 1.2

(188) Če **moreš**, se odstrani.
if mod.2sg refl remove.
If you can, remove yourself. median: 2, mean: 2.1, SD: 1.1

(189) Če le **moreš**, se odstrani.
if at.all mod.2sg refl remove.
If you can, remove yourself. median: 4, mean: 3.4, SD: 1.5

Below are examples in questions.

(190) A **moremo** zdaj it ven brez maske?
Q mod.1p here go in without mask
Can we go in without a mask? median: 2, mean: 2.7, SD: 1.4

(191) Kako **moreš** tako govoriti? [Marušič and Žaucer (2016)]
what mod thus talk
How can you talk like this? median: 5, mean: 3.4, SD: 1.5

(192) Pa misliš, da **moreš** dvignit to vrečo?
and think.2sg that mod move this bag
Do you think you could carry this bag? median: 3, mean: 3.2, SD: 1.3

The results for these examples are mixed. As an overall tendency, it appears that speakers tend to reject possibility readings in non-upward entailing contexts, but with more variation than

in unembedded contexts (comparing the standard deviations). The example in (191) is generally accepted; this could be due to the fact that it is a fixed expression, therefore the possibility reading remained. However, not all accepted responses had to do with fixed expressions. For example, (186) seemed to be widely accepted. Moreover, (189) is an example in which the NPI particle *le* ('at all') significantly improved the example, suggesting that the possibility reading is indeed there, only it needs some extra support to be accessed. Another result is that deontic examples were rated less high than circumstantial examples, which matches what is said in the literature (e.g. Roeder and Hansen (2007)), that possibility *moči* does not have deontic readings. However, flavor is not the only factor for rejecting the example: example (188) favors a circumstantial reading, but its ratings are comparable to the bad examples in unembedded cases.

Hypothesis: *moči* is being reanalyzed. A SLI trigger is supposed to easily yield optionality between a weak and a strong meaning in non-UE contexts. How can one explain why speakers are resistant to interpreting *moči* as possibility in non-UE contexts?

One hypothesis I pursue is that *moči* is currently in an unstable phase, and being reinterpreted from a SLI trigger to an item ambiguous between a weak PPI necessity modal and a strong NPI possibility modal. I argue for this hypothesis by observing that possibility readings in non-UE contexts (except negation) had several speakers, from in person elicitation and in the comment boxes, report that possibility readings sounded archaic, or that they could imagine their parents saying these sentences. The archaic readings could point to the possibility SLI trigger. Furthermore, the expressions that received the highest ratings with possibility *moči* in non-UE contexts can be seen as semi-fixed expressions. In fact, (Marušič and Žaucer, 2016 p.15) cite several such fixed expressions in which possibility *moči* is found in non-negative contexts; all examples happen to come from non-upward-entailing contexts. I take this as further evidence for the existence of old *moči* as a possibility modal and obligatory SLI trigger, once fully productive.

I asked the speakers to report their age in the questionnaire. Unfortunately, there were mostly speakers in their 20s and 30s, and no speakers were above 60. Three speakers were between 50 and 60, but only one, who is 58, survived filtering. The answers provided by that speaker were

consistent with a hypothesis that 'older' speakers accept more possibility readings: they rated all the non-UE sentences as 4/5, except for (188), rated 1/4. From my direct elicitations, I had one speaker of 73 years old who accepted all of the examples in non-UE contexts.

This grammaticalization path matches the one hypothesized in section 3.2.8.1, where obligatory existential SLI triggers are always quickly reinterpreted as universals as soon as they enter the grammar, in the absence of independent support for them being underlyingly existential. We have independent evidence that *moči* only recently became an obligatory SLI trigger, transiting from an optional one (where unembedded possibility readings of *moči* were still observed up to the mid-20th century), as argued for in section, which gives an analysis for obsolete *moči* in section 3.2.4.2. This means that the obligatory SLI period of *moči* has been in fact very short, and we are possibly observing today the last remnants of its possibility readings (contrasting with the centuries-long period of it being an optional SLI trigger).

Perfective form Other evidence of a SLI-triggering possibility form of *moči* comes from the perfective verb *zmoči*, unambiguously an implicative possibility modal.

(193) ***Z-mogla*** sem dvigniti tega kamna. ... *#but I didn't lift it.*
PF-MOD AUX.1SG lift this stone
I was able to lift this stone, #but I didn't lift it.

*I had to lift this stone.

Zmoči can be morphologically decomposed into *moči* and the perfective-forming prefix *z-*. Only the possibility reading is available. This blocking of SLIs by perfective, yielding an unambiguous weak reading, is observed elsewhere, and expected given the generalization and analysis given in Chapter 4. As *moči* becomes necessity in positive contexts, it is very likely that *zmoči* will retain its unambiguous implicative possibility meaning, and be lexicalized separately from necessity *moči*, despite its original compositional parse. This semantic separation of related verb forms is common in Slavic languages.

3.2.3.3 French *avoir (à)*

In this section, I will argue that French modal expression *avoir (à)* (literally 'have'+'to') is ambiguous between an possibility modal triggering a scaleless implicature, and a necessity modal that doesn't. This modal has received little attention in the literature; this section therefore contributes to the description of the French modal system.

The French data from this section appears to be subject to considerable interspeaker variation. For this reason, each of these judgments were run through at least six speakers, using small questionnaires or direct elicitation. All speakers have the necessity reading of *avoir (à)* (for all examples). One speaker rejects the possibility readings completely, and others (including myself) accept them, often noting their markedness, and sound archaic for two speakers (something their parents would say).

In unembedded contexts, *avoir (à)* only has a necessity reading.

(194) J'***ai*** ***à*** lui parler, # je suis contente.
I'have to pro talk I am happy
I {have to, ***can**} talk to her, #I am happy.

Under negation, it is ambiguous between a possibility and a necessity reading, with a preference for the necessity reading.

(195) Je **n'*ai*** **pas** *à* lui parler ... {je suis contente, je suis triste}.
I neg'have neg to pro talk I am happy I am sad
I don't have to, can't talk to her, I'm happy.
I can't talk to her, I'm sad.

In conditional antecedents, the necessity reading dominates, but the possibility reading is accessible to some speakers.

(196) **Si** j'***ai*** ***à*** lui parler, je serai contente/énervée.
if I'have to pro talk, I be.fut happy/annoyed
If I can talk to her, I will be happy.

If I have to talk to her, I will be annoyed.

In questions, the use of *avoir (à)* seems marginal altogether; to the extent that it is interpretable at all, we get a necessity reading.

(197) {Est-ce que tu as, As-tu, T'as} à lui parler?

Do you have to / can you talk to her?

In the perfective aspect,[11] both necessity and possibility readings are available.

(198) J'ai ***eu*** ***à*** lui parler... {je suis contente, je suis énervée}.
I'have have.pf to pro talk I am happy I am annoyed
I got to talk to her, I am happy.

I had to talk to her, I am annoyed.

The data with *avoir (à)* is not a typical SLI pattern. If we ignore its marginal use in questions in which the possibility reading is not obviously available at all, it does look like *avoir (à)* has the readings of a scaleless implicature trigger, plus some additional necessity readings, namely with sentential negation, and the perfective aspect – places in which a necessity reading of a possibility SLI trigger is generally not observed.

I present two possible analyses of this data. The first was presented in Jeretič (2020), in which *avoir (à)* is ambiguous between a possibility scaleless implicature trigger and a necessity modal. Because of the initial unsatisfactory nature of this analysis, I proposed a different one in Jeretič (2021a), where French *avoir (à)* was an unambiguous possibility modal triggering a scaleless implicature, whose special syntax allowed more freedom for the exhaustifier to apply. I

[11]Note that *avoir (à)* only optionally licenses an actuality entailment in its possibility reading. This will be a challenge for the AE-based analysis of SLI blocking in Chapter 4 – see the chapter for discussion on the possibility of extending the AE-based analysis to certain perfective-marked non-AE licensors.

give reasons to prefer the ambiguity analysis. I will also show that in the context of the diachrony of 'have to' constructions cross-linguistically, the ambiguity analysis looks much more plausible.

***Avoir à* is ambiguous.** The data above are consistent with *avoir (à)* being ambiguous between a possibility modal POSS_D that triggers subdomain alternatives, and a necessity modal NEC that doesn't. We can summarize the effects of these assumptions below, and see that they match the distribution of *avoir (à)*.

(199) Predicted distribution for *avoir (à)* ambiguous between POSS_D and NEC.

a. unembedded: unambiguous necessity

(i) POSS_D: $\Diamond \rightsquigarrow \Box$ (obligatory strengthening)

(ii) NEC: $\Box$

b. under sentential negation: ambiguous

(i) POSS_D: $\Diamond$ (no strengthening under negation)

(ii) NEC: $\Box$ (no alternatives to exhaustify)

c. perfective: ambiguous

(i) POSS_D: $\Diamond$ (scaleless implicature blocked by perfective)

(ii) NEC: $\Box$

There is a slot for EXH to appear very close to *avoir (à)*. Perhaps exhaustification can happen very close to *avoir (à)*, before negation or perfective applies, allowing for the following configurations in (i), in addition to the expected ones in (ii):

(200) Predicted distribution for *avoir (à)* as a SLI triggering possibility if EXH can appear locally:

a. unembedded: unambiguous necessity

$\text{EXH}^2 \Diamond \equiv \Box$

b. under sentential negation: ambiguous

(i) $\neg\, \text{EXH}^2 \Diamond \equiv \neg\Box$

(ii) $(\text{EXH}^2)\ \neg\Diamond \equiv \neg\Diamond$

c. perfective: ambiguous

(i) $Pf\,\text{EXH}^2\ \Diamond \equiv \check{\Box}$

(ii) $(\text{EXH}^2)\ Pf\,\Diamond \equiv \check{\Diamond}$

This almost accounts for the data. However, one additional puzzle remains: the exhaustification in (200c-i), yielding a AE-licensing necessity modal makes the utterance globally stronger than the utterance without exhaustification, which is incompatible with the assumptions made on EXH application. This is one of the reasons to prefer the ambiguity analysis.

Another reason to prefer it is that the necessity reading appears to be the preferred reading in negated and perfective contexts. Under the local EXH analysis, this is difficult to explain: we would have to say that the default position for EXH is local.

While at first glance implausible, the ambiguity analysis becomes plausible from a diachronic point of view. I appears that *avoir (à)* can be seen as originally a possibility SLI trigger, and is being reinterpreted as necessity modal; for some speakers, both readings are accessible, for others, the necessity parse dominates. This claim is supported by the fact that the possibility readings of *avoir (à)* are associated with sounding archaic for some speakers. I give arguments in section 3.2.8.1 that this evolution is more generally observed with obligatory possibility SLI triggers. Furthermore, in section 3.2.8.2, I give a more precise account of the ambiguity of *avoir (à)* in the context of the diachrony of 'have to' constructions cross-linguistically. In particular, the possibility reading of *avoir (à)* corresponds to a compositional parse (where *avoir* and *à* are interpreted separately), and the necessity parse is an opaque parse, where *avoir à* is interpreted as an idiom.

3.2.4 Optionally scaleless existential

In this section, I give examples of two modals which can receive analyzes as optional possibility SLI triggers: Swedish *få* and obsolete Slovenian *moči*. I show that they follow the pattern expected

for optional existential SLI triggers: optional SLI everywhere except under sentential negation and when perfective-marked.

3.2.4.1 Swedish *få*

Swedish *få* is one of several Scandinavian languages with a variable force modal, as noted in Yanovich (2016). Swedish deontic modal *få* has exactly the distribution of an existential item projecting both subdomain and scalar alternatives, and displaying thus an optional scaleless implicature by pruning its necessity alternative.

3.2.4.1.1 Unembedded Unembedded, *få* is ambiguous between a possibility and necessity modal.

I first show contexts in which a necessity reading of *få* is unavailable, and it must be interpreted as possibility instead.

(201) Alice **får** gå ut, men hon **får** också stanna.
Alice fa go out but she fa allowed stay
'Alice is allowed to go out, but she is also allowed to stay.'

(202) *Context: Alice wants to go into a building. A guard stops her and says.*

Du **få** gå in om du har en officiell inbjudan.
you can go in if you have an official invitation

'You can go in if you have an official invitation.'

I now show context which are only compatible with a necessity reading of *få*.

(203) *Context: I'm telling a story in which Isac illegally parked the car, and the police caught him.*

Isac **får** betala en bot.
Isac fa pay a fine

'Isac has to pay a fine.'

In the following example, we find two instances of *få* in the same sentences, but with different force interpretations: the first is only compatible with a necessity reading, while the second is only compatible with a possibility reading.

(204) *Context: The child really dislikes celery.*

A: Varför gråter barnet?
why cry child
'Why is the child crying?'

B: Han **får** äta sellerin innan han **får** lämna bordet.
he far eats celery before he can leave table
'He has to eat the celery before he can leave the table.'

I also check the past tense of *få*; the pattern remains.

(205) *Context: Isac parked illegally.*

Isac blev tagen och **fick** betala en bot.
Isac was caught and far pay a fine

'Isac got caught and had to pay a fine.'

(206) *Context: this is the future, and we are talking about the Covid-19 pandemic.*

Det var galet, vi **fick** bära munskydd inomhus.
it was crazy we far wear mask indoors

'It was crazy, we were required to wear masks indoors.'

(207) Sara fick ett arbetstillstånd och **fick** leva i USA.
Sara got a work.permit and far live in USA
'Sara got a work permit, and was allowed to live in the USA.'

(208) I december **fick** svenskar fortfarande åka kollektivtrafik utan munskydd.
in december far swedes still go public.transport without mask
'In December, Swedes were still allowed to go in public transport without a mask.'

3.2.4.1.2 In non-UE contexts Embedded in non-UE contexts, it is again ambiguous. I first show uses of *få* in conditional antecedents, in contexts which only a possibility reading.

(209) *Context: Lucas loves ice cream, but only eats it when his mom gives him permission.*

Om Lucas **får** äta glass blir han glad.
if Lucas fa eat ice.cream be.fut he happy

'If Lucas is allowed to have ice cream, he will be happy.'

(210) *Context: Sara used to constantly be traveling around the world, but now the pandemic restrictions prevent her from leaving her city.*

Om Sara **fick** lämna sin stad skulle hon resa jorden runt just nu.
if Sara fa.past leave her city would she trip the.world around just now

'If Sara were allowed to leave her city, she'd be traveling around the world right now.'

Now are examples of *få* embedded in conditional antecedents, but only admitting a necessity interpretation.

(211) *Context: Maria took the train without paying and is worried about getting caught.*

Om Maria **får** betala en böter blir hon olycklig.
if Maria fa pay a fine be.fut she unhappy

'If Maria has to pay a fine, she will be unhappy.'

Questions are another non-UE context in which readings of *få* are ambiguous. I first show uses of *få* which are only compatible with a possibility reading.

(212) *Child to mom:*

Få jag få glass, snälla?
fa I get ice.cream please

'Få jag få glass, snälla?' (infantile)

Two speakers report that this use of *få* is somewhat infantile, and that it is perhaps because of the use of *få* for two different meanings. The following example does not have that effect.

(213) *Context: pandemic, masks are generally recommended, but the speaker wants to know what the rules are about masks outdoors.*

Får folk gå utomhus utan munskydd i den här staden?
fa people go outside without mask in the here city

'Are people allowed to go outdoors without a mask in this city?'

Få can also be used as a necessity modal in questions.

(214) A: Isac got caught taking the train without a ticket.

B: **Får** Isac betala en bot?
fa Isac pay a fine
'Does he have to pay a fine?'

In all of these examples of ambiguity, possibility *få* seems to be the default reading. This is seen in translations of examples in contexts that are compatible with both readings.

(215) *Context: out of the blue, a mother says to her child.*

Nu **få** du gå ut.
now fa you go out

Consistently translated spontaneously as: 'You can now go outside'.

This is consistent with the claim that a necessity reading of an optional SLI trigger is derived by pruning, which needs some contextual support.

3.2.4.1.3 Under negation In contrast with all the cases presented above, under negation, only the permission reading is available.[12]

I first show that a prohibition reading is available. This reading is expected if *få* is a possibility modal, and it takes narrow scope with respect to negation (as more generally assumed).

[12]Note that a reading 'is allowed to not' is available, with marked prosody, just like in English 'Isac can NOT pay the fine.' This narrow scope reading of negation is available with any verb, and is naturally analyzed as vP-level negation (see section X).

(216) *Context: Peter is a prisoner.*

Peter **får** inte lämna fängelset.
Peter fa not leave prison

'Peter is not allowed to leave the prison.'

In contrast, a context which makes only the (narrow scope) necessity reading available is incompatible with a felicitous use of negated *få*.

(217) *Context: The rules in this building are pretty relaxed. The doorman says:*

#Du **får** inte visa bevis på vaccination för att komma in.
you can not show proof of vaccination to come in

int. 'You don't have to show a proof of vaccination to enter.'

Instead, the necessity modal *beöva* can be used in the place of *få* in this sentence to conveyed the intended meaning.

(218) *Context: Pandemic.*

#Jag har tur, jag **får** inte jobba hemifrån.
I am lucky I fa not job from.home

int. 'I am lucky, I don't have to work from home.'

In summary, the modal *få* can have readings corresponding to a possibility modal, a necessity modal in almost all contexts: unembedded and in non-UE environments. However, when negated, it can only have a possibility reading (scoping, as assumed, below negation).

This pattern is the one expected for an optional existential SLI trigger.

Note on *få*'s flavors The modal *få* is restricted to deontic readings in its existential interpretation.

(219) Vi **får** gå in.
we fa go in
We are allowed to go in.

(220) Jag {**#får**,kan} klättra i ett träd.
I far climb on a tree
int. I am able to climb a tree.

Like under the possibility interpretation, pure circumstantial readings are not available for *få*.

(221) Jag {**#får**,måste} nysa.

int. I need to sneeze.

(222) A: How do you get to Zaplaz?

B: Du {**#får**, kan} gå den här vägen om du inte har något emot taggar.
you fa can go the here way if you not have something against thorns
'You can go this way if you don't mind thorns.'

In its universal interpretation, the deontic reading is available, as shown in the examples about paying fines.

(223) Isac **får** betala en bot.
Isac fa pay a fine
'Isac has to pay a fine.'

However, in addition, an apparently teleological meaning also arises, aside from the expected deontic reading.

(224) *Context: the ball got stuck in the tree.*

Jag **får** gå upp i trädet.
I fa go up the tree

'I am forced to (have no choice but) go up the tree.'

(225) A: How do you get to Zaplaz?

B: Du **får** gå den här vägen.
you fa go the here path
'You are forced to go this way.'

The readings are similar to 'are forced to', which adds an additional strength to the modal compared to a more neutral teleological necessity (e.g. English 'have to', Swedish 'måste').

The flavor of *få* in these sentences would be described as teleological. However, in its possibility readings, *få* clearly cannot be used teleologically. We could hypothesize that an expression that is semantically a deontic necessity can always be used as a teleological necessity, thinking of it as a deontic necessity in which the universe is casting an obligation on the speaker, given a certain goal. However, this makes the prediction that there is no expression for deontic necessity that cannot be used teleologically. Let's try with English 'is required', which appears strongly deontic. It is unclear whether this prediction is borne out. In the following sentence, it seems like the purely teleological reading might be marginally available, but a deontic reading is still dominant.

(226) ?There are no planes. I am required to take the train.

I leave a full explanation of this reading to future work.

3.2.4.2 Obsolete Slovenian *moči*

I argue that Slovenian *moči* went through a stage in which it was an optional SLI trigger for several centuries. We can find evidence for obsolete *moči* in historical texts, where in non-negated contexts, it can have both a possibility and a necessity reading. Marušič and Žaucer (2016) cite several non-negated possibility readings of *moči* from the 11th century all the way up to late 19th century; the authors also claim that *moči* retained its possibility meanings until mid-20th century. I cite a few examples directly from their paper here (the sentences were cited with contexts, so I have to trust the authors that the translations indeed correspond to possibility meanings).

(227) Tîge se **mosem** i mui este buiti
like.that prtc can.1p and we still be.inf
'We can still be like them.' [Freising text segments, circa 1000]

(228) ... de tu istu **more** inu hoče per pravim času sturiti
that this same can and wants at right time do
'... that he can and wants to do the same thing at the right time.' [Trubar 1557]

(229) ... tudi **more** celo družino v drug panj predjati.
also can whole family in another beehive move
'he can also move a whole colony of bees into another beehive'

[1871, Kmetijske in rokodelske novice]

Necessity meanings are expressed interchangeably by *moči* and *morati*, an unambiguous necessity form. For example, as found in Merše 2013 p.133, in the 16th century, different translators use different forms for the same meaning, as shown in (230). Interestingly, translator Trubar translates certain necessity readings in Luter's German texts by *moči* in several writings which he later replaces by *morati*, as seen in (231) (more examples in Merše 2013 p.20).

(230) Ie **mogal** tako veliko pokuro sa naſ obſtati (Krelj 1567: CLXXIb)[13]
Ie **moral** tako veliko pokuro sa nas obſtati (Juričič 1578: I,135a).[14]
'He had to suffer such punishment for us.'[15]

In some cases, Merše claims that Trubar's replacements were 'hypercorrections', where the original possibility meaning was lost after Trubar replaces ambiguous *moči* with unambiguously necessity *morati*. The following translation from Luther's bible is based on an original possibility meaning in old German.

(231) Luther: So ein ander sich dÃŒenchen lesset / er **müge** sich Fleisches rhÃŒmen (Luter 1545 (1974): 2369)[16]
Trubar: Aku ſe kei enimu drugimu ſdy, de ſe **more** na Meſſu ſaneſti (Trubar 1567:30a)[17]
→ Aku ſe kei enimu drugimu ſdy, de ſe **mora** na meſſu ſeneſti (Trubar 1581–82: II,193).[18]
'If any of you think you can trust in external ceremonies [...].' (translation of original meaning in old German, found on biblija.net)

[13]Sebastijan Krelj, 1567: *Postilla Slovenska*. Regensburg.
[14]Jurij Juričič, 1578: *Postilla, To ie Kerszhanske Evangelske predige.* Ljubljana
[15]Translation provided by Zala Mojca Jerman Kuželički, a modern Slovenian speaker.
[16]Martin Luther, 1544: *Hauspoſtill* I–III. Wittenberg. Bayerische StaatsBibliothek, Digitale Bibliothek, MÃŒnchener DigitalisierungsZentrum
[17]Primož Trubar, 1567: *Svetiga Pavla LYSTVVI.* Tübingen.
[18]Primož Trubar, 1581–82: *Ta Celi Novi Testament.* Tübingen.

In order to complete the optional SLI pattern for obsolete *moči*, we need to make sure that negated *moči* can only have a *cannot* reading. At least 15 instances of 'ne more' were found in Primož Trubar's searchable online texts, from the website of the Slovenian Pedagogical Institute.[19] All meant 'cannot'.[20] Below are two examples from Trubar's 1577 translation of the new testament.

(232) Eno figovu drevu, mui bratie, more li olike, oli ena vinska terta fyge roditi? Glih taku en studenec **ne more** slano inu slatko vodo dati.
'can a fig tree, my brethren, yield olives, or a vine figs? neither can salt water yield sweet.'

(233) Kateri ie iz Buga royen, ta greha ne sturi, zakai tu nega seime per nim ostane inu on **ne more** grešiti, zakai on ie iz Buga royen.
'Whosoever is begotten of God doeth no sin, because his seed abideth in him: and he cannot sin, because he is begotten of God.'

Finally, like in contemporary Slovenian, perfective marked *moči* (*zmoči*) can only have a possibility reading.

Note that additional evidence that *moči* used to be a possibility modal comes from the fact that Old Church Slavonic, and many current Slavic languages have cognates of *moči* which are unambiguously possibility modals. See footnote 6 in Marušič and Žaucer (2016) for an example of *moči*'s cognate in Old Church Slavonic; contemporary cognates are possibility modals *moč'* in Russian, and *moći* in Bosnian-Croatian-Serbian.

The scalemate discussion of *moči* in section 3.3.1.2.2 will provide independent evidence for *moči*'s mid-20th century shift from an optional SLI trigger to an obligatory SLI trigger.

[19] https://www.pei.si/en/ISBN/zbrana-dela-primoza-trubarja-xiv-primoz-trubar/

[20] One must be careful about drawing too firm conclusions from this categorical distribution. negated necessity meanings are generally much less frequent than impossibility readings. This was seen at least in Spanish and French child-directed speech in Jeretič (2018).

3.2.5 Obligatorily scaleless universals

In this section, I give examples of four modals which can receive analyzes as obligatory necessity SLI triggers: French *falloir*, Spanish *deber*, English *must*, Ewe *ele be*. I show that they follow the pattern expected for obligatory necessity SLI triggers: when negated, they trigger an obligatory SLI in unembedded and QUD neutral contexts, an optional SLI in non-UE contexts, and no SLI when the modal is perfective-marked. In contrast with possiblity SLI triggers, there is generally no 'local' negation operator available which would block an embedded SLI from arising (since the sentential negation is already used in the SLI triggering expression), although there is a marginal construction in French that appears to serve as one.

3.2.5.1 French *falloir*

French *falloir* is a necessity root modal verb which takes an expletive subject *il*, and can embed different types of complements: CPs, infinitival clauses and DPs. Its obligatory SLI behavior is the same no matter what type of complement it combines with. In particular, when negated, it is unambiguously strong when unembedded; and ambiguous in non-upward-entailing contexts. See Horn (1972); Homer (2011) for related observations and relevant discussion on *falloir*.

3.2.5.1.1 Unembedded In unembedded environments, negated *falloir* produces an interpretation equivalent to wide scope.

(234) Il ne **faut pas** aller à l'école. #Mais on peut si on veut.
it neg must neg go to school but we can if we want
a. We must not go to school. #But we can if we want. $\Box\neg$
b. *We don't have to go to school. But we can if we want. $*\neg\Box$

In the following example, negated *falloir* is used in a context that does not make available the QUD $\{\Box, \neg\Box\}$. And the weak reading is not available.

(235) – Que vas-tu faire aujourd'hui?
what go-2s do today
What are you going to do today?

– Il **ne faut pas** que j'aille au bureau. #Donc je pense que je ne vais pas y
it neg must neg that I.go to office so I think that I neg go neg there
aller.
go
(i) *int.* I don't have to go to the office. So I think that I will not go. □¬

(ii) *We don't have to go to school. But we can if we want. *¬□

Only the strong reading $\Box\neg p$ is available. This is shown by the infelicitous continuation *think p*, which suggests that the speaker has the option that p, that would have been made available by the negated necessity $\neg\Box p$.

3.2.5.1.2 Embedded in non-UE contexts Embedded under non-upward-entailing contexts, negated *falloir* is ambiguous between (apparent) wide and narrow scope.

(236) *Conditional antecedents*

– Que vas-tu faire aujourd'hui?
what go-2s do today

What are you going to do today?

– S'il **ne *faut* pas** aller au bureau, je pense que je ne vais pas y aller.
if'it NEG must NEG go to office I neg will neg there go
If I don't have to go to the office, I think I will not go. ¬□

a. S'il **ne *faut* pas** aller au bureau, il n'y a rien à faire, je dois
if'it NEG must NEG go to office it neg'there have nothing to do I must
travailler ici.
work here
If I have to not go to the office, there's nothing I can do, I need to work here. □¬

(237) *Restrictor of universal*

Il n'y a pas de place dans les tiroirs, donc...

'There is no space in the drawers, so...'

a. ... j'ai décidé de jeter tous les papiers qu'il **ne** ***faut*** **pas** que je garde
I'have decided of throw all the papers that'it NEG must NEG that I keep
(même si je pourrais les garder).
even if I could them keep
(i) '... I decided to throw all the papers that I shouldn't keep.' □¬

(ii) '... I decided to throw all the papers that I don't have to keep, ¬□

even if I could keep them.'

b. *Compare: restrictor of existential*

... j'ai décidé de jeter des papiers qu'il **ne** ***faut*** **pas** que je garde
I'have decided of throw some papers that'it NEG must NEG that I keep
(#même si je pourrais les garder).
even if I could them keep
(i) '... I decided to throw some papers that I shouldn't keep, □¬

#even if I could keep them.'

(ii) *'... I decided to throw some papers that I don't have to keep, *¬□

even if I could keep them.'

(238) *Under negated think*

Context: Pandemic, and workers have been not obligated to come to the office. The speaker says what they think of the state of affairs today.

a. Je ne pense pas qu'il **ne** ***faut*** **pas** aller au bureau aujourd'hui.
I NEG think NEG that'it NEG must NEG go to office today

(i) ... Donc on est maintenant obligés d'y aller.
so we are now obliged to go
... So we now have to go. □¬

(ii) ... Donc comme tous les jours, on peut rester à la maison.
so like all the days we can stay at the house
So like every day we can stay at home. ¬□

b. *Compare: under non-negated think*

Je pense qu'il **ne** ***faut*** **pas** aller au bureau aujourd'hui. ... # Donc je pense que
I think that'it NEG must NEG go to office today so I think I
je vais rester à la maison.
will stay at the house

(i) *int.* 'I think we don't have to go to the office today. ... So I think I will stay at home.' ¬□

(ii) 'I think we must not go to the office today. ... # So I think I will stay at home.' □¬

In questions, we have to make sure that negation does not occupy a higher syntactic position as it does in biased questions. The question expression 'est-ce que' allows to disambiguate between high negation and low: a negation embedded under this question construction does not make a biased question, as in the following example.

(239) Est-ce que tu n'y vas pas?
Q comp you neg.there go neg
Is it the case that you're not going?

When we embedded negated *falloir* under this question construction, both scopes are freely available.

(240) Est-ce qu'il ne faut pas que t'y ailles?
Q comp you neg must neg that you.there go
Is it the case that you don't have to go? (¬□)

Is it the case that you have to not go? (□¬)

3.2.5.1.3 Perfective When perfective marked, only a narrow scope is available.

(241) Il **n'** a **pas** ***fallu*** sortir.
it NEG AUX NEG must.PF go.out
*We had to not go out. (□¬)

We didn't have to go out. (¬□)

3.2.5.1.4 Local negation Generally, with universal SLI triggers, there is no non-UE operator that can apply close enough to the negated necessity expression for exhaustification not to be able to apply, and predict optional behavior. Negative subjects are not a good test, since they can QR

above the TP boundary. In French, there is an available but marginal construction with local, sentential negation (additional to the one part of the tested negated necessity expression) in which only narrow scope is observed.

(242) a. ??J'aime ce pays: jamais ne faut-il pas fumer.
I.like this country never neg must-it neg smoke
??I like this country: never must we not smoke.

b. J'aime ce pays: ce n'est jamais le cas qu'il ne faut pas fumer.
I.like this country it neg.is never the case that.it neg must neg smoke
I like this country: it is never the case that one must not smoke.

The context favors a wide scope reading of the modal, where the speaker is expressing happiness at the fact that there is no place in which it is forbidden to smoke. However, the embedding of negated *falloir* in this inversion construction under *jamais* ('never') appears to only permit narrow scope.

3.2.5.1.5 A note on DP complements The modal *falloir* can also take DPs as complements, like English *need*.

(243) Il faut un médicament.
expl faut a pill
You need a pill./A pill is needed.

When negated, the narrow scope of the modal seems, at least at first glance, more available than in most cases we have seen.

(244) Il ne faut pas de médicament.
it neg faut neg of pill
A pill is not needed to get better. ¬□

The wide scope still is, however, very much available.

(245) Pour une séance de méditation réussie, il ne faut pas de distraction.
for a session of meditation successful it neg faut neg of distraction
For a successful meditation session, we must not have any distractions.[21] □¬

The narrow scope of *falloir* is available with strong contextual support, and DP complements correlate with strangeness of wide scope. When looking at a corpus, most cases of 'faut pas DP' are in fact wide scope, meaning that users would opt for another expression to express narrow scope.

3.2.5.2 Spanish *deber*

In this section, I give evidence for Spanish *deber* as an obligatory necessity SLI trigger. Unembedded, negated *deber* strongly prefers a wide scope interpretation.

(246) *Context: a parent makes the following announcement to their child in the morning of a school day.*

a. **No debes** ir al colegio hoydía. Estás enfermo.
neg must.2sg go to school today be.2s sick
You must not go to school today. You are sick. □¬

b. **No debes** ir al colegio hoy, hay huelga. #Pero puedes si quieres.
neg must.2sg go to school today is strike but can.2sg if want.2sg
int. You don't have to go to school today, there is a strike. But you can if you want.
*¬□

Embedded in non-UE contexts, negated *deber* is ambiguous. For example, in a conditional antecedent, I show below both scopes are available.

(247) a. Que hacemos hoy?
what do.1pl today
What are we doing today?

b. (i) Si **no debemos** ir, yo prefiero quedarme.
if neg must go I prefer stay
If we don't have to go, I prefer staying. ¬□

[21] https://dailylama.shop/blogs/meditation/debuter-en-meditation

(ii) Si **no debemos** ir, no hay nada que hacer, nos quedamos.
if neg must go neg is nothing to do 1pl stay
If we can't go, there's nothing we can do, we'll stay. □¬

(248) a. Voy a botar todos los papeles que **no debo** guardar... me podrían traer
will to throw all the papers that neg must keep. 1s could bring
problemas.
problems
I will throw all the papers that I shouldn't keep... they could bring me problems.

□¬

b. Voy a botar todos los papeles que **no debo** guardar... quiero hacer espacio.
will to throw all the papers that neg must keep want make space
int. I will throw all the papers that I don't have to keep... I want to make space. ¬□

In the restrictor of a universal quantifier, both scope interpretations are available; this is to be compared with the restrictor of an existential quantifier, where the narrow scope is infelicitous.

(249) a. Voy a botar algunos papeles que **no debo** guardar... me podrían traer
will to throw some papers that neg must keep 1s could bring
problemas.
problems
I will throw some papers that I shouldn't keep... they could bring me problems. □¬

b. Voy a botar algunos papeles que **no debo** guardar... quiero hacer espacio.
will to throw some papers that neg must keep want make space
I will throw some papers that I don't have to keep... #I want to make space. *¬□

With downward-entailing subjects, both scopes are again available.

(250) Como son las reglas en el colegio ahora con la pandemia?

What are the rules for school now with the pandemic?

a. Ningún niño **no debe** ir al colegio... es la ley.
no child neg must go to school is the law
No child doesn't have to go to school... it's the law. ¬□

b. Ningún niño **no debe** ir al colegio... es un derecho universal.
no child neg must go to school is a right universal
No child has to not go to school... it's a universal right. □¬

(251) Como son las reglas en el colegio ahora con la pandemia?

What are the rules for school now with the pandemic?

a. Pocos niños **no deben** ir al colegio... hay muy pocas excepciones.
few children neg must go to school is very few exceptions
Few children don't have to go to school... there are very few exceptions. ¬□

b. Pocos niños **no deben** ir al colegio... la mayoría puede.
few children neg must go to school the majority can
Few children have to not go to school... the majority can. □¬

These examples are to be contrasted with an upward-entailing quantifier subject like *some children*, where the narrow scope reading is more difficult to get.

(252) Como son las reglas en el colegio ahora con la pandemia?

What are the rules for school now with the pandemic?

a. Algunos niños **no deben** ir al colegio... #si piden permiso.
some children neg must go to school if ask permission
int. Some children don't have to go to school... if they ask for permission. *¬□

b. Algunos niños **no deben** ir al colegio... si están enfermos.
some children neg must go to school if are sick
Some children have to not go to school... if they are sick. ¬□

3.2.5.3 English *must*

The scaleless implicature pattern of *must* has been described in Homer (2011, 2015); Iatridou and Zeijlstra (2013), though of course, identified as a PPI pattern. Unembedded, only a wide scope is available.

The data in this section is based on introspective judgments, and checked with many speakers. Note that some speakers (mostly Americans, it seems), never accept weak readings of *mustn't*. I have a short discussion about this at the end of this section. The data cited in this section is from speakers who do accept weak readings of *mustn't* (in the environments given below).

(253) You **must not** go to school. #But you can if you want. □¬

Embedded in non-UE contexts, at least for some dialects of English, *must* can take narrow scope with respect to negation. For example, in the antecedent of a conditional.

(254) a. If we **must not** go, I prefer to stay. ¬□

b. If we **must not** go, there's nothing we can do, we'll stay. □¬

(255) *No previous mention of people being prohibited from wearing a mask.*
"I call on @GovRonDeSantis to ban [DT] from visiting the State of Florida if he or those attending **mustn't** wear a Mask."[22] ¬□

Narrow scope of *must* is also available under extra-clausal negation.

(256) The senator does not think people **must not** be wearing masks.

Under DE quantifier subjects, both scope interpretations of *must* are also available, as shown in (257a) and (257b) which is to be contrasted with the unavailability of its narrow scope with respect to negation under UE subjects, as shown in (257c).

(257) What are the rules for school with the pandemic?

a. (i) No children **mustn't** go to school... it's the law. ¬□

(ii) No children **mustn't** go to school... it's a universal right. □¬

b. (i) Few children **mustn't** go to school... there are very few exceptions. ¬□

(ii) Few children **mustn't** go to school... most can. □¬

c. (i) Some children **mustn't** go to school... #if they ask for permission. *¬□

(ii) Some children **mustn't** go to school... if they are sick. □¬

We can try the negative inversion construction used to diagnose non-strengthening with local negation, as in the following clunky, marginal example. The following set of examples will all be marginal.

[22] https://twitter.com/Jan0077/status/1280575913395191808

(258) Never must we not wear a mask. never>not>must

This sentence becomes even clunkier when *must* is negated. If I can interpret the sentence, however, it is as 'never are we not required to wear a mask', and not as 'never are we required to not wear a mask'.

(259) ?/*Never mustn't we wear a mask. never>not>must

We can make the sentence slightly better with a full *not*, and appeal to prosody to control for sentential negation (as is generally the case in English and in other languages), and we can see that it correlates with scope. I indicate prosodic units with parentheses below. Sentential negation, i.e. that which applies to *must*, is in the same prosodic unit as it; in contrast, vP negation is in the same prosodic constituent as the vP.

(260) a. (Nowhere must we not) (wear a mask). never>not>must

b. (Nowhere must we) (not wear a mask). never>must>not

In such constructions, the negation must outscope *must* obligatorily. If we create a context that makes acceptable the narrow scope of negation, but not the wide scope, the sentence, with sentential negation prosody, is infelicitous.

(261) a. #I like this country: (nowhere must we not) (smoke a cigarette). never>not>must

int. *never>must>not

b. I like this country: (nowhere must we) (not smoke a cigarette). never>must>not

I take this as evidence of unambiguous narrow scope under local negation.

Note that to one speaker who did not accept narrow scope in non-UE contexts, the above sentences also involved a fixed wide scope.

3.2.5.3.1 On the different dialects. As reported in Iatridou and Zeijlstra (2013), and confirmed in my own research, the narrow scope of *must* is not available for all speakers of English. Out of 6 English speakers asked, 3 get the 'not required' reading in (255) (1 american, 1 canadian and me). The other 3 (american) do not. This means that for some speakers of English, perhaps most American speakers, *must* is a necessity modal that is interpreted above negation, and does not have SLI pattern. How to explain this is unclear. My hypothesis is that root modals *always* scope below negation, and syntactic means of getting wide scope are not available. See chapter 5 for more on this, and on the same point about *must* specifically.

How do speakers get its wide scope interpretation then, if not for a SLI pattern? I do not have an explanation at this point, and can only speculate. When I ask speakers' intuitions about *must*, I often get comments like 'this is hypothetical, because I would never use *mustn't*', or 'I don't think *must* is in my grammar'. The low frequency of *must* might be the source of the lack of a SLI pattern. We could imagine the following hypothesis: subdomains can only be posited during the critical age of acquisition. Most children do not get enough instances of root *must* to lexicalize subdomains, since it is basically absent from their input, due to its very low frequency as a root modal, and exclusive use in formal contexts. *Must* and *must not* are then eventually acquired by individuals past the critical age, too old to posit subdomains for *must*, or innovate the narrow scope of *must not*. Therefore, *must not* is stored independently from *must* as a prohibition expression.

3.2.5.4 Ewe *ele be*

The Tongugbe Ewe necessity modal construction *ele be* is formed from an expletive subject, the copula, and an embedded clause, headed by the complementizer *be*.

(262) E-le be m-a-yi.
expl-be comp 1s-prosp-go
I must go.

Note that this construction is not exactly parallel to the typical existential construction, nor the possessive construction, as shown below in (263). This stands in contrast with several other modal

constructions observed cross-linguistically, but otherwise resembles them in that it is an impersonal existential construction, formed by an expletive and the copula embedding a proposition.

(263) a. *E-le avu.
expl-be dog
int. There is a dog.

b. Avu li.
dog exists
There is a dog.

c. Avu le asi-nye.
dog be hand-poss
I have a dog.

When negated, the modal expression yields a prohibition.

(264) Me-le be m-a-yi o.
neg-be comp 1s-prosp-go neg
I must not go.

We can check this in a context which would favor a negated necessity reading.

(265) *Context: Pandemic; masks are required indoors, but not outdoors. I tell my friend this information.*

Me-le be mi-a-ɖɔ mask le gota o.
neg-be comp 1p-prosp-wear mask be.loc outside neg

'We must not wear a mask outside.' □¬

int. 'We don't have to wear a mask outside.' *¬□

If we want narrow scope, we can add the adverb 'necessarily'.

(266) Me-le be mi-a-ɖɔmask le gota kokoko o.
neg-be comp 1p-prosp-wear mask be.loc outside necessarily neg
'We don't necessarily have to wear a mask outside.'

In a downward-entailing context like a conditional antecedent, a narrow scope is available, without adding 'necessarily'.

(267) Nenye be me-le be m-a-yi o, m-ateŋu a-tsi anyi.
if that neg-be comp prosp-go neg, 1sg-can pros-stay ground
If I don't have to go, I can stay.

This data is therefore consistent with *ele be* being a necessity obligatory SLI trigger.

3.2.6 Optionally scaleless universals

Optionally scaleless universals have essentially a uniformly ambiguous behavior with respect to negation. Unambiguous narrow scope is not easy to come by; if at all visible, it is generally in the perfective aspect. With existential SLI triggers, we generally observe it under sentential negation, since there is no place for EXH to apply in between. However, as already noted, with universal SLI triggers, the sentential negation slot is already used up, which means it is more difficult to find evidence in which the expression is obligatorily weak. Sometimes there is a language-specific construction like the marginal one already observed in French, in which another negative element can be local enough to diagnose an unambiguously unstrengthened expression. Perfective marking may also be available. Sometimes, however, neither of these tests are available, and the evidence is absent altogether.

However, even without this evidence, if we observe optional behavior of a necessity modal with respect to sentential negation (and that optional behavior is not observed when non-negated), I argue that it must be a SLI trigger. Since I argue in Chapter 5 that root modals must be interpreted below negation, and cannot undergo any type of interpretable movement above it, there are no other options, as far as I am aware, of expressing optional wide scope with respect to negation, besides triggering an optional SLI. Therefore, I will cite examples of optional SLIs in which there is no other evidence than their basic optional behavior.

3.2.6.1 French *devoir*

In unembedded contexts, *devoir* is ambiguously interpreted above or below negation, as shown below.

(268) *Context: a parent makes the following announcements to their child in the morning of a school day.*

a. Tu ne **dois pas** aller à l'école aujourd'hui. Tu es malade.
it neg must neg go to school today you are sick
You must not go to school today. You are sick. □¬

b. Tu ne **dois pas** aller à l'école aujourd'hui, il y a grêve. Mais tu peux si
it neg must neg go to school today it there is strike but you can if
tu veux.
you want
You don't have to go to school today, there is a strike. But you can if you want. ¬□

In the same marginal inversion construction allowing for a negation to be close enough to the modal, we observe obligatory narrow scope in the (a) example, in a context which prefers wide scope.

(269) a. ??J'aime ce pays: jamais ne doit-on pas fumer.
I.like this country never neg must-we neg smoke
??I like this country: never must we not smoke.

b. J'aime ce pays: c'est jamais le cas qu'on ne doit pas fumer.
I.like this country it neg.is never the case that.we neg must neg smoke
I like this country: it is never the case that one must not smoke.

In the perfective aspect, we observe narrow scope only of *devoir*.

(270) On **n'** a **pas** ***dû*** sortir.
we NEG AUX NEG must.PF go.out
*We had to not go out. (□¬)
We didn't have to go out. (¬□)

The data with *devoir* is consistent with an optional SLI analysis: optional behavior unembedded (and in most contexts), obligatorily unstrengthened interpretation under a local non-UE operator, and when perfective-marked.

3.2.6.2 Spanish *haber que* and *tener que*

Spanish modal expressions *haber que* (lit. 'there be to') and *tener que* ('have to') both exhibit an optional SLI pattern.

(271) *Context: a parent makes the following announcements to their child in the morning of a school day.*

a. **No {tienes/hay} que** ir al colegio hodía. Estás enfermo.
neg must.2sg that go to school be.2s sick
You must not go to school. You are sick. □¬

b. **No {tienes/hay} que** ir al colegio hoydía, hay huelga. Pero puedes si quieres.
neg must.2sg that go to school today is strike but can.2sg if want.2sg
You don't have to go to school, there is a strike. But you can if you want. ¬□

In the perfective aspect, they are interpreted obligatorily unstrengthened.

(272) **No hubo/tuviste que** ir, que bueno.
neg must.pf that go what good
*You had to not go. *□¬

You didn't have to go, how good. ¬□

3.2.6.3 Russian *nužno* and *nado*

As is well documented (Yanovich, 2013; Van der Auwera, 2001; Horn, 1972; Iatridou and Zeijlstra, 2013; De Haan, 2002), Russian modals *nužno* and *nado* have variable scope interpretations with respect to negation.

I give examples from unembedded, QUD-neutral contexts, both narrow and wide scope interpretations are available for *nado* and *nužno* with respect to negation.

(273) A: Čem segodnja sobiraeš'sja zanimat'sja?
what today are.planning occupy.self.with
'What are you planning to do today?'

B: Mne segodnja ne nado/nuzhno v ofis, tak čto dumaju ostatsja doma, budu
to.me today not needed to office so ptcl I.think to.stay at.home will
serialy smotret'.
series watch
'I don't need to go to the office, so I think I'll stay at home, I'll be watching series.'

(274) A host announces to their guests:

Zdes' ne nado/nužno kurit'.
here neg must smoke

'Here it is prohibited to smoke.'

There is no local negation, or perfective version of these modals, to check unambiguous narrow scope. Thus, the evidence for a SLI pattern is deficient. However, my more general hypothesis relies on the fact that variably wide scope of modals can only be achieved via optional SLIs. So if I am right, this must be an optional SLI, and therefore there must be potential scalemates. We simply cannot take Russian as evidence that optional SLIs exist, but we have French and Spanish for that.

Interestingly, nevertheless, there are certain configurations in which the wide scope seems to be blocked. In particular, the variable scope behavior disappears in the future tense, marked on these adjectival modals by a future marked copula, whose unmarked position is after the modal. In these cases only narrow scope is available.

(275) Mne ne nužno/nado budet chitat'.
1s.dat neg must cop.fut.3s read
I will not have to read.

*I will have to not read.

This cannot be due to the presence of the copula alone, because the copula is present in the past tense, but the variable scope is available then.

(276) Mne ne nužno/nado bylo chitat'.
1s.dat neg must cop.past.n read
I didn't have to read/I had to not read.

A natural aspect to check is whether the future tense in these particular constructions licenses an actuality entailment. This is because environments that license an actuality entailment block scaleless implicatures. However, it appears that the future tense does not automatically license actuality entailments, as shown here.

(277) Mne nužno/nado budet chitat', ... no ne budu.
1s.dat must cop.fut.3s read but neg will.1s
I will have to read, ... but I won't.

I have one informant who reports that there are two readings, that appear to correspond to present and future perspectives. If the modal has a future perspective, i.e. the obligation is in the future, the above sentences are fine. If the modal has a present perspective, i.e. the obligation is in the present is about a future event, the sentence is bad.[23] This is something to explore. In particular, as I discuss in Chapter 4, there is potential for SLIs to be blocked not only by actuality entailments, but by the entailment of the presence of any actual event. This is a point I leave for future work.

3.2.7 On some additional predictions of the SLI analyses

In this section, I discuss two predictions of the SLI analysis, seen in Chapter 2, that are not immediately borne out, and require additional explanation.

The first is that negated existentials are supposed to block strengthening as well, which is not what we observed. The second is the fact that universal quantifiers are supposed to block strengthening, but don't, which I argue is due to syntactic reasons (i.e. the EXH can apply below it, and since the environment is UE, an obligatory SLI trigger will obligatorily trigger a SLI).

[23] Deontic modals are always future orientated. I have not checked the meaning difference between a sentence with a non-future marked modal and a future-marked modal with present perspective.

3.2.7.1 Negated subjects and necessity SLI triggers

In Chapter 2, we saw that an existential quantifier scoping in between a negation and the universal SLI trigger should block strengthening. Therefore, both obligatory and optional necessity SLI triggers are expected to take apparent narrow scope under a negative subject. However, we observe that they instead that they can take apparent wide scope.

Below are examples that show the wide scope of optional SLI trigger *devoir*, and obligatory SLI triggers *deber* and *must* with respect to the negation of a negative quantifier subject.

(278) *Context: Kidnapper says to hostages:*

a. Personne ne doit sortir d'ici.
no-one neg must go from.here

b. Nadie debe salir de aquí.
no-one must go from here

c. No-one must leave this place.

If we assume that the negative quantifier subject scopes above the modal, we have the LF in (279). However, this LF predicts that no strengthening to universal quantification is available, because the existential quantification makes the subdomain alternatives non-IE at the first round of exhaustification, and the result produced, shown in (279b), would be contradictory with a SLI.

(279) a. $S = \neg\exists x.\Box P(x)$

b. $\textsc{exh}[Alt(S)][S] = \neg\exists x.\Box P(x) \wedge \exists x.\Diamond P(x)$

In order to account for the fact that necessity SLI triggers nevertheless can trigger a SLI when negated by a negative quantifier, I assume that the negative quantifier splits its scope into a negation, scoping above the modal, and an existential quantifier, scoping below (presumably staying in, or reconstructing to the subject's vP-internal position). The base LF before EXH application is shown in (280a). Now, we have a negated necessity SLI trigger, which is the typical configuration allowing for strengthening to a wide scope interpretation.

(280) a. $\neg\Box\exists x.P(x)$

b. $\text{EXH}^2\neg\Box\exists x.P(x) \equiv \Box\neg\exists x.P(x)$

Scope splitting of negative quantifiers by modals has been observed by many authors, in English, German, Dutch and Scandinavian languages (Abels and Martí, 2010; De Swart, 2000; Penka, 2011, 2012; Potts, 2000 a.o.).[24] I give below a classical example in English from Potts (2000), where the sentence can have a reading in which the modal *need* splits the scope of the negative quantifier *no employees*. The same reading arises in the passive construction, where *no employees* is in the subject position (and the modal is not a negative polarity item, so as to make the examples more comparable without introducing additional confounds).

(281) a. (i) The company need fire no employees. [Potts (2000)]

(ii) No employees need to be fired.

b. 'It is not the case that the company needs to fire employees.'

c. $\neg\Box\exists x.(\text{employee}(x)\wedge\text{fire}(x))$

Negation takes a clear wide scope above the modal. The sentence can be uttered by a speaker who knows the company is working well, but has no knowledge of the internal composition of the company's workforce, thereby making no claims about specific employees. This reading can be accounted for by the existential quantifier taking low scope with respect to the modal. Thus, having scope splitting of negative quantifiers around modals, including SLI triggering modals, is plausible, if not expected.

Furthermore, the split scope proposal makes a prediction: whenever there is strengthening to a wide scope interpretation, the existential quantifier must take narrow scope with respect to a

[24]Note that the proposal in Abels and Martí (2010) assumes a different LF than then one in (280a), where negative quantifiers denote existential quantifiers over choice functions, and split scope comes from the indefinite taking narrow scope with respect to the modal. This proposal would actually incorrectly predict lack of strengthening, since the existential quantifier over choice functions is present in between negation and the modal.

modal.[25] I check such a reading in the following context, where a prohibition is true of each of the boys in the world of evaluation, but not true of any boy in any possible world.

(282) Context: In a family, every boy has one day, randomly assigned each week, in which they are allowed to take a break from chores. Today, no boy is in that situation.

a. ??It so happens that today, no boy must take a break from his chores.

b. ??Par hasard, aujourd'hui, aucun garçon ne doit interrompre ses tâches ménagères.
by chance today no boy neg must interrupt his chores

c. *int.* 'It so happens that today, it must be the case that no boy interrupts his chores.'

My own intuitions, checked with one speaker (linguist) for the English example, suggest that these sentences are indeed odd in the given context. This fact provides support for an account of wide scope necessity modals that is not derived by movement of the modal above negation. If this were the case, then the intended readings should naturally arise.

3.2.7.2 Universal quantification

Strengthening is blocked in the scope of a universal quantifier. In particular, if they are local and non-QRable, they are supposed to block strengthening obligatorily. Local and non-QR-able universal quantifiers seem to be universal quantificational adverbials, like *always*. However, it appears that they do not block strengthening, for any of the possibility SLI triggers, namely Siona *ba'iji*, Slovenian *moči* and Swedish *få*.

(283) Tsiadë saiye ba'iji tarapoa-na cua̲'me neñe-re ca-quë... ai jë'jo-yë
always go must tarapoa-dir things make-inf-re say-nonasrt really tired.1s
'I always have to go to Tarapoa to work. I'm really tired.'

(284) Vedno morem plačati globe.
always modal pay fines
I always must pay fines.

[25] A terminological note: in the relevant literature on split scope of negative quantifiers, the narrow scope reading of the existential with respect to an intensional operator is referred to as the *de re* reading (and the wide scope is *de dicto*). I do not use this terminology so as to not create confusion with the more commonly used semantic *de re*/*de dicto* distinction to refer to transparent vs opaque readings of indefinites. See more in Nelson (2019).

(285) a. Jag får alltid betala böter.
I mod always pay fines
I always have to pay fines.

b. Jag ar en person som alltid få betala böter.
I am a person who always mod pay fines
I am a person who always has to pay fines.

We would expect these adverbials to be local, and therefore block strengthening. However, this distribution suggests that exhaustification applies before the universal quantifier.

Note that if EXH *can* apply in between the universal quantifier and the SLI trigger in its scope, then it globally strengthens the utterance, because the scope of a universal quantifier is UE. There is evidence from Swedish in particular that there is such a slot. Swedish has the adverbial *aldrig*, 'never', which appears to correlate with optional strengthening (I show examples in a dependent clause to control for a matrix level adverbial, which in unembedded contexts, could in principle apply below the modal). And crucially, *få*'s necessity reading is possible with *never*, but not plain sentential negation.

(286) a. Jag ar en person som aldrig få betala böter.
I am a person who never mod pay fines
I am a person who never {has to, is allowed to} pay fines.

b. Jag ar en person som inte få betala böter.
I am a person who neg mod pay fines
I am a person who {*doesn't have to, isn't allowed to} to pay fines.

This test cannot be run in Slovenian, because it is a negative concord language, and therefore sentential negation must be present whenever *never* is. The test is also unavailable in Siona, because it does not have negative quantifiers, and 'never' is expressed as 'not sometimes', therefore sentential negation is again present.

3.2.8 On the diachrony of modal SLI triggers

3.2.8.1 An acquisition bias and diachronic consequences

While the data in this section is mainly synchronic, there are a few cases in which looking at the diachronic development of SLI triggers is useful to understand the more general picture. In this section, I give a number of arguments that are suggestive of a picture in which obligatory possibility SLI triggers are, in most cases ('most cases' to be defined), unstable in their diachronic development, and are rapidly reanalyzed into necessity modals.

The first argument comes from thinking about the learnability of SLI triggers. If a toddler is confronted with a neg-raising modal, how do they decide whether the modal is an existential or a universal SLI trigger (or potentially even something else)? Indeed, as neg-raisers, in unembedded non-negated and negated contexts, possibility and necessity SLI triggers behave in essentially the same way. Data that differentiates them is rarer: in contexts with a specific QUD, and when embedded in non-upward-entailing environments. A child is likely not exposed enough to modals in these contexts. How then can the child learn whether an item is a possibility or a necessity?

In order to solve this learnability puzzle, I hypothesize the following acquisition bias: confronted with a neg-raising modal, i.e. whose distribution is ambiguous between an obligatory necessity and obligatory possibility SLI, and in the absence of sufficient evidence from contexts other than unembedded and negation, the child will give a preference for non-negated forms rather than negated forms to not be derived via implicature.

(287) a. Type of data the child hears and meanings inferred from contextual cues:[26]

(i) 'M(p)' $\equiv \Box p$

(ii) 'Neg(M(p))' $\equiv \Box \neg p$

(iii) Insufficent data from contexts licensing potential weak readings of 'M(p)' or 'Neg(M(p))'

b. Possible analyses of M:

(i) M is a possibility SLI trigger:

[26] Dieuleveut et al. (in prep) argue that children are sensitive to contextual cues to infer modal force.

$\text{EXH}^2\ \Diamond(\text{p}) \equiv \Box p$

$\neg\Diamond(\text{p}) \equiv \Box\neg p$

(ii) M is a necessity SLI trigger:

$\Box(\text{p}) \equiv \Box p$

$\text{EXH}^2\ \neg\Box(\text{p}) \equiv \Box\neg p$

c. Analysis preferred: M is a necessity SLI trigger, because the child gives a preference for non-negated forms to not be derived via implicature.

This means that all obligatory possibility SLI triggers (absent independent evidence for underlying possibility readings, to be discussed shortly) will be reanalyzed into necessity modals, in the absence of additional evidence.

The second argument for this diachronic hypothesis, and its corresponding learnability bias, comes from the current available data on the typology of obligatory SLI trigger. Among neg-raising modals I have looked at, there appears to be many more necessity modals than possibility modals. I have found only 3 obligatory possibility SLI triggers – Siona *ba'iji*, French *avoir (à)* and Slovenian *moči*. In contrast, I have examples of 4 obligatory necessity SLI triggers, that were selected among more candidates that I have not included in this chapter (Dutch *moeten*, Greek *prepi*, Khoekhoe *ni*, German *haben zu*, Portuguese *dever*), which have passed initial tests for a universal SLI pattern.

Furthermore, out of the three obligatory possibility SLI triggers I analyze, two of them, Slovenian *moči* and French *avoir (à)*, exhibit patterns suggesting reanalysis into necessity modals, further skewing the typology, and supporting the hypothesis that obligatory possibility SLI triggers do not remain long that way. In fact, the historical analysis of *moči* provides an idea of the life expectancy of a possibility SLI trigger. I have provided evidence that optional *moči* was around until mid-20th century. Therefore, the timeframe between *moči*'s becoming an obligatory SLI trigger and its being reanalyzed into a necessity modal is relatively short – roughly 70 years (as an upper bound for seeing actual necessity tokens of *moči* appear in the data after it has become an obligatory SLI trigger). This gives an idea of what the conditions should be for a possibility

obligatory SLI trigger to exist in a language. I will argue in the scalemate study of *moči* (section 3.3.1.2.2) that the shift from optional to obligatory SLI behavior corresponds to the disappearance of *moči*'s scalemate *morati* in colloquial speech at around the same time. Therefore, speakers up to the mid-20th century were still exposed to unembedded possibility readings of *moči* (i.e. frequent unambiguous possibility readings), while it was still an optional SLI trigger. However, they were also witnesses of the decline of *morati* in colloquial speech, and therefore its disappearance as an appropriate scalemate to *moči*. As a result, speakers began to treat *moči* as an obligatory SLI trigger, and the number of unembedded possibility readings of *moči* declined. Eventually, speakers begin to posit necessity readings for it, contributing to the disappearance of *moči* as a possibility SLI trigger. This makes sense as a more general tendency, where speakers exposed to unembedded and unnegated necessity utterances with a modal M will learn the modal as a necessity modal, rather than a obligatorily strengthened possibility, if there is no or little unambiguous evidence of M being a possibility modal.

There is one caveat to considering the asymmetric typology of obligatory SLI triggers as an argument for the diachronic hypothesis. There appears to also be a possible asymmetry between possibility and necessity optional SLI triggers, and possibly even non-SLI triggers, where necessity modal items are more numerous. Among optional SLI triggers, we have as possibility modals Swedish *få* and its Scandinavian cognates, and obsolete Slovenian *moči*; as necessity modals, there is French *devoir*, Spanish *tener que* and *haber que*, and Russian *nužno* and *nado*. However, these modals do not pose a learnability problem, as the distribution of their readings in unembedded contexts is different. Furthermore, there is evidence from Slovenian (and perhaps from Old English **motan*, as described in Yanovich (2016), to be discussed shortly), that a possibility optional SLI can survive for centuries under that form. I leave the puzzle about this asymmetry open.

The third argument thus comes from Yanovich's (2013; 2016) work on the diachrony of English *must*. While English *must* is currently a necessity modal, Yanovich shows that it used to be a variable force modal in Old English and Early Middle English. He describes a stage of Old English **motan* in which it was compatible with both possibility and necessity meanings, but under negation, was only interpreted as narrow scope possibility. This is compatible with **motan* being

an optional SLI trigger (although Yanovich himself does not give that analysis). Yanovich does not provide evidence for a stage in which *must* was an obligatory possibility SLI trigger, which is not surprising, since it would be more difficult to spot and Yanovich was not looking for it, and that stage would be relatively short if *must* would be reanalyzed as a necessity within a generation. In order to give support for the existence of this stage, one would have to find evidence of *must* as a possibility in non-UE contexts, while it was unambiguously necessity in UE contexts, as well as the concurrent disappearance of a scalemate to *must* (either by its disappearance from the register of *must*, or a change in the syntax or semantics of *must* or its scalemate that would break the scalematehood relation, as defined in the following section).

Other than Yanovich's work, there are not many discussions in previous work that would provide support for this diachronic hypothesis. This is not surprising, since SLIs have only recently surfaced as a recognized phenomenon. Furthermore, there is very literature on the diachrony or acquisition of modal force. Aside from Yanovich, I am not aware of anyone discussing force from a diachronic point of view, and on the acquisition side, the literature is only in its beginning stages, found in Dieuleveut et al. (in prep, 2019); Jeretič (2018); Noveck (2001); Öztürk and Papafragou (2015). However, there is nothing in these works that could shed light on the hypothesized diachrony of possibility SLI triggers, since they don't contain examples of possibility SLI triggers in them (nor were the authors looking for them).

Finally, the fourth argument is that this hypothesis about the diachrony of SLIs has desirable consequences for the analysis of 'have to' constructions cross-linguistically, of which French *avoir (à)* is an example. The analyses of these constructions gain a great deal of explanatory power once the learnability bias is taken into account, both in proposing a compositional origin based on an existential quantifier, and observing how most such expressions have been grammaticalized into necessity modals. I discuss this in the following section 3.2.8.2.

3.2.8.2 A grammaticalization path for 'have to' constructions

In this section, I give an overview of a cross-linguistically common type of modal expression formed from an existential or possession construction (e.g. English *have* in *have to*), generally as-

sociated with root necessity. I propose that it begins as a compositionally derived construction that yields a possibility meaning, but that can then be grammaticalized into a necessity. This grammaticalization analysis will shed light on the ambiguous behavior of French *avoir (à)*. Furthermore, it will give tools to determine the lexical status of Spanish *tener que* and *haber que* and Ewe *ele be* (which fall into the 'have to'-type modal constructions), necessary to determine scalematehood relations, or lack thereof, with other modals in the lexicon of the language, which is the task of section 3.3.

3.2.8.2.1 The BE–modal generalization and a hypothesis Necessity constructions bearing a relation with existential or possessive constructions are very pervasive cross-linguistically, though not systematically available. In this section, I expand the possession-obligation generalization proposed by Bhatt (1998) to any construction involving an existential construction, namely 'there is to vP', 'has to vP', and 'get to vP'. I propose a compositional origin story for these expressions, and a diachronic grammaticalization path that separates them from their initial compositional origin. This story is partially based on the more general diachronic hypothesis proposed in the previous section 3.2.8.1, in which obligatory possibility SLI triggers end up being learned as necessity modals.

To my knowledge, the only cross-linguistic analysis of such constructions is given by Bhatt (1998),who notes the widespread link between possessive constructions and obligation expressions formed from the possessive and non-finite verbal forms. His analysis is based on a semantics of possession that is formed from an existential construction, and the existence of a covert necessity modal. As Bhatt acknowledges, this analysis does not fulfill the desideratum of drawing a link between the existential construction and the obligation semantics, that should exist given the pervasiveness of such constructions.

In this section, I formulate a hypothesis that would address this desideratum. I propose that existential constructions are formed from an existential quantifier, while generally type-inflexible, can acquire type-flexibility and quantify not only over sets of individuals but also sets of worlds. Just as a typical quantifier over individuals, the set quantified over is restricted to a relevant set

of elements. A relevant set of worlds will contain worlds in which relevant facts hold, i.e. a circumstantial modal base. The modal flavors that arise from these constructions will therefore all be root, however, not all root flavors are expressed. I argue that this set of worlds will be further restricted by any possible ordering source compatible with the construction's argument structure. Maintaining Bhatt's assumption that possession is built from existential constructions, I argue that besides the possessive construction, we find similar constructions with an impersonal existential and constructions based on verbs with the semantics of 'receive', which can be analyzed as possession constructions along with a giver, and can therefore also be based off the existential construction. We can summarize the three types of existential constructions which can be used to express modality, differing only in their argument structure.

(288) a. There is to vP.
Siona *ba'iji*, Ewe *ele be*, Spanish *haber que*

b. (X) has to vP. $\simeq$ There is to vP at X.
English *have to*, Spanish *tener que*, French *avoir (à)*

c. (X) get to vP (from Y). $\simeq$ There is to vP at X from Y.
Swedish *få*, French *avoir (à)*, English *get to* and *gotta*

Thus, utilizing the type-flexible existential quantifier from each of these constructions, we can make a modal that is of existential force. However, we observe universal force in almost all of these constructions. I argue that this universal force comes from either an existential SLI trigger, or a universal that has been grammaticalized from an existential SLI trigger.

I list below all the relevant constructions, and whether they are grammaticalized as necessity, or still a possibility modal.

(289) a. English. I {have to, gotta, have got to} go. necessity, no subdomain alts

b. Ewe. Ele be mayi. necessity, with subdomain alts

c. Spanish. Tengo que ir. necessity, with scalar and subdomain alts

d. Spanish. Hay que ir. necessity, with scalar and subdomain alts

e. French. J'ai à y aller. — both parses available

f. Siona. Saiye ba'iji. — possibility, with subdomain alts

g. Swedish. Jag får gå. — possibility, with subdomain and scalar alts

h. English. I get to go. — possibility, no subdomain alts

3.2.8.2.2 Evidence for (non-)grammaticalization In this section, I will give evidence of grammaticalization of the necessity parses, and non-grammaticalization of SLI-triggering possibility parses.

There are two ways a construction can be grammaticalized with its particle: either as a lexical word or an idiom span, i.e. a sequence of consecutive heads whose semantics is non-compositionally derived. In both cases, they will be associated with a single primitive meaning. The difference between these two types is in their syntactic behavior. A lexical word will behave as a word, meaning that it will never be able to be split in the middle by an adverb. An idiom span on the other hand, as a series of consecutive syntactic heads, which behave syntactically identically to a non-idiom span counterpart. Therefore, adverb splitting will be allowed. However, we can still identify its grammaticalization by making a list of clauses headed by the particles involved in the constructions. If the construction is allowed, then there is no grammaticalization, if it isn't, then there is, provided the language otherwise allows such lists.

(290) Tests for grammaticalization.

a. Lexical word:

*BE, adverb, to vP

b. Lexical word or idiom span:

*BE to vP, to vP and to vP

English Let's begin with English modals *got/get to* and *have to*. First, the phonological (and orthographical, arguably) incorporation of the particle *to* into *gotta* is the clearest mark of grammaticalization we have for these necessity constructions, in fact, for many speakers that use

gotta, the non-phonologically reduced version *got to* is not available. Several authors have described this grammaticalization (Tagliamonte and D'Arcy, 2007; Tagliamonte, 2004 a.o.), see also Stockwell and Schütze (2019) for variation of the availability of these types of constructions, and their interaction with negation).

The presence of both necessity *gotta* and implicative possibility *get to* is significant. These appear to have come from the same verb, yet are now pretty obviously separate lexical items. We could hypothesize a common origin, where the SLI-triggering possibility modal is interpreted as possibility in the perfective aspect where it licenses an AE, and the SLI is blocked (though this relies on the assumption that English used to have a perfective, which it does not now), and necessity elsewhere. Now, those meanings are split into an AE-triggering possibility and a necessity modal. Indeed, *get to* is now a semantically implicative verb, like *manage*, where the AE is part of the meaning of the modal, and triggers an AE without the need of the perfective aspect.

We can run tests for grammaticalization of these expressions. I will argue that there are two possibilities for grammaticalization: one-word lexical items and idiom spans. These two options converge in their property that they are not derived compositionally, and are simply assigned a fixed modal reading in the lexicon. The difference between them is in their syntactic behavior: while on the one hand, we have an item behaving as a single word, on the other, we have an item behaving in a syntactically similar way as a compositional parse, where the BE-based word and the infinitival particle can have lives of their own, and separate when they are allowed to by the grammar.

Therefore, testing one-word items will be significantly easier than idiom spans.

I argue that English *gotta*, *have to* and *get to* are one word lexical items, because they cannot be split by an adverbial.

(291) a. *I got/have, unfortunately, to go home.

b. ??I get, finally, to go home.

We can also check these cases in lists.

All cases of grammaticalization involve non-compositional expressions, therefore, the conjunction of a list of constructions should be blocked.[27,28] And indeed, for English *get to, got to* and *have to*, this is not possible.

(292) a. ??Today I get/got/have to meet a friend, to go shopping and to go to a museum.

b. ??Today I don't get/got/have to meet a friend, to go shopping and to go to a museum.

In contrast, this is possible with a non-grammaticalized parse like English 'allowed to', formed from an adjectival predicate that selects an infinitival complement. This construction freely allows adverbial insertion and lists of *to*-headed clauses.

(293) a. We are(n't) allowed, finally, to go out.

b. We are(n't) allowed to go out, to go into stores masked, and to meet friends in parks.

Spanish In Spanish, *tener que* and *haber que* are idiom spans. They allow adverbial splitting, but not list making.

(294) a. Tenemos/Hay, desgraciadamente, que irnos de aquí.
have.1p/is unfortunately comp go from here
We unfortunately have to leave this place.

b. ??Tengo/Hay que ver a un amigo, que hacer compras y que ir a un
have.1s/is that see comp a friend comp do groceries and comp go to a
museo.
museum
I have to go see a friend, go shopping and go to a museum.

The unavailability of a list of *que*-headed infinitival clauses contrasts with the availability of the same clauses in a very similar construction in which a noun is present.

[27]This test originated by a spontaneously offered ungrammatical judgment by Hagen Blix for the corresponding *have to* construction in German.

[28]It appears that cases of simple conjunction with two items are still allowed, but lists are not. This suggests that ATB extraction is allowed for the former, but not the latter.

(295) Tengo cosas que mirar, que comprar, que comer, lo que quieran.
have.1s things comp look comp buy comp eat what comp want
I have things to look at, to buy, to eat, whatever you want.

French French is analyzed as ambiguous between a grammaticalized necessity parse and a non-grammaticalized, compositional possibility SLI trigger parse. I will show data from lists showing a contrast between the necessity and possibility parses in relevant environments.

A disclaimer: the data in this section is only preliminary. I report my own judgments; however, there appears to be quite a bit of variation among the judgments of other French speakers consulted. This is not surprising, given that variation was already observed in the availability of SLI triggering *avoir (à)* in the first place. Moreover, it might very well be that the ambiguity of *avoir (à)* is an unstable stage of the modal, possibly muddying the judgments of even the speakers who allow both parses. Because of the instability of *avoir (à)*'s ambiguity, and the relative difficulty of these constructions, a controlled survey of the data should be desirable in order to confirm whether there is a contrast.

The ambiguity analysis of *avoir (à)* predicts that in unembedded, unnegated contexts, a list is possible. This prediction is borne out in the following sentence.

(296) Aujourd'hui j'ai [break] à ranger, à faire les courses et à écrire.
Today I have to tidy up, to go shopping and to write.

(297) Je suis contente, aujourd'hui je n'ai pas à faire les choses que je dois faire habituellement:
à ranger la maison, à travailler, à faire les courses.

However, this is not always available. In the previous example, a prosodic break improves the sentence. If a necessity parse is preferred, as is suggested in section 3.2.3.3 on the data with *avoir (à)*, we could imagine that if a break is not there, we are garden-pathed into the necessity parse, until we encounter the second *à*. We can construct an example in which the garden path is harder to repair, as in the following, which is not available.

(298) ??Aujourd'hui j'ai beaucoup de choses à faire: à ranger ma chambre et à travailler.
Today I have a lot of things to do: to tidy up and to work.

The compositional and grammaticalized parses of *avoir (à)* get differentiated in non-upward-entailing contexts, and when *avoir (à)* is perfective-marked, where the former parse can be interpreted as possibility one, and the latter is interpreted as necessity. Here we can see contrasts between the two parses.

(299) a. Eh, tu n'as pas à faire ça! à entrer dans ma chambre comme ça, à prendre mes affaires, à m'embêter...
'Hey, you can't do that! go into my room like that, take my things, bother me...'

b. ??Je suis contente, aujourd'hui je n'ai pas à faire les choses que je dois faire habituellement: à ranger la maison, à travailler, à faire les courses...
'I am happy, I no longer have to do everything I had to do. tidy up the house, work, go shopping...'

In the perfective, there is again a contrast (though the compositional parse appears somewhat degraded, at least compared to the negated example, but still better than the necessity parse).

(300) a. ?La semaine dernière, il a eu à faire des choses incroyables... à rencontrer son gourou, à lui poser des questions et même à lui toucher les cheveux.
'Last week, he got to do incredible things: meet his guru, ask him questions and even touch his hair.'

b. ??Cette semaine, j'ai eu à faire beaucoup de choses... à écrire ce chapitre, à ranger la maison et à m'occuper de tout le monde.
'This week, I had to write a chapter, clean the house and take care of everyone.'

Note: It appears that typical three-item coordination à-headed clauses are always available. However, we observe a contrast between the two parses when the coordination is not an argument

of *avoir*, but is anaphoric to the expression 'to do things'. This may be due to specificities of French syntax allowing ATB extraction of *avoir*, and therefore allowing the idiom span to surivive in coordinations. However, in anaphoric contexts, ATB extraction is no longer possible.

Interestingly, adverb splitting in the perfective is also significantly worse with the necessity parse than the possibility parse, suggesting that necessity *avoir (à)* is lexicalizing into a single word.

(301) a. ??J'ai eu, malheureusement, à payer une amende.
I had, unfortunately, to pay a fine.

b. J'ai eu, enfin, à rencontrer mon idole.
I got, finally, to meet my idol.

There is evidence that for some speakers, *avoir (à)* is resembling the *get to-gotta* grammaticalization split, because *avoir (à)* in its negated possibility use is often preferred in implicative contexts. If you ask a French speaker, the most natural examples with the intended negated possibility reading of *avoir (à)* come in contexts in which the event described by the prejacent has already occurred, or is likely to occur.

(302) a. Tu n'as pas à me parler comme ça!
'You don't get to talk to me like that!'

b. ?Les étudiants de NYU n'ont pas à retourner sur le campus sans se faire vacciner.
The students at NYU cannot return to campus without getting vaccinated.

Note that a positive version is not yet available, suggesting current polarity sensitivity.

(303) ??J'ai à sortir et voir un film ce soir.
int. 'I get to go out and see a movie tonight.'

The slight weirdness of the non-implicative context might suggest a general preference for the grammaticalized parse. However, the compositional parse is still available, as shown in the examples above.

At what point do compositional parses cease to exist? When the BE operator ceases to be type-flexible. This surely happens shortly after parses have been grammaticalized into non-compositional items that do not rely on a type-flexibility of the BE operator to be interpreted modally.

Ewe In Ewe, the *ele be* construction does not allow list making with the complementizer, or adverb splitting. This suggests that the construction is indeed grammaticalized.

(304) E-le be m-a-wɔ dɔ, (*be) (m)-a-tutu, ʊu-a ŋu (*be) (m)-a-yi adagbe.
expl-be comp 1s-prosp-do work comp 1s-prosp-clean car-def body comp 1s-prosp-go hunting
'I must work, clean the car and go hunting.'

(305) ?E-le, unfortunately, be m-a-yi.
expl-be unfortunately comp 1s-prosp-go
int. 'We must, unfortunately, go.'

Siona Siona, in contrast, allows for lists with its 'there is' construction, suggesting that there is no grammaticalization of the *be* with the infinitival markers.

(306) Beo-ji pupu-ye, ca-ye, banije ao ai-ñe.
neg.cop-3s smoke-inf talk-inf nor food eat-inf
'We must not smoke, talk nor eat.'

3.3 On the nature of scalar alternatives

Having collected a significant number of SLI-triggering modals of different types, we can now address a question that has so far been left open: what determines whether a lexical item projects scalar alternatives? In other words, why is it that obligatory SLI triggers, like Siona *ba'iji* and

French *falloir*, do not associate with a scalemate, while optional SLI triggers like Swedish *få* or Spanish *tener que* do? One answer is that lexical items are arbitrarily specified for associating with a scalemate or not. This answer is theoretically dispreferred, because it gives the child one more lexical property to learn, and it would furthermore question a central aspect of previous theories of scalar alternatives, which states that scalemates are found in the lexicon. For these reasons, I give preference to the hypothesis under which scalemate association (i.e. the property that allows for projection of scalar alternatives) is not an idiosyncractic lexical property, and instead is fully determined by the lexicon of the language. I provide support for this hypothesis in section 3.3.1 by showing that data from the languages of each of the studied SLI triggers, along with certain plausible stipulations, is consistent with it. The comparison of the lexicons of obligatory and optional SLIs will allow a new definition of scalar alternatives, one in which a scalemate must be a lexical item that is grammatical and felicitous in all of the item's contexts of use.

After coming up with a definition of scalar alternatives based on data from SLI triggers, I turn in section 3.3.2 to data on non-SLI triggers. Non-SLI triggers may also trigger scalar implicatures, and are therefore also expected to project scalar alternatives. This investigation will reveal, perhaps surprisingly, that the constraints on the shape of scalar alternatives observed for SLI triggers in 3.3.1 do not apply in certain examples of non-SLI triggers. I therefore propose a theory in which there are two types of scalar alternatives, which I call "lexical scalar alternatives" and "clausal scalar alternatives". As the names suggest, the difference between these two types of scalar alternatives will be found at the level at which they are generated: at the word-level, or at the clause-level. This distinction correlates with the constraints on the shape of scalar alternatives. Lexical scalar alternatives will require a close match in syntactic and semantic properties, in order to allow replacement at the level of the word. In contrast, clausal scalar alternatives will not require that level of precision, because they will be generated at the level of the clause, based on a notion of semantic equivalence, which does not require a full morphosyntactic and semantic match.

3.3.1 What makes a scalar alternative? The answer from SLI triggers

3.3.1.1 Overview

According to the definitions given in Chapter 2, the difference between obligatory and optional SLIs lies in the presence of a scalar alternative. Therefore, under the hypothesis that scalematehood is not an arbitrary lexical specification, if an item projects subdomain alternatives, an obligatory SLI pattern arises when there are no appropriate scalemates, and an optional SLI pattern arises when an appropriate scalemate is available.

I will test the hypothesis that scalematehood is lexicon-based by looking for potential scalemates of each SLI trigger in the lexicon of each language. 'Potential scalemates' are expressions whose meaning appears to be the dual of that of the SLI trigger (e.g. necessity modal expressions are potential scalemates to a possibility modal, and vice versa). Whether or not they will be actual scalemates depends on what the constraints are on scalematehood.

I will compare various properties of each SLI trigger and its potential scalemate(s). Under the lexicon-based scalemate hypothesis, we expect that whenever there are no candidates for scalemates in the lexicon, the SLI trigger must be obligatory. If there are potential scalemates to the SLI trigger, then the SLI trigger should be obligatory just in case the scalemate differs from it in a relevant property. Therefore, for an obligatory SLI trigger, I will stipulate that the differences between it and its potential scalemate(s) block scalemate association. For an optional SLI trigger, I will stipulate that the differences (if any) between it and its potential scalemate do not block scalemate association. Based on this resulting set of stipulations, I will draw a generalization about what makes a scalemate appropriate.

The detailed comparisons of SLI triggers and potential scalemates are found in section 3.3.1.2 for obligatory SLI triggers, and section 3.3.1.3 for optional ones. The results of these comparisons reveal a promising picture for a lexicon-based theory of scalar alternatives; I give a brief overview below. Table 3.4 summarizes the comparison between obligatory SLI triggers and their potential scalemates (sometimes selected among a larger set of potential scalemates in the lexicon to be most similar to the SLI trigger), and Table 3.5 does the same for optional ones.

SLI trigger	potential scalemate	SEMANTICS			SYNTAX			other
		flavors	tense	aspect	pos	as	c-type	
ba'iji	∅							
moči	*morati*	=	=	=	=	=	=	infrequent
·	*treba*	=	=	=	≠	=	=	
avoir (à)	*devoir*	=	=	=	=	=	≠	
falloir	*pouvoir*	=	=	=	=	≠	=	
·	*être possible de*	=	=	=	=	=	=	*ê.p.d.* not lexical
ele be	*ateŋu*	=	≠	=	=	≠	=	
·	*moɖeɖe le be*	=	≠	=	=	=	=	
deber	*poder*	=	=	≠	=	=	=	
must	*can*	=	≠	=	=	=	=	
·	*may*	⊃	=	=	=	=	=	

Table 3.4: Comparing properties of obligatory SLI triggering modals and their potential scalemates

In Table 3.4, we can see that the obligatory SLI triggers and their potential scalemates, if present, all differ in at least one semantic or syntactic property. We also find one SLI trigger (*ba'iji*) that does not have any potential scalemates in the lexicon.

SLI trigger	potential scalemate	SEMANTICS			SYNTAX			other
		flavors	tense	aspect	pos	as	c-type	
†*moči*	*morati*	=	=	=	=	=	=	*morati* PPI
få	*behöva*	⊂	=	=	=	=	=	
devoir	*pouvoir*	=	=	=	=	=	=	
tener que	*poder*	=	=	=	=	=	=	*t.q.* idiom span
haber que	*se-poder*	=	=	=	=	=	=	*h.q.* idiom span
nužno, *nado*	*možno*	=	=	=	=	=	=	*možno* PPI

Table 3.5: Comparing properties of optional SLI triggering modals and their potential scalemates

Table 3.5 shows the comparison of optional SLI triggers and their potential scalemates and reveals that there are the following differences: the scalemate can express a superset of flavors of that of the original item; the scalemate can be polarity sensitive, and the original modal can be an idiom span. These properties are thus stipulated to not block scalemate association. Furthermore, there is one pair of items in which no differences are observed (*devoir-pouvoir*).

Looking at the two tables together, we observe that the properties which differentiate optional SLI triggers and their scalemates are not the same as those which differentiate obligatory SLI

triggers and their potential scalemates. This allows us to propose a consistent lexicon-based theory of scalar alternatives. In particular, an item can be the scalemate of another only if it matches in all relevant syntactic properties (part of speech, argument structure, complement type) and semantic properties (flavors, temporal and aspectual profile). It does not have to match in polarity sensitivity. A scalemate must be a lexical item, as shown by the fact that the French possibility expression *être possible de*, not an atomic lexical item, cannot be a scalemate to *falloir* (which otherwise seem to match it in all properties). Furthermore, it appears that scalar alternatives cannot be derived (solely, at least) by replacement of syntactic constituents. This is shown by SLI triggers *tener que* and *haber que*, which are lexical spans, and therefore part of the language's lexicon, but non-constituents, since they are spans. Lastly, it appears that an item cannot act as a scalemate to another when it is low frequency in a given register (which is the case for Slovenian necessity modal *morati*, which is hardly used in everyday speech in contemporary Slovenian).

The set of properties that constrain scalematehood can be formulated into a plausible generalization: an item B can be a scalemate to an item A if A and B are lexical items and if A can be replaced by B without affecting a sentence's grammaticality or its semantics, modulo quantificational force. In section 3.3.1.5, I explain how this generalization captures the data in the tables, and discuss its significance. I then sketch a theory of 'lexical scalar alternatives' that predicts this generalization. I also talk about how it compares to previous theories, and discuss directions for further work.

3.3.1.2 Potential scalemates to obligatory SLI triggers

In this section, I review all obligatory SLI triggers from section 3.2. I will scan their lexicons for most likely candidates for potential scalemates (corresponding to necessity modals for possibility SLI triggers, and possibility modals for necessity SLI triggers). I compare the syntactic and semantic properties of the SLI trigger and its potential scalemate(s). These properties are then stipulated to block scalemate association, in order to account for the scalelessness of obligatory SLI triggers.

3.3.1.2.1 Siona *ba'iji* Siona *ba'iji* is a possibility modal and obligatory SLI trigger. In Siona, there is no necessity modal in the lexicon of the language, and for this reason, *ba'iji* cannot have a scalemate. This is consistent with the obligatoriness of the SLI observed with *ba'iji*.

3.3.1.2.2 Slovenian *moči* Obsolete *moči* was an optional SLI trigger, and then became contemporary *moči*, an obligatory SLI trigger. According to the hypothesis that links the type of SLI triggering with the availability of a scalemate, there should be a scalemate that was no longer available. I will argue that *morati* used to be a scalemate to *moči* up until the mid-20th century, but then its disappearance from colloquial speech made *moči* into an obligatory SLI trigger.

Let's start with the modal lexicon of the language. The currently available necessity modals in the language are *morati*, *treba*, and *naj*. Modals *treba* and *naj* cannot be appropriate scalemates to *moči* for syntactic reasons. *Moči* is verbal, inflects as a verb, and takes a nominative subject. Syntactically, *treba* and *naj* are adverbial. In contrast, *morati* has a similar syntactic behavior as *moči*, being an inflecting verb, and taking a nominative subject. Furthermore, as shown in Roeder and Hansen (2007), *morati* can express all the flavors that *moci* expresses: pure circumstantial, teleological, deontic, and epistemic.[29] Therefore, *morati* seems to have all the morphosyntactic and semantic conditions to be *moči*'s scalemate.

I argue that despite the perfect match in syntax and semantics, *morati* cannot be a scalemate to *moči* because of its near-disappearance from colloquial speech in modern colloquial Slovenian. I will show based on corpus data that *moči* is used in colloquial speech, while *morati* is found almost exclusively in formal register. Note that there can be confusion as to how often *morati* is used in colloquial speech. As mentioned in an earlier discussion, this is because in standard Slovenian, the inflected forms of *moči* and *morati* sound identical, e.g. '*morem*' and '*moram*' for first person singular are both pronounced as */morəm/*.[30] The forms diverge in the participial forms, used in past and future tenses: *mog(e)l-(a/o/i)* for *moči* and *moral-(a/o/i)* for *morati*.

[29]Note that I do not have enough evidence to answer the question as to whether a match in epistemic readings is necessary for scalematehood. I leave this to further research.

[30]This is not true in some dialects, where /e/ and /a/ phonemes are distinguished phonetically, for example the dialect spoken around Nova Gorica. However, that fact is irrelevant in that dialect, because the modal *upati* is used overwhelmingly instead of *moči*, as mentioned in Marušič and Žaucer (2016).

Prescriptively, *moči* is a possibility modal only (and allowed in negative contexts only), while *morati* is prescribed as the necessity modal. In the present tense, this prescriptivism is seen in writing only, since the pronunciation is the same. In contexts licensing participial forms, prescriptivists will argue that only *moral-(a/o/i)* is the "correct" form for a necessity meaning. However, the uses of this form in non-formal contexts are very rare. A search of the Gos corpus of spoken Slovene (Verdonik et al., 2011) (http://www.korpus-gos.net/) shows that participial uses of *morati* are almost absent in informal situations, in contrast with participial forms of *moči*. The corpus is tagged for different types of speech situations, allowing to control for formal and colloquial speech. I identified the category that seemed most informal and unaffected by prescriptive rules was 'non-public private' (*nejavni zasebni*), which is comprised of conversations among family or friends. The category that seemed most formal was 'public – informative and educational' (*javni informativno-izobraževalni*), comprised of moderated discussions on the radio or TV, and classes and lectures from elementary school to university. I show the counts of participial forms of *moči* and *morati* in Table 3.6, for each of these sub-corpora.

	total # words	*mog(e)l(a/o/i)*	*moral(a/o/i)*
colloquial	290.990	159	24
formal	359.549	73	252

Table 3.6: Uses of participial forms of *moči* and *morati* in colloquial and formal situations

The contrast is clear: in colloquial speech situations, for 159 uses of participial *moči* in informal situations, there are only 24 uses of *morati*; in formal speech situations, the ratio is reversed: for 73 uses of *moči*, there are 252 uses of *morati*. Therefore, it is safe to say that in current colloquial Slovenian, *morati* is hardly ever being used.

In order to explain the shift from an optional SLI pattern to an obligatory one, I am further claiming that *morati* used to be used frequently in colloquial contexts. I unfortunately do not have the tools for determining exactly when *morati* disappeared from everyday speech, as I do not have access to corpora of old spoken Slovenian. However, I checked in the same Gos corpus if colloquial instances of *morati* increase with age, in case the disappearance of *morati* is recent.

Counting unambiguous (participial) uses of the two modals, we have the results below in Table 3.7.

age	*mog(e)l(a/o/i)*	*moral(a/o/i)*	ratio *moči*:*morati*
19-24	55	7	7.9:1
25-34	40	1	40:1
35-59	41	9	4.6:1
>60	21	7	3:1

Table 3.7: Uses of participial forms of *moči* and *morati* per age group

The *moči*:*morati* ratio appears to be higher for ages above 35 than for those below 35, and highest for people above 60. This suggests that the disappearance of *morati* from colloquial speech is relatively recent, and has been occuring gradually at least since mid-20th century. Marušič and Žaucer (2016) report that possibility readings of *moči* could be observed until up to mid-20th century. Therefore, it would not be impossible to claim that the increased rarity of *morati* in colloquial speech induced the loss of its scalemate status with *moči*.

Since the loss of *morati* in colloquial speech is not categorical, we could imagine scalemate-hood as sensitive to frequency and/or register. A possible scenario is that low frequency affects the exposure of the potential scalemate to children: if below a certain threshold, they will not consider the modal as a scalemate. Another possibility is that register must match: *morati* cannot act as a scalemate to *moči* simply because it would not be used in the same range of contexts as *moči*.

Thus, we can imagine that when *morati* was still used in colloquial speech, *moči* was an optional SLI trigger. But as its frequency in colloquial speech waned (sometime around mid-20th century), *moči* could not associate with it no longer, and became an obligatory SLI trigger.

In conclusion, there seems to be a number of observations that correlate with the evolution of *moči*. First, the loss of *morati* in the main vocabulary allowed *moči* to become an obligatory SLI trigger. Second, as observed by Marušič and Žaucer (2016), *moči* was progressively replaced by *lahko* in positive contexts – this allowed the language to have a form to express the range of possibility meanings that *moči* used to express in the positive contexts. Third, the loss of *morati* might

have been aided by its phonological merging with *moči* in inflected contexts (which correspond to present tense in all persons, i.e. arguably the most common uses).

Finally, one fact about *morati* must be noted: it is currently a PPI, as it is ungrammatical with negation, as shown below.

(307) *Nisem morala it.
neg.cop must.prt go
int. 'I didn't have to go.' OR 'I had to not go.'

I also show evidence that it used to be a PPI back when it was expected to still act as a scalemate to *moči*. A search in a historical corpus that includes texts from the turn of the 20th century shows that searches of unambiguous cases of negated *morati* (search: 'ni moral') in unembedded contexts are nonexistent.[31] In contrast, examples of negated *moči* (search: 'ni mogel'), for the 'cannot' reading, and negated *trebati* (search: 'ni bilo treba') for the 'not have to' reading are very common. Since there were many clear uses of possibility *moči* before the turn of the 20th century, as Marušič and Žaucer (2016) report, we observe no correlation between *moči* being an optional SLI trigger and *morati* being a PPI. This is informative to the theory of scalar alternatives: polarity sensitivity does not appear to affect scalemate association.

3.3.1.2.3 French *avoir (à)* I have analyzed *avoir (à)* as ambiguous between a non-compositional parse, in which *avoir à* is an idiom span with a necessity meaning, and a compositional parse in which a possibility modal meaning arises from composing *avoir* with an *à*-headed clause (see section 3.2.8.2). This possibility parse gives rise to an obligatory SLI trigger, and is therefore expected to not associate with a scalemate in the lexicon. And indeed, *avoir (à)* differs from the necessity modals in the French lexicon in that it takes as complements *à*-headed clauses, which no French necessity modal does, e.g. *devoir à ...* is ungrammatical.[32]

[31] www.clarin.si/noske/sl.cgi/first?iquery=ni+moral&corpname=imp&corpus-search-form=true

[32] This also suggests that a Katzirian simplification algorithm is not available in this case, where *avoir* would be replaced with *devoir*, and the particle *à* deleted. After all, the necessity modal *devoir* covers all flavors, and just like *avoir (à)*, has all temporal perspectives (see the section on *devoir* in 3.3.1.3.2 for evidence).

3.3.1.2.4 French *falloir* French *falloir* is a root necessity modal and obligatory SLI trigger. Therefore it is expected to be the case that there are no possibility modals that can act as scalemates to it.

I will compare *falloir* with the two most plausible scalemates to it: *pouvoir* and *être possible de*. *Falloir* is obligatorily impersonal, and requires an expletive subject *il*, as shown in (308a). This differs from *pouvoir*, which requires a contentful subject, as shown in (308b).

(308) a. {Il, *je, *tu, ... } faut partir.
exp *1sg, *2sg ... must leave
One must leave. (cannot encode explicit attitude holder)

b. {Je, tu, il, ... } peux/t partir.
1sg, 2sg, 3sg/it ... can leave
{I, you, s/he/it, ...} can leave.

Due to these facts, replacing *falloir* with *pouvoir* is semantically odd unless the expletive is also changed; no subject can take the place of expletive “il" and still produce the desired meaning. Here, the unavailability of replacement is therefore due to the argument structure of the modal, a property reflected both in the syntax and semantics of the modal.

Another difference is that *falloir* can select a wider range of complement types, e.g. finite complement clauses, while *pouvoir* can’t.

(309) a. Il faut que tu partes.
it must that you go
‘It must be that you go.’

b. Il faut un crayon.
it must a pencil
A pencil is needed.

(310) a. *Je peux que tu partes.
I can that you go

b. *Je peux un crayon.
I can a pencil

Note that in cases where *falloir* embeds a complement clause, as in (311a) we could imagine a sentence with possibility *pouvoir* that achieves the possibility meaning needed for a scalar alternative, where it acts as a raising verb (the context is chosen to prefer that reading), as in (311b).

(311) a. Il ne faut pas que le bébé reste seul.
it neg must neg that the baby stay alone
The baby must not stay alone.

b. Le bébé ne peut pas rester seul.
the baby neg can neg stay alone
The baby cannot stay alone.

Here, the semantics of the two sentences is arguably exactly the same. However, the replacement of *falloir* by *pouvoir* is impossible here for independently motivated reasons: the sensitivity of scalemate replacement to the syntax of the expressions (which here differs), and the requirement that the scalemate must match the item in all of its contexts of use.

We also consider the expression *être possible de*, literally 'be possible to'. This expression is impersonal, like *falloir*. However, it is not a lexical item, and therefore by assumption cannot replace *falloir* in the lexical space. Evidence for it not being compositionally derived is found from the possibility of ellision of the *de*-headed clause.

(312) A: C'est possible d'y aller?
it.is possible to.there go
'Is it possible to go?'

B: Oui, c'est possible.
yes it.is possible
'Yes, it is possible.'

Furthermore, even if the theory allowed for replacement of constituents in the tree, it would not help for *être possible de*, which is not a constituent.

3.3.1.2.5 Spanish *deber* Spanish *deber* is a necessity obligatory SLI trigger. The theory therefore says that it should not be able to associate with any possibility item in the Spanish lexicon.

The one plausible candidate for a scalemate to *deber* is the possibility modal *poder*. I argue that it cannot associate with it because it has one (visible) difference: it interacts differently in the perfective aspect. Most modals in Spanish, as is observed more generally across languages, license an actuality entailment when perfective marked. This is shown crucially for possibility modal *poder*, and necessity modal *tener que*.

(313) a. Pude ir, #pero no fuí. → I went.
can.pf go but neg went
int. I was able to go, but I didn't go.

b. No pude ir, #pero fuí. → I didn't go.
neg can.pf go but went
int. I wasn't able to go, but I went.

(314) a. Tuve que ir, #pero no fuí. → I went.
have.pf that go but neg went
int. I had to go, but I didn't go.

b. No tuve que ir, #pero fuí. → I didn't go.
neg have.pf that go but went
int. I didn't have to go, but I went.

In the perfective aspect, the first observation is that *deber* is marked, and there seems to be a preference for a perfective-marked *deber* with negation, although it is not categorical. Furthermore, its entailments are reversed: when non-negated, perfective-marked *deber* licences an anti-actuality entailment, and when negated, it licenses an actuality entailment.

(315) a. *Context: there is a dangerous part of the path. I need to get to the other side if I want to reach my goal, the top of the mountain.*

Debí pasar. #Y pasé. ⇝ I didn't pass.
must.pf go and passed
(i) *int.* 'I had to pass. And I passed.'

(ii) 'I should have passed.'

b. *Context: there is a dangerous part of the path, and it was common sense that it was too risky to take it no matter the circumstance.*

No debí pasar. #Y no pasé. ⇝ I passed.
neg must.pf go and neg passed

(i) *int.* 'I didn't have to pass. And I didn't pass.'

(ii) 'I shouldn't have passed.'

The same meaning can be expressed with a typical counterfactual construction, which is constructed from the modal and counterfactual marking, as shown below.

(316) a. Deber-ía haber pasado.
must-cf have passed
'I should have passed.'

b. No deber-ía haber pasado.
neg must-cf have passed
'I shouldn't have passed.'

I will not attempt to give an analysis of this unexpected behavior, but only take it to mean that *deber* has a particular semantics which prevents it from associating with *poder*.

Otherwise, *deber* and *poder* behave exactly alike: they are identical syntactically, cover all modal flavors, and can both take past, present and future temporal perspectives.

This brings up the noteworthy observation scalematehood may be blocked because of the behavior in an environment in which the presence or absence of a scalemate doesn't matter. In this case, SLIs are blocked in the perfective aspect. This example supports the claim that an item must have the same scalemate across environments, even in those in which they don't matter, suggesting that scalemates are derived at the word-level, and sensitive to every aspect of the semantics of the item.

3.3.1.2.6 English *must* *Must* is, for some English speakers, a necessity modal and obligatory SLI trigger. I will argue it does not associate with any possibility modal in the language, because it is different from its auxiliary possibility counterparts *might*, *may* and *can* in having more modal flavors and/or different temporal properties.

Might is purely epistemic, and therefore cannot compete with *must* in its root meanings, which is where we expect the scaleless implicature to arise. We can therefore rule it out.

May has a more restricted set of flavors than *must*. It expresses deontic and epistemic meanings, as shown below.

(317) a. #To go to Harlem, you may take the A train. (teleological)

b. #Jane may climb the tree. (ability/pure circumstantial)

c. #Hydrangeas may grow here. (pure circumstantial)

In contrast, *must* is available with teleological and pure circumstantial flavors.

(318) a. To go to Harlem, you must take the A train. (teleological)

b. Jane must sneeze. (pure circumstantial)

Possibility modal *can*, in contrast, expresses the whole range of root modal flavors, just like *must*.[33] Therefore, *can* does not differ from *must* with regards to flavors expressed.

I will now show that the temporal profile of *must* differs from that of *can*, but not from that of *may*. Indeed, in its root flavors, *must* can only have present perspective.[34]

(319) a. #Yesterday, Vicky must.PAST to school. [*int.* had to]

b. #Probably next week, Vicky must.FUT go to school. [*int.* will have to]

Like *must*, *may* can only have present temporal perspective.

[33]There is variation in whether *can* can express epistemic meanings, and some authors report epistemic *can* is an NPI. Regardless, I have chosen to ignore the effect of a modal being able to express or not epistemic meanings, partly because of the lack of evidence, and partly because it is very plausible that it wouldn't matter to scalematehood. In this dissertation I am assuming that epistemic modals have a different syntax and semantics to root modals, so it is quite possible they have a different entry in the lexicon, and therefore don't necessarily associate with the same scalemates.

[34]In fact, in its epistemic flavors as well. If we admit the more general possibility for past perspective with epistemic modals, *must* does not appear to have them.

(i) When Susan arrived at Bob's house, she saw that the place was packed. There [had to,#must have been] be at least a hundred people there. But she found out later that actually, there were only 60.
[context borrowed from Rullmann and Matthewson (2018)]

(320) a. #Yesterday, Vicky may.PAST go to school. [*int.* could go]

b. ?Probably next week, Vicky can.FUT go to school. [*int.* will be able to]

If we take *can* to be a non-inflectable modal (crucially, analyzed as a separate lexical item from *could*), it has the same distribution as *must*.

(321) a. #Yesterday, Vicky can.PAST go to school. [*int.* could go]

b. ?Probably next week, Vicky can.FUT go to school. [*int.* will be able to]

However, there are reasons to think that they are not a separate item. First, the *-ould* suffix can in theory be isolated (by factorizing it out from *can-could*, *will-would* and *shall-should*), and does bear phonological resemblance to the regular past morpheme. If this is the case, then *can* can have a past perspective reading when inflected in the past tense, an option that *must* does not have.

If we prefer the analysis in which *can* is not the same lexical item as *could*, we can find another difference between *must* and *can*. Rullmann and Matthewson (2018) note that these two modals behave differently in sequence of tense scenarios, where *must* can have a simultaneous reading, allowing the temporal perspective to match that of the verb of saying, while *can* cannot, where the temporal perspective must be present tense. Note that *may* appears to allow for a simultaneous reading, like *must* (in contrast with what Rullmann and Matthewson (2018) report).

(322) a. When I turned 5, my mom told me I must begin doing chores.

b. #When I turned 5, my mom told me I can begin going out alone.

c. When I turned 5, my mom told me I may begin going out alone.

Therefore, there are contexts in which *must* is available but *can* is not, which means *can* cannot act as a scalemate to *must*.

These two examples of *may* and *can* failing to be *must*'s scalemates show again that the semantics of the item matters, and that scalematehood appears to be derived at the level of the word, rather than the utterance.

Finally, while we have enough arguments to explain *must*'s scalelessness, it is interesting to note that its root meaning is marked for formal register. Perhaps this could have a role in the scalemate search. Intuitively, the reverse should happen: a register-marked item cannot act as a scalemate for a general-use item, since it could not act as an alternative always (as discussed for Slovenian *moči*). But perhaps the reverse is possible too, and register-marked items are separate, and don't access items of the core lexicon as alternatives. Again, this would not makes sense at the utterance level, where general use utterances can of course act as alternatives to utterances in formal register. However, if an item is register-marked in its syntax or semantics, and there is a requirement on substitution that scalemates have to match at least all of the item's syntactic and semantic properties, then we could imagine that *must* could only associate with other formal items. This hypothesis would have to be checked in another situation, where everything else matches. I therefore leave this here as an interesting hypothesis.

3.3.1.2.7 Ewe *ele be* *Ele be* is a necessity modal and obligatory SLI trigger. I will show that it differs from two possibility modal expressions *ateŋu* and possibility construction *moɖeɖe le/li*, and therefore cannot have them as scalemates.

Ele be ranges across root meanings, from pure circumstantial (323), shown here, teleological (not shown), to deontic readings, as already seen in (265).

(323) E-le be m-a-nye.
expl-be comp 1sp-prosp-sneeze
'I must sneeze.'

It cannot express epistemic readings.

(324) *Context: the lights are on...*

#E-le be wo-a-nɔ aɸeme.
3s-be that 3s-prosp-be.loc home

int. 'He must$_{epistemic}$ be home.'

The temporal profile of *ele be* is deficient, as it cannot inflect for tense. For example, its expected inflection for past tense is ungrammatical, as shown below.

(325) a. *E-nɔ (anyi) be m-a-yi.
expl-be.past (ground) comp 1s-prosp-go
int. 'I had to go.'

b. *E a-nɔ (anyi) be m-a-yi.
expl prosp-be.past (ground) comp 1s-prosp-go
int. 'I will have to go.'

As potential scalemates, Ewe has possibility modal *ateŋu*, 'can', and possibility construction *moɖeɖe le/li*, 'there is a way to'.

(326) M-ateŋu a-yi.
1s-can prosp-go
'I can go.'

(327) Mo-ɖeɖe le/li be m-a-yi.
way-make.nom exists comp 1sg-prosp-go
'We can go.' *lit.* 'There is a way to go.'

Both these modals can take circumstantial, teleological and deontic meanings, which makes them similar to *ele be* in the range of root modal flavors they can express. However, both these modals differ in their semantic profile from *ele be* in that they can be inflected for past and future tense.

(328) a. Me-teŋu yi.
1sg.past-can go
'I was able to go.'

b. Ma-teŋu a-yi.
1sg.prosp-can prosp-go
'I will be able to go.'

(329) a. Moɖeɖe nɔ anyi be ma-yi.
path be.pst ground comp 1sg.prosp-go
'I could go.'/'It was allowed that I go.'

b. Modɖeɖe a-nɔ anyi be ma-yi.
path prosp-be.pst ground comp 1sg.prosp-go
'I will be able to go.'/'It will be allowed that I go.'

Furthermore, they appear to be different syntactically. Modal *ateŋu* is clearly syntactically different from *ele be* as a verb that can take a subject, and embeds an infinitival clause (rather than a non-finite clause).

Instead, the modal *modɖeɖe le be* appears very similar syntactically to *ele be*, in that it has the same argument structure: it is also impersonal, i.e. cannot combine with a subject, and also combines with a non-finite clause. One potentially relevant difference is found in their relative complexity, where *modɖeɖe le be* is more complex than *ele be*. First, *modɖeɖe* is a contentful noun, while *e* is an expletive. Further, *modɖeɖe* is morphologically complex: it is a nominalization of the the verb 'make way', where *mo* is 'way', *ɖe* is verbal 'make', and reduplication corresponds to nominalization (see e.g. Fabb (1992)). However, one may object to the fact that an expression's higher complexity matters to scalematehood, as long as that expression is an idiom, because it is found in the lexical space, and therefore may be able to freely associate with the original item (which appears to be, in this case, an idiom span). I therefore run the tests for idiomatic spans (from section 3.2.8.2) on *modɖeɖe le be*, which, like for *ele be* (see section 3.2.8.2, point to *modɖeɖe le be* being an idiom span, as it cannot coordinate lists.

(330) Mo-ɖeɖe le (*be) m-a-wɔ dɔ, (*be) (m)-a-tutu, ʋu-a ŋu (*be) (m)-a-yi adagbe.
way-make.nom exists comp 1s-prosp-do work comp 1s-prosp-clean car-def body comp 1s-prosp-go hunting
'I can work, clean the car and go hunting.'

It appears that the complementizer *be* cannot be separated from the modal expression in both cases. This suggests that both expressions are idiom spans lexicalized along with the complementizer. However, more investigation would have to be done in order to fully determine whether the ungrammaticality of these constructions is indeed due to the modal being an idiom span, or whether it is ruled out by independent constraints of Ewe syntax.

Another reason to suspect that this expression is an idiom span, rather than being interpreted compositionally, is that it can take on deontic readings, which are not necessarily expected from the literal construction, as least based on a comparison with the corresponding expression in English 'there is a way'. This English expression can be interpreted modally, but can only have circumstantial readings, and not deontic (e.g. you cannot say 'there is a way for you to have this cookie' to express permission). Again, this warrants further investigation into the differences between the Ewe and English words for 'way', but it does provide an additional reason to believe *moɖeɖe le be* is idiomatic.

Since *moɖeɖe le be* has been ruled different from *ele be* from having a different temporal profile, I will assume that this is sufficient for the two not to be scalemates of each other. I will leave as an open question whether an idiom span can act as a scalemate to a less complex item. This would ultimately have an impact on the theory of scalemate association. If they cannot be scalemates of each other, then it would question the theory drafted here, in which scalematehood is achieved in the lexical space, before entering the syntactic derivation.

3.3.1.3 Potential scalemates to optional SLI triggers

In this section, I review all optional SLI triggers from section 3.2. I will scan their lexicons for most likely candidates for potential scalemates (corresponding to necessity modals for possibility SLI triggers, and possibility modals for necessity SLI triggers). I compare the syntactic and semantic properties of the SLI trigger and its stipulated scalemate. If there is any difference between the SLI trigger and its scalemate, it will be stipulated to not block scalemate association, in order to account for the scalefulness of optional SLI triggers.

3.3.1.3.1 Swedish *få* Swedish *få* is a possibility modal that is an optional SLI trigger. In order to account for its behavior, we need to find an appropriate necessity modal to account for this optional behavior. I will argue that among frequently used necessity modals in Swedish, the only suitable potential scalemate to *få* appears to be *behöva*. This case will be informative to the theory

of scalemates, because it will show that scalemates can have a superset of flavors of the original item.

In order to establish that as informative, I consider other plausible scalemates among frequently used necessity modals, and argue why they cannot be scalemates: *måste* and *vara tvungen*.

Måste is ruled out as a scalemate because of its temporal profile: it cannot inflect for past or future tense, while *få* can, as shown below.

(331) a. Jag fick gå.
I fa.pst go
'I was allowed/required to go.'

b. Jag kommer att få gå.
I come to fa go
'I will be allowed/required to go.'

(332) a. *Jag måste.PAST gå.
I must.past go
'I have to go.'

int. 'I had/will have to go.'

b. *Jag kommer att måste gå.
I come to must go
int. 'I will have to go.'

The expression *vara tvungen* can be literally translated as 'be forced'. I argue it cannot be a scalemate to *få* for syntactic reasons, a sufficient reason being that the two modal expressions do not have the same complement type.[35] While *få* takes an infinitival clause as a complement, *vara tvungen* takes a clause headed by the particle *att*. Evidence that *att* is not part of a lexical span containing *vara tvungen* comes from the fact that an *att*-headed clause can be grammatically elided, as shown below (just like for English 'be forced').

[35]This is a sufficient reason, but there may be more: if *vara tvungen* itself is not an idiom span, then it cannot in any way replace *få*, since it cannot be found alone in the lexical space – I skip investigating this hypothesis, since it is not needed for our purposes. It is also not a constituent, and therefore cannot replace in *få* in the syntactic tree, even if the theory allows for constituent replacement.

(333) Jag är tvungen <*att gå*>.
I am forced to go
'I am forced <*to go*>.'

For this reason, *få* would not be able to be replaced with *vara tvungen att* in the lexical space. This means *få* and *vara tvungen* select two different types of complements, and therefore cannot be replaced with each other.

Behöva, on the other hand, is a necessity modal that resembles *få* in every relevant way, except for flavors. First, it can be inflected in the past or future as shown below.

(334) a. Jag behövde gå.
I need.pst go
'I had to go.'

b. Jag kommer att behöva gå.
I come to need go
'I will need to go.'

Syntactically, *behöva* is identical to *få*, with the same argument structure (contentful subject), part of speech (verb), complement type (infinitival clause) and complexity (one lexical item).

The one difference between *få* and *behöva* is that *behöva* expresses more flavors than *få* does, namely pure circumstantial (335), teleological (336) and deontic (337).

(335) Jag behöver nysa.
I need sneeze
'I need to sneeze.'

(336) A: How do you get to Zaplaz?

B: Du behova gå den här vägen.
you need go the here way
'You have to go this way.'

(337) Isac behöver betala en bot.
Isac need pay a fine
'Isac has to pay a fine.'

As seen previously, *få* only expresses deontic flavor. If *behöva* is the only good candidate for a scalemate to *få*, which indeed appears to be the case, then this example is informative to the theory: a scalemate may express more flavors than the item in question. This provides support for the idea that scalemates are scalemates if and only if they can replace the item in the lexical space, and be grammatical in all of its contexts of use. This allows for the scalemate to be grammatical in other contexts in which the original item is not. This also has the consequence that scalematehood is unidirectional, because the opposite direction is stipulated to not be true: a scalemate must be able to express at least all the flavors expressed by the original item. There is no direct evidence for this fact (the only observed case is with English *may*, which expresses fewer flavors than *must*; however, its temporal profile is also dissimilar, which we know must be the source of blocking scalematehood).

Competing with a weak necessity modal? We clearly have an available scalemate for *få*– however, we could still ask, theoretically, if a weak necessity modal is a possible scalemate. Swedish has a weak necessity modal *bör* ('should'), which can take present and past forms. However, it's unclear whether it could be used as a formal scalemate; here are a number of reasons to be skeptical of this possibility. First, it is unclear whether weak necessity modals have deontic readings (see Von Fintel and Iatridou (2008) and Chapter 6 for discussion). Second, it is unclear how a weak necessity modal would behave as a scalemate. If it is semantically weaker than a strong necessity modal, as most analyses in the literature suggest (Von Fintel and Iatridou, 2008; Staniszewski, 2020), then we would expect its negation to be compatible with a strong necessity modal, which means that the 'not have to' reading is not derived. Note that in my analysis for proposed in Chapter 6, the semantics of a weak necessity modal is not truth-conditionally weaker than strong necessity modals. However, it does come with differences which might come in the way for acting as a scalemate: first, I take weak necessity modals to be non-quantificational, in contrast with *få* which is assumed to be an existential quantifier;[36] second, they come with QUD

[36]Note: some analyses allow definites to compete with quantificational items, see Magri (2014); Spector (2007). Thus the reverse may be possible too. We could also analyze *få* as an indefinite plurality of worlds, which could compete with a definite alternative. This option comes with its own set of assumptions, in particular, one would

sensitivity that allows exceptions in certain contexts, which might therefore predict the readings of *få* to be QUD-sensitive as well – I do not look into that questionable option here. Finally, a weak necessity modal is very robustly neg-raising, so one might expect that excluding it through exhaustification will yield its neg-raising reading (concretely, exhaustification would produce the reading ‘can and ‘shouldn’t’). In summary, there are a number of reasons to be skeptical of weak necessity *bör* acting as a scalemate, albeit none strong enough to exclude this possibility.

3.3.1.3.2 French *devoir* French *devoir* is a necessity modal and optional SLI trigger. This means there should be a possibility scalemate that can act as an appropriate scalemate to it.

There is an obvious candidate for this role in *pouvoir*, which has the exact syntactic and semantic profile as *devoir* (modulo force).

Syntactically, the two modals behave alike: they are both verbal, take a contentful subject and select an infinitival clause.

Semantically, they are also alike. Both modals range over all flavors (epistemic, deontic, teleological, pure circumstantial), as shown below.

(338) a. Pure circumstantials:

(i) Jean peut entrer dans son pantalon.
Jean can enter in his pants
‘Jean can fit into his pants.’

(ii) Jean doit éternuer.
Jean need sneeze
‘Jean has to sneeze.’

b. Teleological:

Pour aller à Paris, tu peux/dois prendre le train.
to go to Paris you can/must take the train
‘To go to Paris, you can/must take the train.’

c. Deontic:

have to explain how exhaustification interacts with the uniqueness/maximality presupposition of the definite plural alternative. These questions are beyond the scope of this work.

Aujourd'hui, tu peux/dois aller à l'école.
today you can/must go to school

'Today, you can/must go to school.'

d. Epistemic:

La lumière est allumée, Marie doit être à la maison.
the light is on Marie must be at the house

'The light is on, Marie must be at home.'

Next, both modals can be inflected for past, present and future, as shown below.

(339) a. Laura devait/pouvait partir.
Laura must/can.PAST.IPF leave.
'Laura had to/could leave.'

b. Laura doit/peut partir.
Laura must/can.PR leave
'Laura has to/can leave.'

c. Laura devra/pourra partir.
Laura must/can.FUT leave
'Laura will have to/be able to leave.'

Finally, in the past perfective, both modals license actuality entailments.

(340) Laura a pu/dû y aller, # mais elle n'y est pas allée.
Laura have can/must.PF there go but she neg.there is neg went
'Laura could/had to go.' (and she went)

We can therefore pretty confidently say that *pouvoir* and *devoir* are a perfect morphosyntactic and semantic match, and therefore can act as scalemates to each other.

3.3.1.3.3 Spanish *tener que* and *haber que* These two Spanish modals are necessity modals and optional SLI triggers. I will argue that *tener que* can have possibility modal *poder* as scalemate, and *haber que* can have *se-poder* as its scalemate.

Both *tener que* and *haber que* are morphosyntactically complex expressions, and are not syntactic constituents. However, it is their status as elements in the lexicon that allows them to associate with scalemates. Indeed, as argued in section 3.2.8.2, both *tener que* and *haber que* are lexical spans, composed of a modal head, hosting *tener* or *haber*, and a complementizer head, hosting *que*. The semantics of this span is non-compositional, and is that of a typical necessity modal. It is easy to see that if they associate with each other in the lexical space, the rest of the derivation then proceeds in parallel.

This is because both pairs of modals inflect as verbs, select for infinitival complement, and have the same subjecthood status, where *tener que* and *poder* (shown in (341)) have a contentful subject, while *haber que* and *se-poder* (shown in (342b)) lack one.[37] I show basic examples of the verbs below that show this parallel behavior.

(341) Puede/tiene que ir.
can/has to go.
not available: 'One has to go.'

'He/she/they$_{sg}$ can/have to go.'

(342) a. (*Juan) hay que ir.
Juan be to go
'It is necessary to go. One/we must go.'

b. Se puede ir.
refl can go
'It is possible to go. One/we can go.'[38]

We can analyze *se-poder* in a similar way as Manzini (1986) for Italian reflexive *si*, where the impersonal reflexive pronoun *se* is a clitic that enters the derivation in the modal head with the verb *poder*. What is important for our purposes is that this allows *haber que* to associate with *se-poder* in the lexical space.

[37]Note how we can compare here French *falloir* and Spanish *haber que*: both are impersonal root modals. *Falloir* is an obligatory SLI trigger and *haber que* is an optional one. And this can be explained in my theory by the presence in Spanish of an impersonal possibility modal, and the absence thereof in French.

[38]Note that *se-poder* is ambiguous between having an expletive subject or a contentful subject.

Semantically, these modal pairs are alike. All four modals range over all root flavors (deontic, teleological, pure circumstantial). In addition, *tener que* and *poder* can express epistemic flavors.

I first show the range of flavors of *tener que* and *poder*.

(343) a. Pure circumstantial:

(i) Juan puede caber en el pantalón.
Juan can fit in the pants
'Juan can fit into the pants.'

(ii) Juan tiene que estornudar.
Juan has to sneeze
'Juan has to sneeze.'

b. Teleological:

Para ir a Santiago, puedes/tienes que tomar el bus.
to go to Santiago can/have to take the bus

'To go to Santiago, you can/must take the bus.'

c. Deontic:

Hoydía, puedes/tienes que ir al colegio.
today can/have to go to school

'Today, you can/must go to school.'

d. Epistemic:

La luz está prendida, María puede/tiene que estar en casa.
the light is on María can/has to be in house

'The light is on, Marie must be at home.'

I now show the range of root flavors of *haber que* and *se-poder*.

(344) a. Pure circumstantial:

(i) A que frequencia en promedio hay que ir al baño?
at what frequency in average is to go to bathroom
'At what frequency on average does one need to go to the bathroom?

(ii) Creo que se puede caber en este bote? (talking about a group)
think that refl can fit in this boat
'I think that we can fit in this boat?'

b. Teleological:

Para ir a Santiago, se puede/hay que tomar el bus.
to go to Santiago refl can/is to take the bus
'To go to Santiago, you can/must take the bus.'

c. Deontic:

Se puede/hay que ir al colegio hoydía.
refl can/is to go to school today
'It is possible/necessary to go to school today.'

Next, in addition to present tense, all four modals can be inflected for past and future, as shown below.

(345) a. Laura tenía que /podía partir.
Laura had to /can.PAST.IPF leave.
'Laura had to/could leave.'

b. Laura tendrá que /podrá partir.
Laura has.FUT to /can.FUT leave
'Laura will have to/be able to leave.'

(346) a. Había que /Se podía partir.
was to /refl can.PAST.IPF leave.
'One had to/could leave.'

b. Habrá que /Se podrá partir.
be.FUT to /refl can.FUT leave
'One will have to/be able to leave.'

Finally, in the past perfective, all four modals license actuality entailments.

(347) a. Laura pudo/tuvo que partir. ... #Pero no se fue.
Laura can/have.PF to leave but neg refl left
'Laura could/had to leave.' (and she left)

b. Se pudo/Hubo que partir. ... #Pero nadie se fue.
refl can/be.pf to go but no-one refl left
'We had to/could leave.' (and we left)

Therefore, we can conclude that *tener que* can have as its scalemate *poder*, and *haber que* can have as its scalemate *se-poder*.

3.3.1.3.4 Russian *nužno* and *nado* These two necessity modals exhibit an optional SLI pattern, and are therefore predicted to associate with a scalemate. I will show that they behave in an largely identical way, for the purposes of finding a scalemate.

I will argue that they associate with possibility modal *možno*. I will also discuss the potential role of prohibition modal *ne'lzja*.

Nužno and *nado* are adjectival modals. Instead of embedding the prejacent proposition, they are predicates of it – on a par with English 'be necessary'. The subject of the modal is in the dative case.

(348) Tebe nužno/nado sprosit'.
2s.dat must ask
'You have to ask.'

The same syntax is found for *možno* and *nel'zja*, as shown below.

(349) Tebe možno/nel'zja sprosit'.
2s.dat can/can't ask
'You can/can't ask.'

In grammars of Russian, *nužno* and *nado* are often refers to as adverbial modals. However, their adjectival status of this modals is made clear when predicating them of the propositional anaphor *èto* (the following sentences are of course only felicitous in contexts in which the anaphor has a salient antecedent in the discourse, which I skip for simplicity purposes).

(350) a. Èto – nužno.
this necessary
'This is necessary.'

b. Èto – nado.
this necessary
'This is necessary.'

c. Èto – možno.
this possible
'This is possible/permitted.'

d. Èto – nel'zja.
this impossible
'This is impossible/prohibited.'

Moreover, *možno* covers circumstantial, teleological and deontic flavors, just like *nužno* and *nado*. I show the availability of these three flavors for all relevant modals below.

(351) Pure circumstantial:

a. Mne nado/nužno čihnut'.
1sg.dat need sneeze
'I need to sneeze.'

b. Zdes' možno/nel'zja pomestit'sja.
here can/can't fit
'Here it is possible/impossible to fit.'

(352) Teleological:

a. Čtoby popast' na stanciju Universitet vam nužno/nado sdelat' peresadku na Biblioteke Lenina.
in.order.to end.up in station Universitet 2p.dat must make change on Biblioteka Lenina
'In order to go to the Universitet stop, you must change at Biblioteka Lenina.'

b. Idti na Krasnuju Ploščad' možno/nel'zja peškom.
go to red square can/can't on.foot
'You can/can't go to Red Square on foot.'

(353) Deontic:

Po novym pravilam nam nužno/nado/možno/nel'zja v školu segodnja.
by new rules 1pl must/must/can/can't in school today

'According to the new rules we must/can/can't go to school today.'

All these modals can be past or future marked.

(354) Tebe nužno/nado/možno/nel'zja bylo.
2s.dat must/can/can't cop.past
'You had to/could/couldn't.'

(355) Tebe nužno/nado/možno/nel'zja budet.
2s.dat must/can/can't cop.fut
'You will have to /will be able to /won't be able to.'

While perfective is available in the language, it cannot be combined with these predicates (note that they differ in this way from *moč'*, a verbal possibility modal). Therefore, in terms of the relevant syntactic and semantic properties, these modals behave in the same way.

However, a difficulty comes up with the fact that the possibility modal *možno* cannot combine with negation.

(356) *Tebe ne možno sprosit'.
2s.dat ne can ask
int. 'You cannot ask.'

This is problematic, since scalematehood of *nado* and *nužno* is needed specifically when they are negated. The only other possibility modal that has the same syntax, and can combine with negation, is *vozmožno*; however, it does not cover all the flavors – it can be circumstantial, but not deontic.

I analyze *možno* as a positive polarity item, which explains why it does not cooccur with negation. We have previously seen that old Slovenian *moči* associates with *morati*, a PPI. So we have already seen that it is possible for an alternative to a non-polarity sensitive item to be polarity sensitive, which means that some utterances have alternatives whose polarity licensing

requirements have not been met. An alternative explanation is to appeal to *nel'zja* simply as the morphological realization of negation + *možno*.

3.3.1.4 Summary and generalization

The results of the previous two sections can be summarized in Table 3.8 (repeated from the introduction).

	SLI trigger		potential scalemate	SEMANTICS flavors	tense	aspect	SYNTAX pos	as	c-type	other
obligatory		*ba'iji*	∅							
	◊	*moči*	*morati*	=	=	=	=	=	=	infrequent
		·	*treba*	=	=	=	≠	=	=	
		avoir (à)	*devoir*	=	=	=	=	=	≠	
		falloir	*pouvoir*	=	=	=	=	≠	=	
		·	*être possible de*	=	=	=	=	=	=	*ê.p.d.* not in lexicon
		ele be	*ateŋu*	=	≠	=	=	≠	=	
	□	·	*moɖeɖe le be*	=	≠	=	=	=	=	
		deber	*poder*	=	=	≠	=	=	=	
		must	*can*	=	≠	=	=	=	=	
		·	*may*	⊃	=	=	=	=	=	
optional	◊	†*moči*	*morati*	=	=	=	=	=	=	*morati* PPI
		få	*behöva*	⊂	=	=	=	=	=	
		devoir	*pouvoir*	=	=	=	=	=	=	
	□	*tener que*	*poder*	=	=	=	=	=	=	*t.q.* in lexicon
		haber que	*se-poder*	=	=	=	=	=	=	*h.q.* in lexicon
		nado,nužno	*možno*	=	=	=	=	=	=	*možno* PPI

Table 3.8: Comparing properties of SLI triggering modals and their potential scalemates (pos: part of speech; as: argument structure; c-type: complement type)

We can see that these results are consistent with a theory in which having a scalar alternative depends on whether there is an appropriate one in the lexicon. In particular, obligatory SLI triggers all have at least one property differentiating them from their potential scalemates. These differentiating properties range from purely syntactic properties like part of speech to purely semantic ones like interaction with aspect, as well as lexical status and frequency in a particular register. In contrast, optional SLI triggers have their scalemates match all of their properties. I propose the following generalization of these results in (357).

(357) An item B can be a scalemate to an item A if A and B are lexical items and if A can be replaced by B in any sentence without affecting its grammaticality (except polarity licensing), contextual felicity, or semantics modulo quantificational force.

This generalization captures why the selected syntactic properties must be the same: replacing an item with one whose part of speech, argument structure or complement type is different will yield an ungrammatical sentence, unless the surrounding context is also changed. For example, one cannot replace a verbal modal (like *moči*) with an adjectival modal (like *treba*) while keeping the rest of the sentence the same (the subject of the modal takes nominative case with *moči*, and dative case with *treba*). If one modal requires an expletive subject, and if it is replaced a modal requiring a contentful subject, the resulting expression is ungrammatical if the expletive cannot be read as contentful, or the sentence's semantics has been modified beyond quantificational force, if the expletive can be read as contentful (e.g. French 'il' is syncretic between an impersonal and third person singular masculine pronoun). If two modals differ in the syntactic type of the complement they select, then they cannot replace each other (without also changing the type of their complement). For example, *avoir* from the expression *avoir à...* cannot be replaced by *devoir* because *devoir à...* is ungrammatical.

This generalization also captures why the semantic properties such as the flavors expressed, the temporal and aspectual profile must be maintained in the scalemate. If the potential scalemate B expresses less flavors than a given item A, then it will not be able to act as a scalemate to A in all contexts of use, namely in those where A expresses the flavor that B cannot express. For example, *may* cannot express teleological or pure circumstantial readings, and therefore cannot act as a scalemate to *must* when *must* expresses those flavors. In those contexts, replacement would produce contextual infelicity. In contrast, there is no problem if the scalemate can express more flavors, as long as it covers all the flavors expressed by the original item (e.g. like scalemate *behöva* expressing teleological and pure circumstantial readings, which *få* doesn't). If the temporal profiles are different, then replacement yields ungrammaticality in some contexts. For example, if a modal does not combine with tense at all, like *must*, then replacing it with a modal which does combine

with tense will produce a sentence with an unsaturated tense variable. Finally, if a modal interacts with aspect in a different way, then the semantics is affected. For example, *poder* cannot act as a scalemate to *deber* because the actuality inferences are reversed when it interacts with perfective, meaning their semantics differs beyond quantificational force.

A property that does not matter to scalematehood is polarity sensitivity. This is found with obsolete *moči*'s ability to associate with *morati*, a PPI, and necessity modals *nužno* and *nado*, which can associate with PPI *možno*. Polarity licensing is seen as a different type of phenomenon from pure syntactic grammaticality (Chierchia, 2013); so this does not weaken the generalization.

Finally, if an item is not part of a particular register, it cannot act as a scalemate to another item that can be used in that register, since that would yield contextual infelicity (e.g. *morati* cannot act as a scalemate to *moči* because it is used at most very infrequently in colloquial contexts).

This generalization also reflects another property of SLI triggers, namely that their obligatory or optional status appears to be fixed across environments. For example, an item will not be obligatory in flavor A and optional in flavor B. This is expected only if there is a scalemate that covers *all* contexts of use.

I add one note about how flavors were compared, and question whether the equality relation shouldn't rather be treated as subsethood. Based on my assumptions (as stated in section 3.1.3), I have taken ability to be a type of pure circumstantial flavor, which in principle has a necessity counterpart; however, there are reasons to think that it should be treated as separate, and that it doesn't have a necessity counterpart at all. If this is the case, there should be instead of equality a subsethood relation between many of the studied SLI triggers and their potential scalemates. In particular, for almost all of the necessity modals, the possibility scalemates have an ability reading. In these cases, the subsethood relation is allowed between an item and its scalemate, and therefore doesn't affect the results. The only case that would be problematic under this different conception of the role of ability is in for obsolete *moči*, which clearly has an ability reading, and therefore would have a superset of flavors relative to its scalemate *morati*. This case is particularly difficult to investigate given its historical nature, and I leave the question for further study. However, this new way of determining flavor relationships is worth looking into. It would address the concern

brought up in 2.4.2.1, asking why English *or* is not an optional SLI trigger (since it has subdomain alternatives, and a theoretical prunable scalar one). The answer would go along these lines: pruning is only licensed if the result is not equivalent to another expression in the language. This would rule out pruning of *and* for *or*, but not of scalemates which express more flavors, since the result of pruning them yields a modal expression with less flavor ambiguity.

In the following section, I formulate a definition of scalar alternatives based on the generalization in (357). I should mention a caveat to developing a theory based on this generalization: some aspects of it are based on very little data or non-obvious analyses. For example, the claims that a scalemate can express a superset of the modal flavors, but cannot express a subset of them, is shown by just one example each. Also, the data that shows that scalar alternatives have to be in the lexicon is based on analyses of particular items. Therefore, the generalization awaits more data for some parts of it to be confirmed, and perhaps slightly modified. However, as a whole, the data is strongly suggestive of a reality behind a lexicon-based theory of scalar alternatives, as well as the theory behind obligatory and optional SLI triggers. Furthermore, the claim that non-syntactic properties must be visible to scalematehood also appears to be reliable (since it is based on positive evidence from 4 cases, and negative evidence from 7 cases). This result is important, because it is not a feature of previous definitions of scalar alternatives, which I discuss in the next section.

3.3.1.5 Towards a theory of lexical scalar alternatives

3.3.1.5.1 The definition of lexical scalar alternatives In this section, I propose a definition of a lexical scalar alternative that accounts for the generalization in (357). This generalization, as currently formulated, cannot be encoded as such in the grammar, because it quantifies over all possible contexts of an item's use, which are infinite, and is therefore not computationally viable. The definition I propose instead can be viewed as a plausible grammatical rule.

I assume a Distributed Morphology (DM) framework (Halle and Marantz, 1993). Following Marantz (1997), I assume that our grammatical knowledge is composed of three types of lists: the narrow lexicon (a list of terminal nodes that are inputs to the syntax), the encyclopedia (a set

of LF primitives associated with a syntactic structure), and the vocabulary (a set of PF primitives associated with a syntactic structure).

The theory of alternatives so far is grounded in the idea that alternatives are linguistic expressions, rather than LFs (as in Rooth (1985)). I embed this idea in the DM framework by assuming that these linguistic expressions are syntactic structures (rather than PF representations).

I give the following definition of a lexical scalar alternative.

(358) **Lexical scalar alternative**

Let a and b be subtrees (i.e. sets of contiguous terminal nodes).

a has b as a scalar alternative if:

a. $[\![a]\!]$ and $[\![b]\!]$ are in the encyclopedia (they are LF primitives)

b. (i) $\alpha([\![a]\!]) \equiv_{\exists\sim\forall} \alpha([\![b]\!])$ (a and b make the same assertion modulo force)

(ii) $\pi([\![a]\!]) \subseteq \pi([\![b]\!])$ (the presuppositions of a are entailed by those of b)

c. a and b have the same syntactic category and same selectional restrictions

$\alpha(s)$ denotes the asserted content of s; $\pi(s)$ designates the presuppositional content of s. I define $\equiv_{\exists\sim\forall}$ as an equivalence relation where universal and existential quantifiers are equivalent.

In other words, this definition says that an item and its scalemate are LF primitives, i.e. they are not compositionally derived. Their asserted content must be equivalent modulo force, and the scalemate must be defined whenever the original item is defined. Syntactically, they must have the same syntactic behavior, meaning that they must select and be selected by the same syntactic types.

With this definition of scalar alternative, we can derive the alternative of a sentence by parallel syntactic composition, as shown in (359).

(359) Let $[X[a[Y]]]$ be a sentence, where X, a, Y are subtrees. If a has an alternative b, then $[X[a[Y]]]$ has as an alternative $[X[b[Y]]]$.

This definition of lexical scalar alternative captures the generalization in a straigthforward way. Point (a) ensures that the item and its scalemate are lexical items (in the sense used in this chapter). Point (b-i) ensures strict duality, i.e. the same semantics modulo force. Point (b-ii) ensures that the scalemate will cover all contexts of use of the original item (e.g., in the case of modals, that the scalemate as as many or less flavor restrictions than the item). If register is encoded as a presupposition, then it also covers those cases (i.e. b must cover all all of a's registers). Point (c) ensures that if a sentence containing a is grammatical, then a sentence containing b also is. Finally, there is nothing in this definition that prevents b from being polarity sensitive when a is not, as desired.

On this last point, the grammar does one of two things. It may be that formal features, or alternatives projected items, are dropped in alternatives. This option is likely, as it is well-known that certain formal features are dropped in focus alternatives (e.g. uninterpretable gender features). Another option is to have different acceptability conditions on utterances and alternatives, where in only the former are L-trivial forms filtered out (a type of oddness independent of ill-formedness of syntactic or semantic composition, which is said to underlie polarity licensing (Chierchia, 2013)).

3.3.1.5.2 Comparison with previous theories of scalar alternatives This definition of a scalar alternative differs from previous ones proposed in the literature. I briefly show how the current theory compares to three prominent theories of scalar alternatives: Rooth (1985), Horn (1989), Katzir (2007)/Fox and Katzir (2011). I will not discuss these theories in depth, but show that none of them are restrictive enough to capture the data collected from SLI triggers.

In Rooth's (1985) theory, the main restriction on the form of an alternative of a constituent is that it must be a constituent of the same semantic type. This restriction will be a necessary but not sufficient condition for the present theory of alternatives. For Rooth, any syntactic constituent can generate alternatives, and any constituent can be an alternative. It is easy to see that this theory is too unrestrictive to capture the constraints observed on lexical scalar alternatives. It may capture some similar syntactic and semantic behavior, but not all – e.g. this does not differentiate between items with different parts of speech, nor with items with different contextual or semantic

restrictions; it also does not ensure strict duality. Furthermore, it operates on syntactic constituents, rather than lexical items.

Horn (1972, 1989), followed by Gazdar (1979) and others in the neo-Gricean tradition, proposes that scalar alternatives are derived from lexically-specified "Horn scales". Horn scales are sets of lexical items related by asymmetric containment, e.g. {or, and}, {some, all} (or {some, many, all}), {can, must}, etc. Horn's theory resembles that of lexical scalar alternatives in that scalar alternatives are formed from scales of lexical items, rather than syntactic constituents. The scales, depending on how they are defined, may ensure that the semantics of the items is equivalent modulo force (at least for duals). Syntactic behavior of items in Horn scales is left unspecified in the theory; the current theory is therefore more informative on this point. Therefore, if Horn's theory is mostly consistent with a lexical scalar alternatives theory, only less precisely defined. One difference between the theories is that Horn scales encode a bidirectional scalar relationship, while the lexical scalar alternative relationship is only unidirectional.

In Katzir (2007) and Fox and Katzir (2011), an alternative is derived by node replacement in a tree, where a node is substituted in for another, which is either a lexical item, a subtree of the original tree or a contextually available constituent. In contrast, lexical scalar alternatives involve replacement of a lexical item with another. This includes lexical items that do not correspond to syntactic constituents to have scalemates (e.g. Spanish *tener que* and *haber que*); this is a fact not predicted by a Katzirian theory, which only operates on constituents. (Fox&)Katzir capture the similarity in syntactic behavior observed between items and their scalemates, since substitution is performed on an already formed parse tree. However, they do not discuss semantic restrictions on replacing constituents, and predict, similarly to Rooth, that items with different contextual or semantic restrictions may serve as replacements. A Katzirian theory therefore predicts that some items will have scalemates in some contexts but not others (e.g. only for some modal flavors, or only in some registers). This is not what we observe.

I summarize the difference between lexical scalar alternatives and other theories for scalar alternatives in Table 3.9. In this table, I note what type of item can have a scalemate, which type of item can be a scalemate, whether there is a requirement on semantic equivalence modulo force, and

on same syntactic behavior, whether scalematehood is bidirectional or unidirectional, and whether an item is always a scalemate of another or depends on the context.

	item	scalemate	$\equiv_{\exists\sim\forall}$	same syntax	bidirectional	fixed
Rooth	constituent	constituent	no	no	yes	no
Horn	lexeme	lexeme	yes?	?	yes	yes
(Fox&)Katzir	constituent	lexeme/const.	no	yes	no	no
Lexical SAs	lexeme	lexeme	yes	yes	no	yes

Table 3.9: Comparison of different theories of alternatives

To conclude, the theory of lexical scalar alternatives differs from previous ones in imposing most restrictions on scalematehood. It appears most similar to Horn's in that scalematehood holds of lexical items; lexical SAs are defined more precisely with regards to semantic and syntactic restrictions, but these could easily be specified in Horn's theory; one difference is in the directionality of scalematehood; I discuss the significance of this point in the next section.

3.3.1.5.3 Grammaticalized pragmatics To end this section, I speculate about the reason why lexical scalar alternatives should be encoded in this way in the grammar. Why does the grammar prefer a fixed scalematehood relation rather than one that depends on context? Why is bidirectionality not a property of lexical scalar alternatives, like it is in Horn's theory? (After all, the grammar would be simpler if it were, as it would cut the number of specified relations in half.) Why should alternatives allow for unlicensed polarity items? And a more general question, why duals? These questions find an answer if one looks at lexical scalar alternatives as a grammaticalized approximation of a pragmatic phenomenon, that arises as a result of the grammar designing itself to reduce cognitive cost. I assume in the following discussion that cognitive cost increases with grammatical complexity, i.e. the number/length of rules needed to account for the data (using, for example, the Minimum Description Length principle).

We could imagine that no matter what the specifics of the grammar, communicative pressures between speaker and hearer derive pragmatic scalar implicatures, as in their original Gricean

conception (Grice, 1975). In this view, alternatives are *utterances* that the speaker could have said but chose not to, and are constrained by some principle of relevance (Sperber and Wilson, 1995; Levinson, 2000). However, there are reasons to think that a purely pragmatic system deriving scalar alternatives is cognitively costly, because there is no systematic algorithm to derive relevant alternatives. We know for instance from literature on focus that contextual alternatives are always available, and their semantic relationship to the utterance is relatively unconstrained. Nevertheless, this unconstrained pragmatic search for relevant alternatives may yield systematic or highly frequent, and therefore predictable, results. Therefore, it could be beneficial from a processing point of view for these particular results to be grammaticalized and made automatic without passing through pragmatics. This may be the case for scalar alternatives. In other words, a sentence containing a quantifier might be predictably uttered in a discourse that makes relevant its dual counterpart. Given this high mutual relevance property of duals, it is worth encoding dual sentences as alternatives directly into the grammar.

Encoding this property in the grammar in the effort of making the system less costly, however, will leave some of the properties of the original pragmatic system behind. In particular, the grammar has a choice to encode duals of sentences directly, or encode duals of quantifiers as lexical items, and then derive alternative utterances from the bottom up. However, duals of utterances would involve having to compute semantic equivalences (modulo force) of alternative utterances, but determining which are good candidates in the first place is a non-systematic and hence costly procedure. Finding duals of lexical items is much less costly, because the search is of (at most) the lexicon of the language, and having a parallel composition of the sentence and its alternatives adds virtually no complexity to the grammar. This explains the existence of lexical scalar alternatives. However, grammaticalizing scalar alternatives as derived from the bottom up introduces notable differences between the pragmatic and grammaticalized systems. In a purely pragmatic system, there is no constraint on a match between the syntax of the utterance and its alternatives; however, if scalemates are lexical items, there is; otherwise, the system would have to find a way to modify the alternative beyond simple replacement of the scalemate to make it grammatical, which is a non-systematic process. Furthermore, in a purely pragmatic system, an unambiguously deontic

modal can act as a 'scalemate' to a polyfunctional modal, but only in deontic contexts. Encoding this context-sensitivity in the grammar is arguably costly: the system would have to check each of the potential scalemates against the context; it is also unclear how to determine the set of potential scalemates.[39] In contrast, if we keep scalemates fixed and context-insensitive, as with lexical scalar alternatives, then the grammar can avoid the 'search and match' process, and simply stick to the same one (or not much more than one) scalemate, determined in the lexicon, independent of context.

Bidirectionality is not a property of lexical scalar alternatives, despite it being less costly than unidirectional alternatives. The existence of this property can be explained by the fact that lexical scalara alternatives are designed to approximate pragmatics, and the pragmatic system is unidirectional, where the search for relevant alternatives occurs on a case by case basis, in a particular context. This context sensitivity allows for relevant alternatives to include words with stronger contextual restrictions than the words in the original utterance. For example, a polyfunctional modal might very well be present in all alternatives of a deontic modal. However, a deontic modal can only be in the alternative to an utterance containing a polyfunctional modal when it is used deontically, but not in other flavors. When this process is grammaticalized, context-sensitivity is lost, and therefore the deontic modal is blocked from being an alternative to a polyfunctional modal in all contexts, but the opposite need not be true, since the polyfunctional modal covers all of the deontic modal's uses. Making lexical scalar alternatives bidirectional would lose this property of the pragmatic system.

Lexical scalar alternatives may contain unlicensed polarity items. This wouldn't be expected in a purely Gricean system, since the sentence would not be able to be potentially uttered and therefore wouldn't act as a real alternative utterance in its original sense. Why lexical scalar alternatives don't match the pragmatics in this particular case could be due to several reasons. First, polarity clashes are independent of well-formed syntactic and semantic composition, which is currently what lexical scalar alternatives require. This means that the grammar would have to encode an additional constraint to filter polarity items out, and therefore become more complex,

[39]Note that this procedure is an implicit feature of a Katzirian theory.

and perhaps they are uncommon enough that it is not worth it. Another factor that may play into this fact is that it is difficult to pinpoint polarity items and therefore have a system that filters them out effectively. For example, in Chierchia's (2013) system, polarity items are carriers of particular formal syntactic features and project particular alternatives. Perhaps it is already costly to filter out polarity items from other feature carriers and/or alternative projectors. Furthermore, the types of features and alternatives of polarity items is heterogenous, which means that even if the filtering algorithm of scalar alternatives can access particular types of features and alternatives, it would have to encode several combinations rather than one. Finally, it may very well be that the language may compensate for the presence of alternatives with unlicensed polarity items in other way. Indeed, in both cases observed of polarity items as lexical scalar alternatives, the end result of the grammaticalization is identical to what pragmatics would derive. In the case of obsolete Slovenian *moči* having PPI *morati* as a scalemate, the cases in which scalar implicatures are derived are those in which the alternative utterances are non-negated, and therefore when the positive polarity features are licensed, because *moči* is a possibility modal, and *morati* a necessity. Therefore, in a pragmatic system, a *morati* sentence has no problem being a scalar alternative to *moči*. Whenever *moči* is negated, the expression is strong, and therefore no scalar implicature would be derived anyways. In a pragmatic system, no alternative need be derived to a negated *moči* utterance, and in the grammaticalized lexical scalar alternative system, an alternative would be derived but with no truth-conditional effect. In the case of Russian *nužno* and *nado* having as a scalemate positive polarity *možno*, the situation is reversed: the alternative crucial to deriving the scalar implicature contains the ungrammatical negated *možno*. In a pragmatic system, this would be disallowed; however, Russian contains a prohibition modal *nel'zja*, which covers all contexts of use of *možno*, and therefore can be used as a pragmatic alternative. While the scalar alternative derived by the pragmatic process is different from the one derived by the grammaticalized one, the scalar implicatures derived by each system end up being equivalent.

To conclude, one could hypothesize that as many properties of the pragmatic system are imported to the grammaticalized system, as long as they don't make the overall cognitive cost higher. Scalar alternatives are highly predictable in the pragmatic relevance search, therefore duals

are grammaticalized as alternatives. Grammaticalization shifts the generation of alternatives from the level of the utterance to the level of the word. Unidirectionality of scalematehood is maintained because it matches the pragmatics, despite the fact that bidirectionality would make the grammar simpler, but the gain in processing cost is not worth the loss in the making grammaticalized pragmatics diverge from the original pragmatics. In contrast, filtering out polarity items is not worth the cost of doing so in the grammaticalized system, despite diverging from the original pragmatic system.

3.3.2 What makes a scalar alternative? The answer from non-SLI triggers

Now that we have developed a theory of what scalar alternatives should look like in certain cases, I look at cases of typical scalar implicatures observed with non-SLI triggers. This investigation will reveal that the scalar alternatives involved in distinguishing optional and obligatory SLIs cannot be responsible for all cases of scalar implicatures.

In particular, I show that lexical scalar alternatives cannot explain the scalar implicatures observed with English necessity modal *have to* or with Siona possibility modal *de'oji*. On the basis of these facts, I will argue that scalar alternatives may be derived in two different ways: at the word level and at the clause level. I call these two types "lexical scalar alternatives" and "clausal scalar alternatives". These two types will have different properties, and be relevant in different situations.

3.3.2.1 Scalar implicatures but no lexical scalar alternatives

3.3.2.1.1 English *have to* Negated English *have to* licenses a scalar implicature. I first show this is indeed the case using a few diagnostic tests.

In the following dialogue, B's response is a commentary on the scalar implicature generated by A's negated *have to* utterance.

(360) A: Mary doesn't have to go to school today. ($\rightsquigarrow$ *Mary can go to school today*)
B: Oh, I didn't realize she could!

Furthermore, this scalar implicature is embeddable. In the following conditional utterance, the consequent is meant to be an explanatory paraphrase of the antecedent. The consequent "you have the choice" is only valid if the scalar implicature $\neg\neg\Diamond$ has been computed.

(361) If you don't have to go, that means you have the choice.

Another test for diagnosing a scalar implicature is making use of Hurford's constraint in disjunctions: if no implicature has been computed, the negated *have to* expression is entailed by the *must not* expression (if the flavor is fixed), and disjoining the two would violate Hurford's constraint. However, one can disjoin the two and produce a felicitous sentence, as the following.

(362) In Siona, you either don't have to or must not use plural marking.

These tests confirm the intuition that *not have to* generates a scalar implicature. This means *have to* must project a scalar alternative. However, there is no obvious candidate for a possibility lexical scalar alternative to *have to*.

English *have to* is verbal (often dubbed 'semi-modal'), which can be clearly evidenced by its need for *do*-support when negated. There is no possibility modal in English that has the same syntactic status. In particular, *can* is an auxiliary, while *is allowed/able* are formed from auxiliary *be* and an adjective. Despite the difference in syntactic behavior, we could still imagine a non-standard analysis to give the chance for *have to* to have a lexical scalar alternative: both modals, *have to* and *can*, originate in the head of the ModP (note: *have to* is treated as one word, as is assumed anyways – see section 3.2.8.2), and the rest of the derivation occurs in parallel, except for PF operations, namely head movement (or copying) of *can* and insertion of *do* in front of negated *have to*.

However, even if this analysis were right, it would not be enough to establish lexical scalemateship of *have to* and *can*. The previous section established lexical scalar alternatives to be sensitive to semantic constraints. It so happens that *have to* has a wider semantic profile to *can*

and *be allowed/able to*. In particular, *have to* can be inflected for past and future. In contrast, *can* cannot be inflected for future.

(363) a. 'You won't have to leave.'

$\rightsquigarrow$ *You will be allowed/able to leave.*

b. **You will not can leave.*

This rules *can* out as a lexical scalemate.

As for considering the expressions *be allowed/able* as scalar alternatives, they can be inflected for past and future, but they do not span all the flavors expressed by *have to* (which range across root meanings, in addition to circumstantial meanings): *be able to* does not express deontic flavor, while *be allowed to* only expresses deontic flavor. I show this below.

(364) a. Deontic:

(i) You have to eat your spinach.

(ii) Am I allowed to have a cookie?

(iii)#Am I able to have a cookie?

b. Pure circumstantial:

(i) The apple has to fall to the ground if you let go of it.

(ii) #We are allowed to fit in this boat.

(iii) We are able to fit in this boat.

Because neither *be allowed to* nor *be able to* spans all root flavors expressed by *have to*, they cannot be lexical scalar alternatives to it. Furthemore, there are clear syntactic differences with *have to*, and they most likely don't correspond to LF primitives (and rather derived from the adjectival modals).

3.3.2.1.2 Siona *de'oji* Besides *ba'iji*, analyzed as a possibility SLI trigger, Siona has another possibility modal, *de'oji*, which, in contrast with *ba'iji*, does not trigger a SLI. Furthermore, it appears to trigger a scalar implicature, as shown by the following diagnostic tests.

(365) a. – Sai-ye de'o-quë?
go-INF good-NONASS
'– Can we go?'

b. – Beo-ji... sai-ye ba-'i-ji.
NEG.be-3S go-INF be-INF-3S
'– No... we must go.'

(366) Sai-ye de'o-to, jaje baito më'ë-bi ña-jë'ë.
go-INF good-COND so then you-SBJ see-OTH
'If you can go, so then you decide to go.'

Therefore *de'oji* does trigger a scalar implicature. However, there is no necessity modal in the lexicon, since *ba'iji* is not a necessity modal. However, an unembedded *ba'iji* utterance is a necessity utterance. Therefore, the intuitive reason behind the availability of a scalar implicature with *de'oji* is that a *ba'iji* utterance is available to express a necessity interpretation, and thus can serve as an alternative to a possibility *de'oji* utterance. In other words, in order to generate a scalar implicature, the set of alternatives of a *de'oji* utterance looks as follows.

(367) $Alt(\textit{de'oji}\ p) = \{\textit{de'oji}\ p, \text{EXH EXH}\ \textit{ba'iji}\ p\}$

Can we have this set of alternatives derived from lexical scalar alternatives? In Jeretič (2021b), I propose that *de'oji* and *ba'iji* are scalemates to each other, and that silent elements can be added to alternatives. There are first syntactic differences that make it difficult to argue for lexical scalar alternatives, namely that *de'oji* is adjectival and *ba'iji* is verbal. But let's assume that *ba'iji* can be a lexical scalar alternative to *de'oji* (because their syntactic and semantic behavior appears to be otherwise parallel). There remains the problem of having to add an EXH to the *ba'iji* alternative, and this runs into problems. First, it is theoretically unsatisfying: so far, alternatives to utterances have been derived in a clean, parallel way from the scalemates up; adding a stipulation that one

can add an EXH to an alternative but not the original is ad hoc, and it is unclear how it should be implemented. Second, it would create likely create symmetry problems elsewhere: e.g. 'allowed' would be able to have as an alternative 'EXH permitted', i.e. 'permitted and not required', which gives a necessity meaning, which 'allowed' clearly never has.

We could also possibly avoid these problems if EXH in an alternative is licensed just in case it also is applied to the original utterance. This would mean in this case that the original utterance would look like EXH (Alt(*ba'iji* p))(*de'oji* p). However, Alt(*ba'iji* p) is the set of subdomain alternatives over *ba'iji*'s modal base, which is exactly the same as *de'oji*'s (by virtue of the fact that they are alternatives to each other). This would make the *de'oji* utterance yield a SLI, and then no scalar implicature would have the chance to be further derived. One could also imagine a solution in which the alternative to *de'oji* is *ba'iji* together with EXH – [EXH EXH *ba'iji*], where EXH is type-lifted so that it can associate with non-propositional *ba'iji*. This, however, is problematic for several reasons. First, it makes the wrong predictions when associated with negation: such a local exhaustification would predict the absent 'not have to' reading. Furthermore, it violates the property of lexical scalar alternatives appear where they are associated with LF primitives, which would be difficult to argue for this construction.

For these reasons, it is clear that *de'oji* does not have as a lexical scalar alternative *ba'iji*.

3.3.2.2 Clausal scalar alternatives

It is clear that the scalar alternatives observed with negated *have to* and *de'oji* cannot be derived from lexical scalar alternatives. Furthermore, these scalar alternatives seem to be context sensitive (as seen with *have to* having no scalemate spanning all its contexts of use), and syntax insensitive. As discussed in section 3.3.1.5, these are properties of alternatives derived at the level of the clause, rather than of the lexical item.

These alternatives are derived at the level of the clause, and not the utterance, as evidenced from the observed embedded scalar implicatures with negated *have to* and *de'oji*.

I therefore propose that grammar allows for the derivation of alternatives at two levels: lexical and clausal. Note that previous theories of alternatives do not account for clausal alternatives

either: clausal scalar alternatives are syntax-insensitive, while Hornian and Katzirian theories are (at least) syntax-sensitive.

Allowing for clause-level scalar alternatives has a consequence: they cannot have the same status as lexical scalar alternatives in distinguishing between optional and obligatory SLI triggers. Indeed, if negated *have to* has clausal scalar alternatives, then we also expect obligatory SLI triggers such as *falloir*, *deber*, *must* to have clausal scalar alternatives, because the differences with their potential scalemates are comparable to the differences between *have to* and its potential scalemates). However, these obligatory SLI triggers are obligatory because they do not have a scalar alternative. Therefore, clausal scalar alternatives do not have a role in SLI computation. This must mean that they are generated only *after* EXH has applied to subdomain alternatives. This contrasts with lexical scalar alternatives, which are projected together with subdomain alternatives.

In other words, clausal scalar alternatives can be responsible for scalar implicatures with non-SLI triggers, but not with SLI triggers. If an item is SLI triggering (i.e. if it projects subdomain alternatives), it will be an obligatory SLI trigger if there are no available lexical scalar alternatives in the language, whether or not there are clausal scalar alternatives available.

This therefore allows a *not have to* utterance to have scalar alternatives, from which scalar implicatures can be derived. Below are examples.

(368) Clausal scalar alternatives to *not have to* utterances:

a. Alt(You don't have to go): You cannot go.

b. Alt(You won't have to$_{deon}$ go.): You won't be allowed to go.

c. Alt(You won't have to$_{circ}$ go.): You won't be able to go.

(369) Clausal scalar alternative to a *de'oji* utterance:

Alt(saiye de'oji): EXH saiye ba'iji.

How should one define a clausal scalar alternative? So far, we have determined that they are context-sensitive and syntax-insensitive, which reflects the fact that they are generated at clause-level. They are furthermore equivalent modulo force.

This is in fact compatible with being generated in the pragmatics, in the search for relevant alternatives (following the discussion in 3.3.1.5.3). However, it is also compatible with grammaticalized scalar alternatives generated at the clause-level. I give the two options for the nature of clausal scalar alternatives below.

(370) Two options for the nature of clausal scalar alternatives

a. **Pragmatic scalar alternative**, derived at the level of the clause through the pragmatic search for relevant alternatives

b. **Grammaticalized clausal scalar alternative**[40]

Clause a has clause b as a scalar alternative if:

(i) Given a context C, $[\![a]\!]^C \equiv_{\exists\sim\forall} [\![b]\!]^C$

(ii) b is at most as complex as a (based on some notion of relative complexity, e.g. number of pronounced syntactic nodes).[41]

If option (b) is the correct one, the effect of this grammaticalization is relatively minimal, compared to the pragmatic mechanism: it makes the generation of scalar alternatives fully systematic, and cuts the cost of the relevance search by already assuming that duals are relevant. However, it is unclear how the costs of the two procedures compare, because looking for dual utterances still requires searching among a set of candidates that is unclear to determine, and whose number may be infinite, or very large (if there are additional constraints). Therefore, unlike with lexical scalar alternatives, encoding clausal scalar alternatives in the grammar is not obviously less costly.

Determining the relative cost of the relevance search and of the dual search is left for further research.

[40]There are other options for deriving dual utterances, which I will not discuss here. One is to posit a Katzirian-like replacement of the universal quantifier by an existential quantifier, on the pure LF, independently from their syntax, and only afterwards mapped to an available sentence of the language. This solution might require departure from seeing an LF as fully dependent on the syntactic tree (the 'Meaning First' approach by Sauerland and Alexiadou (2020), for example, may be more amenable to such a solution).

[41]This differs from Katzir's (2007) notion of relative complexity, but is there for the same reason, namely to avoid symmetry problems.

One could also argue for theoretical advantages of one option versus the other. For example, at a first glance, it appears that that there is an advantage of having only the pragmatic option, without grammaticalized clausal alternatives: since it is assumed to be there anyways, the grammar would be simpler. However, one could always attempt to unify lexical and clausal scalar alternatives, and allow the equivalence search at two points in the derivation of a sentence: in the lexicon, and at the level of the clause, including contextual parameters. If this is possible, the grammar is hardly more complex. Another way to explain this is to say that clausal scalar alternatives, because they are context-sensitive, are generated after contextual parameters have been plugged in, which happens above the TP, the point at which EXH applies.

Another potential advantage to pragmatic scalar alternatives is that the fact that they are derived after SLIs are comes for free (since pragmatic computations come after EXH has been applied in the syntax). However, one could easily say that the alternatives of a clause can be derived only once: if alternatives are generated at the level of a word, no extra alternatives can be generated further in the derivation, e.g. at the level of the clause. This predicts that if subdomain alternatives are projected (from a lexical item, by assumption), no clausal scalar alternatives can be generated.

One could argue that the data from embedded scalar implicatures is evidence of grammaticalization, since this was the original reason for positing a grammatical scalar implicatures (see discussion in Chierchia et al. (2012)). However, one can have pragmatics at the clause-level: Simons (2010) has proposed an attractive way of deriving embedded scalar implicatures in a purely Gricean framework, by applying the Gricean Maxim of quantity not only to utterances, but any available clause. Therefore, I don't take embedded scalar implicatures to be evidence for grammaticalization.

There are potential differences in the distribution of these two conceptions of clausal scalar alternatives, which may help distinguish between them. This question awaits further investigation.

To conclude, I have argued for the existence of clausal scalar alternatives, which have the properties of being sensitive to the context (i.e. they are derived once context parameters have already been plugged in), and insensitive to the syntax (i.e. the utterance and its alternative need not

have the same syntactic skeleton). They differ on these two properties from lexical scalar alternatives, which are context-insensitive and syntax-sensitive. Furthermore, clausal scalar alternatives do not play a role in SLI generation, and therefore must be generated after EXH has applied to alternatives projected by lexical items (i.e. subdomain alternatives and/or lexical scalar alternatives). I leave open the nature of clausal scalar alternatives, namely whether they are derived fully in the pragmatics, or whether they are grammaticalized.

3.3.3 The existence of items lacking subdomain alternatives

In this section, I argue for the assumption that subdomain alternatives are a lexicalized property, separating SLI triggers (obligatory and optional) and non-SLI triggers.

One assumption the theory of obligatory and optional SLIs rests on, as I presented it, is the QUD-sensitive, and otherwise unrestricted, availability of pruning scalar alternatives to account for optional SLIs. Since not all modals trigger SLIs (e.g. 'you can go' can never mean 'you must go'; 'you don't have to go' can never mean 'you mustn't go'), a correlate of this assumption is that subdomain alternative projection is not available to all modals. In other words, it is a lexicalized property.

This claim might not be too surprising to some, in light of the state-of-the-art analyses of polarity sensitive items, which lexically encode subdomain alternatives (invoking a type of exhaustifier that, in contrast with the EXH used in this dissertation, does not escape contradiction: Chierchia 2013; Zeijlstra 2017 a.o). However, one may contest this assumption, and instead argue that all items project subdomain alternatives, but that sometimes scalar alternatives are not prunable, therefore never releasing the subdomain alternatives to trigger a SLI. In this section, I give arguments that there must exist items that do not trigger subdomain alternatives.

First, from a theoretical point of view, removing idiosyncratic behavior in subdomain projection does not help us move away from idiosyncrasy altogether. We still need to account for the difference between optional SLI triggers, and non-SLI triggers: why can the former prune its scalar alternative but not the latter? Perhaps the two different proposed types of scalar alternatives

behave differently with respect to prunability: lexical scalar alternatives can be pruned to reveal subdomain alternatives, while clausal scalar alternatives cannot.

However, this assumptions runs into problem, because it would mean that non-SLI triggers should always be associated with clausal scalar alternatives. This does not seem to be the case. For example, the English adjectival modals *permitted* and *required* seem to behave in exactly the same way, suggesting that they are lexical scalar alternatives to each other. Similarly, BCS (Bosnian/Serbian/Croatian) possibility and necessity modals *moći* and *morati* appear to behave in an exactly parallel way morphosyntactically and semantically, as described and analyzed in Veselinović (2019). However, they do not appear to trigger SLIs (because, as claimed in Veselinović (2019), neither of these modals displays a neg-raising behavior). We would therefore expect lexical scalar alternatives to be available for these items, nevertheless they do not project subdomain alternatives.

Second, I put forward evidence from Nez Perce and Ecuadorian Siona that could not be explained in our framework if we assumed subdomain alternative projection by all items.

Nez Perce *o'qa*. As described by Deal (2011), the Nez Perce deontic modal lexicon is restricted to one lexical item – *o'qa*, which descriptively has variable force, i.e. it can express both possibility or necessity meanings, as shown in (371).

(371) 'inéhne-**no'qa** 'ee kii lepít cíickan
take-MODAL you DEM two blanket
a. You can take these two blankets.
b. You should take these two blankets.

This variable force pattern, however, is restricted only to upward-entailing contexts; when embedded in downward-entailing contexts, it can only have possibility readings, as shown under negation in (372) and in a conditional antecedent in (373).

(372) *Context: you are explaining to someone who thinks they have to leave that they are not in fact required to do so. It's not necessary for them to leave.*

#wéet'u 'ee kiy-**ó'qa**
not you go-MODAL
(intended) 'You don't have to go'.

(actual, but weird in the context) 'You can't go.'

(373) *Prompt: If I have to call the doctor, I will.*

#c'alawi 'a-múu-**no'qa** saykiptaw'atóo-na, kaa 'e-múu-nu'
if 3OBJ-call-MOD doctor-OBJ then 3OBJ-call-PR
(intended) 'If I have to call the doctor, I will'.

(actual, but not the prompt) 'If I can call the doctor, I will.'

Based on data of this type, Deal (2011) analyzes *o'qa* as a possibility modal that cannot trigger a scalar implicature because of the lack of such an item in the lexicon, hence the possibility of using *o'qa* to express necessity, as a special case of the possibility reading. In non-UE contexts, however, the necessity reading is not stronger than the possibility reading, therefore not a special case of it, and therefore it cannot be expressed by *o'qa*.

Deal (2011) does not consider any kind of additional strengthening mechanism in the grammar, and I adopt her analysis as is, crucially without appealing to subdomain alternatives to *o'qa*. But what happens if we assume that all modals triggered subdomain alternatives? This means *o'qa* would also trigger subdomain alternatives. But if it did, its expected behavior would be different, both in unembedded and downward-entailing environments. First, we would expect an obligatory necessity reading when unembedded. We could maybe argue that since there is no other possibility modal in the language, functional reasons would pressure pruning subdomain alternatives for *o'qa*, accounting for its common possibility reading (more than would be expected for SLI triggers observed in this chapter). This is questionable given Deal's observation that possibility is the default reading. However, the strongest evidence against subdomain alternative projection is from downward-entailing environments. If it triggers subdomains, we should expect exhaustification to be optional in these environments. There is no functional pressure to not express necessity read-

ings in these environments, of course, since in fact that is a reading that is otherwise unexpressable. However, this is not what we observe.[42]

Therefore, I conclude that Nez Perce *o'qa* does not project subdomain alternatives, and its variable behavior is explained as in Deal's (2011) analysis.

Note that this is also the first case we have seen of an utterance that lacks scalar alternatives altogether, even a clausal one. Deal does mention the use of periphrastic constructions to express necessity in Nez Perce, e.g. through imperatives. The existence of these constructions, which express necessity, but are not exact duals to *o'qa* utterances, provides support for a constraint on clausal scalar alternatives that they should be exactly equivalent to the original utterance modulo force.

Siona *de'oji*. As mentioned in the previous section, there is another possibility modal in Siona, *de'oji*. This modal never licenses a scaleless implicature. However, there are no necessity modals in the language to block it. If *de'oji* had subdomain alternatives, it would have the exact same architecture as *ba'iji*. Why would the strengthened *ba'iji* utterance act as a clausal scalar alternative to the *de'oji* one, and not the other way around? The only way of explaining the difference without being stipulative is by saying that *ba'iji* has subdomain alternatives, and *de'oji* doesn't.

Therefore, based on the evidence from Nez Perce and Siona, subdomain alternative projection must be lexically encoded.

3.3.4 The typology

With all these pieces in place, we can draw up the following typology in Table 3.10, in which items can be categorized into those projecting subdomains or not, and those projecting lexical scalar alternatives or not. A further distinction is made for items that do not project either subdomains

[42] Another explanation to entertain is that EXH cannot apply in embedded environments in Nez Perce. However, this type of behavior has not been observed for all the items described in this section.

or lexical scalar alternatives: whether or not they are part of utterances that have clausal scalar alternatives.

	subdomain alts	**no subdomain alts**
lexical Scalar Alts	◇: *få*, †*moči* □: *devoir*, *tener que*, *haber que*, *nužno*, *nado*	◇: *permitted;* □*: required* ◇: *moći*$_{BCS}$; □: *morati*$_{BCS}$
no lexical Scalar Alts	◇: *ba'iji*, *moči*, *avoir (à)*$_1^{\%}$ □: *falloir*, *deber*, *must*$^{\%}$, *ele be*	**clausal Scalar Alt:** ◇: *de'oji*; □: *have to* **no clausal Scalar Alt**: ◇: *o'qa*

Table 3.10: Typology of modals according to type of alternative projected
(modals from Swedish, Slovenian, French, Spanish, Russian, Siona, English, Ewe, Bosn/Croat/Serbian, Nez Perce)

3.4 Conclusion

In this chapter, I have presented 14 items from 7 languages that can be identified as SLI triggers, and fall in four different categories: either existential or universal, and either with obligatory or optional SLI behavior. They are all unified in their predicted behavior. Obligatory SLI triggers are obligatory in unembedded and QUD-neutral contexts, unlicensed under clausemate negation, and optional in other non-UE contexts. Optional SLI triggers differ from obligatory ones in that they are optional in unembedded and QUD-neutral contexts.

In the second part of the chapter, I investigated the theoretical difference between obligatory and optional SLI triggers, following the analyses of SLI triggers presented in Chapter 2, where obligatory SLI triggers lack a scalar alternative and optional ones have one. I scanned the lexicons of each SLI trigger for their potential scalemates, and compared a number of syntactic and semantic properties. The result of this study showed that all obligatory SLI triggers had at least one property distinguishing them from their scalemates, while optional SLI triggers had none. Based on these results, I proposed a new theory of 'lexical scalar alternatives', which are characterized by needing a full match in syntactic and semantic behavior. This theory is more constrained than previous theories of scalar alternatives, but bears most resemblance to that of Horn's (1972), in that lexical

scalar alternatives associated are with each other at the word-level. I argued that the particular properties of lexical scalar alternatives could be explained by viewing them as a grammaticalized approximation of scalar alternatives derived pragmatically. I then showed that another type of scalar alternative had to be active in grammar, namely clausal scalar alternatives. This type of alternative is derived at clausal level, and cannot participate in SLI computation. Finally, I argue that subdomain alternative projection must be lexically-encoded, which allows us to draw a full typology of quantificational items in terms of what alternatives they project.

CHAPTER 4

Scaleless implicatures blocked by Actuality Entailments

4.1 Introduction

As introduced in the previous chapter, there is a peculiar fact further unifying scaleless implicatures: they are blocked when the modal is perfective-marked. I repeat the relevant data here.

Among all the SLI triggers in Chapter 3, the ones that can be perfective marked are Slovenian *moči* and French *avoir (à)* for possibility modals, and French *falloir* and *devoir*, Spanish *tener que* and *haber que* for necessity modals. Spanish *deber* can also be perfective-marked, but its effect is surprisingly different, as mentioned in Chapter 3, so I leave it aside for the discussion in this chapter, assuming that the strange interaction is something special about the semantics of *deber*.

In the right environments, SLIs are computed when these modals are not perfective-marked. In contrast, in the perfective aspect, SLIs are blocked.

(374) a. ***Mogla*** sem dvigniti tega kamna.
MOD AUX.1SG lift this stone
I had to lift this stone. □,*◊

b. ***Z-mogla*** sem dvigniti tega kamna.
PF-MOD AUX.1SG lift this stone
I was able to lift this stone. ◊
*I had to lift this stone. *□

(375) a. J'***ai*** ***à*** lui parler.
I'have to pro talk
I {have to, ***can**} talk to her. □

b. J'ai ***eu*** ***à*** lui parler.
I'have have.pf to pro talk
I got to talk to her. ◊
(also available: 'I had to talk to her', due to *avoir (à)*'s ambiguity – see Chapter 3)

(376) a. Il **ne** ***faut*** **pas** sortir.
it NEG must NEG go.out
We must not go out. □¬
*We don't have to go out. ¬□

b. Il **n'** a **pas** ***fallu*** sortir.
it NEG AUX NEG must.PF go.out
*We had to not go out. *□¬
We didn't have to go out. ¬□

(377) a. On **ne** ***doit*** **pas** sortir.
we NEG must NEG go.out
We must not go out. □¬
We don't have to go out. ¬□

b. On **n'** a **pas** ***dû*** sortir.
we NEG AUX NEG must.PF go.out
*We had to not go out. *□¬
We didn't have to go out. ¬□

(378) a. **No** ***tienes*** ***que*** ir.
neg have.2s that go
You must not go. □¬
You don't have to to. ¬□

b. **No *tuviste* *que*** ir.
neg have.pf.2s that go
*You had to not go. *□¬
You didn't have to to. ¬□

(379) a. **No *hay* *que*** ir.
neg exists that go
We must not go. □¬
We don't have to to. ¬□

b. **No *hubo* *que*** ir.
neg exists.pf that go
*We had to not go. *□¬
We didn't have to to. ¬□

This blocking behavior appears to be uniform across existential and universal SLIs, and across optional and obligatory triggers.

Every other language from Chapter 3 either doesn't have a dedicated perfective marking or cannot mark perfective on the specific modals. Therefore, every SLI trigger that can be perfective-marked appears to be blocked by it, with one exception noted in Chapter 3 – Spanish *deber*. I come back to this case in section 4.4.

In this chapter, I argue that the SLI blocking in each of these examples is not a result of the syntax or semantics of the perfective-marking, but rather of the Actuality Entailment, or anti-Actuality Entailment licensed by it.

When perfective-marked, in non-negated sentences, modals in Slovenian, French and Spanish license Actuality Entailments (AEs), i.e. non-cancellable inferences that the prejacent is true, as in (381a); when negated, they license anti-AEs, i.e. non-cancellable inferences that the prejacent is false, as in (381b) (Hacquard, 2006; Homer, 2011 a.o.).

(380) ***Z-mogla*** sem dvigniti tega kamna. ... *#but I didn't lift it.*
PF-MOD AUX.1SG lift this stone
I was able to lift this stone, #but I didn't lift it.

(381) a. {Il a ***fallu***, On a ***dû***} sortir. ... *#but we didn't go out*.
it AUX NEC.PF we AUX NEC.PF go.out
We had to go out.

b. {Il **n'** a **pas** ***fallu***, On **n'** a **pas** ***dû***} sortir. ... *#but we did*.
it NEG AUX NEG NEC.PF we NEG AUX NEG NEC.PF go.out
We didn't have to go out.

(382) a. Hubo/Tuvimos que ir, ... *#but we didn't go*.
must that go
We had to go (and we did).

b. No hubo/tuvimos que ir, ... *#but we went*.
neg must that go
We didn't have to go (and we didn't).

There is one exception to this behavior: *avoir (à)*, in its possibility reading, is ambiguous between AE-licensing and not. I come back to this case in section 4.4.

In section 4.2, I show how a scaleless implicature analysis of this strengthening predicts its blocking by (anti)-Actuality Entailments. In section 4.3, I provide support for the claim that AEs are the source of the blocking, and in section 4.4, I discuss its challenges.

4.2 Deriving the blocking

In this section I show how an analysis couched in Fox's (2007) framework derives the blocking of SLIs in the presence of actuality entailments or anti-actuality entailments. The contrast I will derive can be summarized as the following (I adopt the notation and used by Alxatib (2019) to represent AE-licensing modals).

(383) SLIs (derived in Chapter 2):

a. EXH EXH $\Diamond p \equiv \Box p$

b. EXH EXH $\neg\Box p \equiv \Box\neg p$

(384) SLI blocking (to be derived here):

a. EXH EXH $p \equiv p$

b. EXH EXH $\neg\check{\Box}p \equiv \neg\check{\Box}p$

In essence, the way it works is that the alternatives of an (anti-)AE utterance all have the same (anti-)AE, and therefore can never be Innocently Excludable with respect to each other. This means that they can never become excludable with respect to the utterance, and therefore never trigger the SLI. I detail how this works below.

While I remain neutral with respect to the details of a theory of actuality entailments, I adopt the assumption that the alternatives of an expression that triggers an (anti-)AE also trigger (anti-)AEs, as shown below for the two relevant cases below: a possibility expression and a negated necessity modal expression.

(385) a. $Alt(\check{\Diamond}_{\{w_1,w_2\}}p) = \{\check{\Diamond}_{\{w_1,w_2\}}p, \check{\Diamond}_{\{w_1\}}p, \check{\Diamond}_{\{w_2\}}p\}$

b. $Alt(\neg\check{\Box}_{\{w_1,w_2\}}p) = \{\neg\check{\Box}_{\{w_1,w_2\}}p, \neg\check{\Box}_{\{w_1\}}p, \neg\check{\Box}_{\{w_2\}}p\}$

This assumption is in line with previous work: I follow Homer (to appear) who analyzes AEs as part of the semantic contribution of a perfective modal utterance, due to the fact that they are not cancellable. For this reason, they also should be part of the semantic contribution of the alternative utterances.

Before beginning the derivations, we have to clarify the peculiar interaction of AE-licensing modals and negation. As observed in section 4.1, when a modal is perfective-marked, it licenses an AE, as shown in (386a) and (387a). When that perfective-marked modal is negated, it licenses an anti-AE, as shown in (386b) and (387b).

(386) a. $p \equiv \Diamond p \wedge p$

b. $\neg p \equiv \neg\Diamond p \wedge \neg p$

(387) a. $p \equiv \Box p \wedge p$

b. $\neg\check{\Box}p \equiv \neg\Box p \wedge \neg p$

The conjunctive inference obtained with negated perfective-marked modals is stronger than the negation of the conjunctive inference $\Diamond$/$\Box p \wedge p$ obtained with non-negated perfective-marked modals. A theory of AEs should capture this. One way of doing so is to posit a biconditional requirement between the prejacent and the modalized expression (for versions of such a requirement, see Alxatib (2019), Homer (to appear)). For our purposes, it is important to note that this biconditional requirement continues to hold when an AE expression is in any negative environment (not only sentential negation). I show this below for extra-clausal negation.

(388) Ce n'est pas le cas qu'elle a pu y aller. ... *#and she went.*
it NEG'be NEG the case that'she have can.PF there go
It's not the case that she could go. anti-AE

Furthermore, the biconditional requirement continues to hold when an anti-AE expression is itself negated. In other words, the negation of a negated anti-AE expression is truth-conditionally equivalent to an AE expression, as expressed in (389), and confirmed empirically in (390).

(389) $\neg\neg\check{\Box}p \equiv \Box p \wedge p$

(390) Ce n'est pas le cas qu'il n'a pas fallu y aller.
it NEG'be NEG the case that'it NEG'have NEG must.PF there go
It is not the case that we didn't have to go.

a. #... mais on n'y est pas allés.
but we NEG'there be NEG went
... but we didn't go. → AE

b. #... mais on ne devait pas y aller.
but we NEG must.IPF NEG there go
... but we didn't have to go. → modal inference

This means that if two modal expressions have the same prejacent, and they license an (anti-)AE, they have the same (anti-)AE, therefore conjoining one and the negation of the other yields a contradiction:

(391) For any two modal bases X and Y:

a. ${}_X p \wedge \neg {}_Y p \equiv {}_X p \wedge p \wedge \neg {}_Y p \wedge \neg p \equiv \bot$

b. $\neg \check{\Box}_X p \wedge \neg\neg \check{\Box}_Y p \equiv \neg \Box_X p \wedge \neg p \wedge \Box_Y p \wedge p \equiv \bot$

As far as our modal expressions are concerned, the (anti-)AE is the same between an utterance and its alternatives. This is because the modals, by hypothesis, project alternatives that vary only by modal base, while their prejacent stays constant. Therefore, the blocking arises from the fact that the alternatives of an AE utterance cannot be exhaustified with respect to each other, because their AEs conflict. Therefore, the alternatives are never IE with respect to each other, which makes EXH application trivial at any point of the derivation, preventing strengthening. The blocking can be seen in the derivation below, for an AE-triggering possibility sentence $\check{S}$ (such as *zmoči*), which projects subdomain alternatives. I assume a toy modal base $\{w_1, w_2\}$ for the purposes of this derivation; the derivation can straightforwardly be generalized to an infinite modal base.

(392) a. $\check{S} = \check{\Diamond}_{\{w_1,w_2\}} p$

b. $Alt(\check{S}) = \{\check{\Diamond}_{\{w_1,w_2\}} p, \check{\Diamond}_{\{w_1\}} p, \check{\Diamond}_{\{w_2\}} p\}$

The first step of the derivation looks similar to a typical SLI triggering sentence: no subdomain alternative is IE (adding an AE does not change this fact), therefore there is no effect on truth conditions.

However, the second step of the derivation looks different. No member of $Alt(\check{S})$ can be excluded from another, since they all have the same AE: conjoining one and the negation of another yields a contradiction, as assumed in (391). This means that the alternatives of the once exhaustified sentence remain the same, as shown below.

(393) $\check{S}' = \text{EXH}\ [Alt(\check{S})][\check{S}] = \check{\Diamond}_{\{w_1,w_2\}} p$

(394) $Alt(\check{S}')$
$= \{\ \text{EXH}[Alt(\check{S})][\check{\Diamond}_{\{w_1,w_2\}} p]\ ,\ \text{EXH}[Alt(\check{S})][\check{\Diamond}_{\{w_1\}} p]\ ,\ \text{EXH}[Alt(\check{S})][\check{\Diamond}_{\{w_2\}} p]\ \}$
$= \{\ \check{\Diamond}_{\{w_1,w_2\}} p \quad ,\ \check{\Diamond}_{\{w_1\}} p \quad ,\ \check{\Diamond}_{\{w_2\}} p \quad \}$

Therefore, the alternatives of the once exhaustified sentence are not IE, and no strengthening is derived, as desired.

(395) $\check{S}'' = \text{EXH}\ [Alt(\check{S}')][\check{S}'] \equiv \check{\Diamond}_{\{w_1,w_2\}}p$

The derivation for a negated universal expression is exactly parallel.

(396) a. $\check{T} = \neg\check{\Box}_{\{w_1,w_2\}}p$

b. $Alt(\check{T}) = \{\neg\check{\Box}_{\{w_1,w_2\}}p, \neg\check{\Box}_{\{w_1\}}p, \neg\check{\Box}_{\{w_2\}}p\}$

(397) $\check{T}' = \text{EXH}\ [Alt(\check{T})][\check{T}] = \neg\check{\Box}_{\{w_1,w_2\}}p$

(398) $$\begin{aligned} Alt(\check{T}') &= \{\ \text{EXH}[Alt(\check{T})][\neg\check{\Box}_{\{w_1,w_2\}}p]\ ,\ \text{EXH}[Alt(\check{T})][\neg\check{\Box}_{\{w_1\}}p]\ ,\ \text{EXH}[Alt(\check{T})][\neg\check{\Box}_{\{w_2\}}p]\ \} \\ &= \{\ \neg\check{\Box}_{\{w_1,w_2\}}p \quad ,\ \neg\check{\Box}_{\{w_1\}}p \quad ,\ \neg\check{\Box}_{\{w_2\}}p \quad \} \end{aligned}$$

(399) $\check{T}'' = \text{EXH}\ [Alt(\check{T}')][\check{T}'] \equiv \neg\check{\Box}_{\{w_1,w_2\}}p$

4.3 Support for AEs – and not perfective aspect – as the source of the blocking

In this section, I provide support for the claim that (anti-)AEs are indeed the source of the blocking, and not the syntax or semantics of perfective aspect. I first present data in which wide scope interpretations are observed when the modal is perfective-marked, but AEs don't arise. I then argue that neither the particular syntax of the French perfective, nor its semantics, is likely to be the source of the blocking.

4.3.1 Neutralized anti-AE

Apparent wide scope of perfective-marked *falloir* and *devoir* can be observed in particular cases in which an (anti-)AE is not triggered, despite the presence of the perfective. Homer (2011, to appear) argues that AEs are a result of aspectual coercion, where the modal that is inherently stative is coerced into an eventive interpretation, namely the event described by the prejacent. The aspectual

clash between the requirement imposed by the perfective and the stativity of the modal can be resolved in other ways, namely if the context introduces a bound time interval during which the modal semantics applies. In these cases, Homer reports that AEs are optional, as in the following examples:

(400) a. Olga a soudain **pu** soulever un frigo, mais ne l'a pas fait.
Olga suddenly became able to lift a fridge, but didn't do it.

b. Entre 15h et 17h, Olga a **pu** soulever un frigo, mais ne l'a pas fait.
In between 3 and 5pm, Olga was able to lift a fridge, but didn't do it.

In such cases, therefore, a wide scope reading of a necessity modal is predicted to be available. And it seems like this is the case. Below is an attested example[1] (continuation added) in which negated perfective *falloir* is coerced into an activity.[2]

(401) Cétait la dernière nuit pendant laquelle **il n'a pas fallu** qu'il relâche sa vigilance (mais il l'a malheureusement relâché vers 3h du matin.)
It was the last night during which he couldn't (#didn't have to) relax his vigilance (but he unfortunately relaxed it around 3am).

The context prefers a wide scope reading of the necessity modal. This contrasts with a context in which no activity is coerced, and an actuality entailment is derived.

(402) **#Il n'a pas fallu** qu'il relâche sa vigilance (#qu'il a malheureusement relâché vers 3h du matin.)
intended: He couldn't relax his vigilance.
actual: #He didn't have to relax his vigilance (#which he unfortunately relaxed around 3am).

[1] https://infocapagde.com/index.php?op=newindex&catid=5&marqeur=805

[2] Other examples in which the modal is coerced into punctual events (using adverbials such as *soudain* 'suddenly', *à un moment* 'at some point') are harder to construct, because they strongly prefer the negation *plus* 'no longer', that brings in its own semantic baggage and interacts with scope in non-trivial ways.

These examples strongly suggest that the actuality entailment is indeed the source of the narrow scope interpretations, lending support for the proposal in this chapter.

4.3.2 Perfective semantics is not the source of the blocking

An alternative analysis could take the semantics of the perfective aspect as the source of the modal's narrow scope. It is conceivable that perfective acts as a 'shielder', in the same way that PPIs can be shielded from the anti-licensing effect of negation (Homer, 2011; Szabolcsi, 2004; Nicolae, 2017). However, shielding is usually observed with universal quantifiers, and perfective is not universal. It is typically analyzed as an existential quantifier (Klein, 1994 a.o.):

(403) $[\![\text{PERF}]\!] = \lambda P \lambda t \exists e.\tau(e) \subseteq t \wedge P(e)$

Existential quantifiers are not known to block wide scope of modals. Moreover, imperfective is generally analyzed in parallel with perfective, only differing from it in encoding a different relationship between event time and topic time. Why would narrow scope be observed with perfective but not imperfective?

Perfective could also act as a 'flattener' by removing active alternatives. This is especially interesting as AE sentences also block Free Choice inferences (Alxatib, 2019), that can similarly be analyzed as an implicature (Fox, 2007; Bar-Lev and Fox, 2020):

(404) a. Je pouvais rendre visite à Léa ou Zoé.
I could.ipf of give visit to Léa or Zoé
I could go visit Léa or Zoé.

→ *I could go visit Léa, and I could go visit Zoé.* (Free Choice Inference)

b. J'ai pu rendre visite à Léa ou Zoé.
I'have can.pf of give visit to Léa or Zoé
I could go visit Léa or Zoé.

↛ *I could go visit Léa, and I could go visit Zoé.* (no Free Choice Inference)

However, perfective does not always flatten alternatives. For example, a perfective-marked sentence with the modal expression *avoir la permission* ('have permission') does not trigger an AE (presumably because of its inherent eventive interpretation), but does license a Free Choice inference:

(405) J'ai eu la permission de rendre visite à Léa ou Zoé.
I'have have.pf the permission of give visit to Léa or Zoé
I got permission to go visit Léa or Zoé. → *I got permission to go visit Léa, and I got permission to go visit Zoé.* (Free Choice Inference)

Therefore, since perfective does not block strengthening in general, it is likely not the source (in itself) of the narrow scope of the modal.

4.3.3 Perfective syntax is not the source of the blocking

One could argue that for French specifically, the differences in the syntax of non-perfective and perfective cases could be the source of narrow scope. I repeat relevant examples below.

(406) a. On **ne** ***doit*** **pas** sortir.
we NEG must NEG go.out
We must not go out. □¬
We don't have to go out. ¬□

b. On **n'** a **pas** ***dû*** sortir.
we NEG AUX NEG must.PF go.out
*We had to not go out. *□¬
We didn't have to go out. ¬□

After all, the French perfective form 'passé composé' is constructed using an auxiliary and a non-finite form of the modal verb, displaying a suggestive surface order relative to negation, and potentially reflecting a different order at LF. However, I argue these facts do not generalize. For example, French near future tense is formed from the auxiliary *va* 'go' and the infinitive form of

the modal verb, yielding a word order parallel to that of passé composé. However, wide scope interpretations are available, paralleling those of the basic case, as shown below.

(407) a. Il **ne** va **pas** ***falloir*** sortir.
it NEG go NEG must.INF go.out
We will have to not go out. (□¬, *¬□)

b. Tu **ne** vas **pas** ***devoir*** sortir.
2s NEG go NEG must.INF go.out
You will have to not / won't have to go out. (□¬, ¬□)

In addition, we can find examples of other types of perfective-marking that are realized as verbal inflection, thus resembling the basic case in syntax and word order, but still yield narrow scope interpretations of the modal. One example is French archaic 'passé simple', a form encoding perfective past where the verb is directly inflected and appears before the negation marker *pas*, as shown in (408).

(408) Il **ne** ***fallut*** **pas** /nous **ne** ***dûmes*** **pas** sortir. ... *#but we did.*
it NEG must.PS NEG we NEG must.PS NEG go.out
We didn't have to go out. (¬□, *□¬)

Of course, another example is found with Spanish necessity modals *tener que* and *hay que*, which have the same basic behavior as *devoir*, as shown in (409), but whose perfective form is a typically inflected modal verb, akin to French 'passé simple'.

(409) a. **No** ***tengo/hay que*** ir.
NEG must go
I don't have to/must not go. (¬□, □¬)

b. **No** ***tuve/hubo que*** ir. # ... *but I didn't.*
NEG must.PF go
I didn't have to go. (¬□, *□¬)

And finally, the fact that we observe this blocking with possibility triggers as well suggests that indeed the blocking is not about syntactic scope.

4.4 Problems with this analysis

4.4.1 Innocent Inclusion does not derive the blocking

I derive the blocking of Actuality Entailments using the EXH operator proposed in Fox (2007).

Interestingly, the update to this operator proposed in Bar-Lev and Fox (2017, 2020) presented in Chapter 2. This operator, which relies on the notion of Innocent Inclusion, yields different results here, and incorrectly predicts strengthening with Actuality Entailments.

In particular, this EXH operator can include without contradiction the subdomain alternatives $\check{\Diamond}_{\{w_1\}}p$ and $\check{\Diamond}_{\{w_2\}}p$, yielding strengthening:

(410) $\text{EXH}^{IE,II} \equiv \check{\Diamond}_{\{w_1,w_2\}}p \wedge \check{\Diamond}_{\{w_1\}}p \wedge \check{\Diamond}_{\{w_2\}}p \equiv \check{\Box}_{\{w_1,w_2\}}p$

In this case, the AEs do not conflict, and instead produce redundant, but therefore consistent, AE statements.

The fact that SLIs are blocked by Actuality Entailments can be taken as an argument against the newer EXH operator proposed by Bar-Lev and Fox (2020). However, it can also be seen as an argument against these analyses of SLI blocking by AEs. I leave this concern for further work.

4.4.2 Spanish *deber*

As mentioned in Chapter 3, Spanish *deber* has an unexpected interaction with perfective aspect. Instead of licensing an AE, it licenses a counterfactual sounding anti-AE.

(411) a. Debío pasar. ... *#And she did.*
must.pf pass
She should have passed. #And she did.

int.. She had to pass.

b. No debío pasar. ... *#And she didn't.*
neg must.pf pass
She shouldn't have passed. #And she didn't.

int.. She didn't have to pass.

Note that this particular form of *deber* is marked, and speakers prefer the unmarked form with an counterfactual marked *deber* combined with a perfective-marked prejacent.

(412) (No) debería haber pasado.
neg must.CF have passed.part
She should(n't) have passed.

This is the expected counterfactual form, and here the meaning of *deber* converges with that of other Spanish modals (in contrast with the simple perfective form).

(413) (No) tenía que haber pasado.
neg must.CF that have passed.part
She should(n't) have passed.

Furthermore, in both these contexts, i.e. the simple perfective or the counterfactual marked perfective, only a wide scope of *deber* is available. This fact is not explained by the analysis in this section, which predicts that any modal licensing a non-cancellable actuality or anti-actuality inference should block a SLI.

I believe that this fact can only be explained once we have a better understanding of the particular semantics of *deber*. It seems like in these cases, it patterns like a weak necessity modal, and as I show in Chapter 6, weak necessity modals should not receive a SLI analysis. However, this is not the end of the story, because as we saw in the previous chapter, *deber* does pattern like a SLI trigger elsewhere. Finally, note that English *should(n't) have* also licenses a non-cancellable (anti-) actuality inference, despite the absence of perfective marking in English (and therefore of AEs with modals other than *should*). This also suggests a possible different source for the AE with weak necessity modals, which in consequence could interact differently with exhaustification.

4.4.3 French *avoir (à)*

French *avoir (à)*, in its possibility reading, only optionally triggers an Actuality Entailment, at least in some configurations.

(414) La maman de Lucas était de bonne humeur, du coup Lucas a **eu à** s'acheter un croissant. Malheureusement la boulangerie était fermée, et il n'a pas pu se régaler.
'Lucas's mom was in a good mood, so Lucas had the opportunity to buy himself a croissant. Unfortunately the bakery was closed, and he was not able to treat himself.'

In this situation, no AE is licensed. However, I argue that an AE is still optionally available. I use Homer's *also* test to diagnose its presence.

(415) Lucas a eu à s'acheter un croissant. Carole s'en est acheté un aussi.
'Lucas got to buy himself a croissant. Carole bought one for herself too.'

Note that this continuation is degraded when there is a cancellable actuality inference, like with English *had to*.

(416) Lucas had to buy himself a car. ??Carole bought one for herself too.

This optional AE associated with *avoir (à)* seems to parallel what Homer calls 'eventive' modals, like *avoir la possibility*, 'have the possibility'.

(417) Lucas a eu la possibilité de s'acheter un croissant.
'Lucas had the possibility to buy himself a croissant.'

a. ... Carole s'en est acheté un aussi.
'... Carole bought one for herself too.'

b. ... Mais il n'a pas pu.
'... But he wasn't able to.'

Interestingly, the necessity version of *avoir (à)* obligatorily licenses an AE.[3]

[3]This lends support for the ambiguity analysis proposed in Chapter 3, between a non-compositional derived necessity, licensing an AE like any non-compositionally derived necessity modal, and a compositionally derived possibility modal, optionally licensing an AE, like syntactically complex modal expression like 'have the possibility'.

(418) J'ai eu à payer l'amende, # mais je ne l'ai pas fait.
'I had to pay the fine, # but I didn't do it.'

The data observed with *avoir (à)* is problematic for the AE analysis, because we observe blocking of a SLI even in the absence of an AE. However, it seems like even in the non-AE situations, an actual event has taken place: not the prejacent, but the giving of opportunity. If this is correct, then the analysis proposed in this section naturally extends to any case which entails the actuality of any event, because all the subdomain alternatives will the actuality of a particular event. I leave working out the details of such an analysis for future work.

4.5 Conclusion

In this chapter, I have presented the phenomenon of SLI blocking by perfective aspect, which affects SLIs triggered by both possibility modals and negated necessity modals, whether their SLI is optional or not. This fact provides support for an analysis that unifies these four different phenomena, like the one proposed in this dissertation. I propose an analysis of this blocking, predicted by the framework proposed in Fox (2007), where actuality entailments block strengthening by rendering alternatives non-innocently excludable.

CHAPTER 5

Against a syntactic account of wide scope necessity modals

5.1 Introduction

This chapter is concerned with analyses of necessity root modals taking apparent wide scope above negation, based on syntactic scope. Let's begin with the empirical picture of the interpretations of negated root modals. On the one hand, possibility modals always scope below negation; this is shown by (419) for English and French, but the same seems to hold across languages in general.

(419) a. Max can't leave. $*\Diamond > \neg; \neg > \Diamond$

b. Max ne peut pas partir.
Max neg can neg go
Max can't leave. $*\Diamond > \neg; \neg > \Diamond$

On the other hand, necessity modals are a mixed bag, as shown in (420): *must* and *falloir* obligatorily scope above negation, *have to* scopes below negation, and *need* (in its non-inflecting, bare VP-selecting form) requires negation or some other similarly downward entailing operator to take scope over it.

(420) a. Max must not leave. $\Box > \neg; *\neg > \Box$

b. Max doesn't have to leave. *□ > ¬; ¬ > □

c. Max need *(not) leave. *□ > ¬; ¬ > □

d. Il ne faut pas partir.
expl neg must neg leave
One must not leave. □ > ¬; *¬ > □

e. Max ne doit pas partir.
Max neg must neg leave
Max must not leave. □ > ¬; ¬ > □

Why are some necessity modals able to or have to take wide scope with respect to negation, while other necessity modals and all possibility modals can't?

Scaleless implicatures explain this pattern, as shown in Chapter 3. I further argue in this chapter that alternative explanations based on syntax are less good. Syntactic explanations for the wide scope of necessity modals fall into two main categories: (1) wide scope modals are interpreted higher than negation because they originate there; (2) the wide scope of a modal is due to its interpretable movement from a position below negation to a position above it.

In section 5.2, I argue that all root modals originate below negation, therefore arguing against analyses of type (1). In particular, analyses of the first type have especially been proposed by Cormack and Smith (2002); Butler (2003); Cinque (1999). I will also discuss analyses that can be extended from proposals in Hacquard (2006) and Collins and Postal (2014) (but which have not been directly proposed by these authors). Section 5.3, which is in large part joint work with Gary Thoms, argues against analyses of type (2); those proposed in the literature involve interpretable movement of the modal driven by polarity sensitivity: Homer (2011, 2015); Iatridou and Zeijlstra (2010, 2013); Zeijlstra (2017).

5.2 All root modals originate below sentential negation

In this section, I present the syntactic background that justifies a crucial assumption for the SLI analysis proposed in Chapter 3 and 4 – namely that root modals originate below negation. The structure and the main arguments for it are given in 5.2.1. In section 5.2.2, I present analyses that

deviate at least partially from the proposed structure to explain the wide scope of some necessity modals; in doing so I eliminate a confound to the SLI account of wide scope necessity modals.

5.2.1 The assumed structure and its motivation

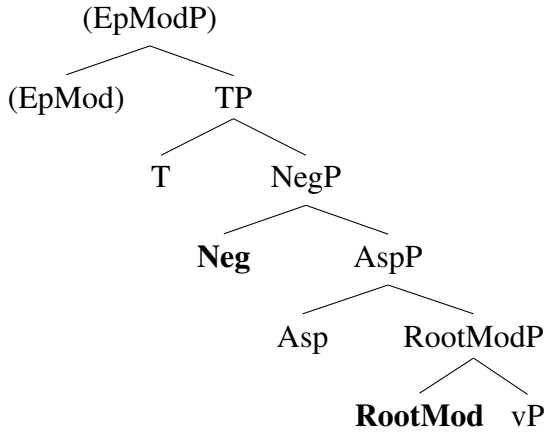
5.2.1.1 Sentential negation > any root modal

A scaleless implicature analysis of root modals crucially relies on the fact that they originate below negation, and are interpreted there. We could imagine an alternative theory of the wide scope of some modals to be explained by the availability of a projection hosting them above negation.

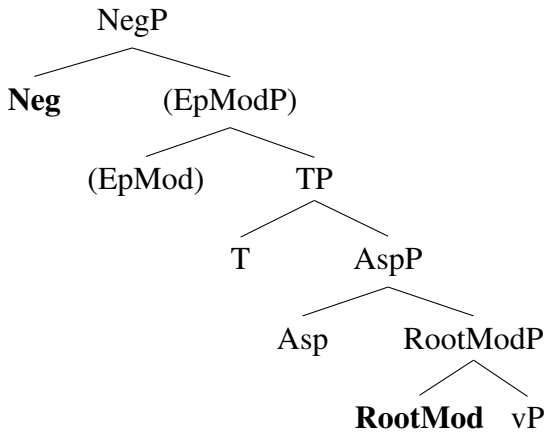
In (421a) and (421b), I show two possible structures for the clausal spine, where negation is low or high, depending on the language. There is ample evidence for different positions for negation, see in particular Zanuttini 1997, allowing for these two structures cross-linguistically; nevertheless I will argue that negation cannot merge *below* root modals, based on empirical and theoretical arguments.

I assume that root modals occupy a fixed position in the syntax, in the RootMod projection, below viewpoint aspect and above the vP. Epistemic modality is in the EpMod projection found higher up in the tree, and can scope above sentential negation when negation is low enough. The position of epistemic modals is generally taken to be higher then tense, but some authors disagree, notably Rullmann and Matthewson (2018).

(421) a.



b.



These syntactic structures are mostly in line with work on the positions of modal elements of different flavors on the clausal spine, relative to other elements and to each other (Cinque, 1999; Hacquard, 2006, 2009; Condoravdi, 2002; Brennan, 1993 a.m.o.); departures from this structure are only partial, and will be discussed in 5.2.2. The main arguments for a universal relative order of negation scoping above root modals are in 5.2.1.2 and 5.2.1.3.

5.2.1.2 Argument 1: The typology of modal-negation scope

It is rather uncontroversial that at least a large majority of root modals have to originate below the interpreted position of negation, since most are interpreted there. The main argument comes from the fact that virtually no possibility modal cross-linguistically can scope above sentential negation. Moreover, it is widely assumed that both necessity and possibility modals share the same semantic properties except for their quantificational force (with the possible exception of ability modals); so if the different positions on the clausal spine have to do with semantics (e.g. like the height difference between epistemics and root modals as proposed by Hacquard (2006)), then we would expect both possibility and necessity modals to pattern together.[1] However, this is not what is observed. In the following, I provide evidence and citations for these empirical claims.

[1]Note, however, that Beghelli and Stowell (1997) propose different syntactic positions for different quantificational items. An analysis along their lines could capture different positions for different quantificational modals. This is the type of analysis I review in section 5.2.2.1.

Among root necessity modals, we observe all sorts of interactions: *must* obligatorily scopes above negation, *have to* below it, and *need* (in its non-inflecting, bare VP-selecting form) actually *requires* negation or some other similarly downward entailing operator to take scope over it.

(422) a. John must not leave. $\Box > \neg$; $*\neg > \Box$

b. John doesn't have to leave. $*\Box > \neg$; $\neg > \Box$

c. John need *(not) leave. $*\Box > \neg$; $\neg > \Box$

(423) a. María no debe partir.
María neg must leave
María mustn't leave. $\Box > \neg$, $*\neg > \Box$

b. María no necesita partir.
María neg must leave
María needn't leave. $*\Box > \neg$, $\neg > \Box$

c. María no tiene que partir.
María neg must leave
María mustn't/needn't leave. $\Box > \neg$, $\neg > \Box$

(424) a. Il ne faut pas partir.
expl neg must neg leave
One must not leave. $\Box > \neg$; $*\neg > \Box$

b. Tu ne dois pas partir.
you neg must neg leave
You must not leave. $\Box > \neg$; $\neg > \Box$

In contrast, root possibility modals seem to always scope below sentential negation.

(425) a. You can't go. $*\Diamond > \neg$; $\neg > \Diamond$

b. Tu ne peux pas y aller.
you neg can neg there go
You can't go. $*\Diamond > \neg$; $\neg > \Diamond$

c. No puedes ir.
neg can go
You can't go. $*\Diamond > \neg$; $\neg > \Diamond$

d. Ne možeš' idti.
neg can.2s go
You can't go. $*\Diamond > \neg; \neg > \Diamond$

The asymmetry has been noted in Iatridou and Zeijlstra (2013), who cite examples from English, Dutch, German, Greek, and Hindi. The generalization is confirmed from the data present in De Haan (1997), an extensive typological survey on scope marking strategies in the interaction of modals and negation. This survey includes English, Dutch, German, Scottish Gaelic, Finnish, Tamil, West Greenlandic, Italian, French, Russian, Modern Greek, Yoruba, Malay, Latin. The observed asymmetry comes from my own analysis of De Haan's data; he himself does not mention it.

The claim about the asymmetry is based on the interaction of *sentential* negation and modals. However, negation is not always sentential, and could be confused with a lower negation that is at the vP level, and when it is not, it affects its scope. It is therefore important to define sentential negation, which I do in the following section 5.2.1.2.1.

Then, based on the results, I describe the methodology I use to determine the scope of negation and modals, and in particular from indirect sources like De Haan's (1997) data in section 5.2.1.2.2.

5.2.1.2.1 Defining sentential negation In some cases, the obligatory narrow scope of possibility modals is not obvious. For example, several authors have cited English deontic 'may' as allowing both narrow and wide scope, therefore drawing a parallel between it and necessity modals like French *devoir*.

(426) You may not go. $\Diamond > \neg, \neg > \Diamond$

However, I argue that the wide scope of *may* in this case is actually due to a lower negation merged at the vP level, and not sentential negation, in contrast with French *devoir*. Syntactically, because the negation is merged at the vP level, it originates below the modal (either adjoined to the vP or in its own projection merged right above the vP), and it is therefore expected to scope below it.

However, at least in the case of *may*, a vP-level negation is not obvious, and forces us to determine the status of negation in cases with wide scope necessity, where we claim to observe a sentential negation status.

In the following, I give tests differentiating the two levels of negation, and show that wide scope possibility modals never pass the tests for sentential negation, while wide scope necessities and wide scope epistemic possibilities do.

I will make the claim that whenever a root possibility modal scopes above negation, the negation is a low vP negation. Below there are examples from English and French; parentheses indicate prosodic units; ")(" indicates a prosodic break.

(427) a. (You can/may)(not go there.) $\Diamond > \neg$; $*\neg > \Diamond$

b. You can't / (cannot) / (may not) go there. $*\Diamond > \neg$; $\neg > \Diamond$

(428) a. Tu peux ne pas y aller.
you can neg neg there go
You can)(not go here. $\Diamond > \neg$; $*\neg > \Diamond$

b. Tu ne peux pas y aller.
you neg can neg there go
You can't go. $*\Diamond > \neg$; $\neg > \Diamond$

There are a number of tests to diagnose sentential vs. vP negation. There are clear-cut syntactic tests, languages-specific reflexes of sentential negation, and somewhat less clear-cut semantic intuitions on the position of negation and the event variable introduced by the vP (e.g. whether negation scopes above or below the existential closure operator). I discuss each of these tests below.

Klima tests Probably the best way to diagnose sentential negation is by using Klima tests (Klima, 1964). I call "Klima test" as any test that can diagnose the presence of sentential negation; i.e. a test that when applied to a positive sentence, makes it ungrammatical.

These include, but are not restricted to the original Klima tests – namely adding an *either*-clause, a *not even* appositive tag or a positive confirmation tag (e.g. 'does it?').

(429) a. It's not raining, or snowing either.

b. *It's raining, and/or snowing either.

(430) a. It's not raining, and neither is it snowing.

b. *It's raining, and neither is it snowing.

(431) a. It's not raining, not even a bit.

b. *It's raining, not even a bit.

(432) a. It's not raining, is it?

b. *It's raining, is it?

See Collins and Postal (2017) for 'extended' Klima tests, i.e. constructions which test for sentential negation beyond the original ones proposed by Klima, and their application to diagnose a matrix negation in classical neg-raising configurations. See De Haan (1997) for an extensive discussion of the applicability of Klima tests to the scope of negation and modals, and their cross-linguistic validity. Note that no Klima test is present in every language, which leaves open the possibility for some languages having no Klima test.

We can run these tests on sentences containing modals and negation, and none of the wide scope possibility modals pass the test, while the wide scope necessity modals and epistemic possibilities easily do so.

(433) a. You **can/may)(not** go there, ... *nor is it useful to you / not even for a second.

b. You **can't / (cannot) / (may not)** go there, ... nor is it useful to you / not even for a second.

In contrast, negated wide scope modals *must* and *should* pass Klima tests.

(434) a. You **mustn't** go there today, ... nor tomorrow / not even for a second.

b. You **shouldn't** go there today, ... nor tomorrow / not even for a second.

Wide scope epistemic possibility modals, in contrast with their root counterparts, pass the Klima tests. This is good evidence for epistemic modals in general scoping above the position for sentential negation, and Klima tests diagnosing negation in that position.

(435) Jane **might/may not** be there today, nor tomorrow.

This same pattern is replicated in French.

(436) a. Tu **peux ne pas** y aller aujourd'hui, ... *Jacques non plus / ni demain.
you can neg neg there go today Jacques neither / nor tomorrow
*You can)(not go here, neither can Jacques / nor tomorrow.

b. Tu **ne peux pas** y aller aujourd'hui, ... Jacques non plus / ni demain.
you neg can neg there go today Jacques neither / nor tomorrow
You can't go today, neither can Jacques / nor tomorrow.

(437) a. Il **ne faut pas** que t'y ailles aujourd'hui, ... ni demain.
it neg must neg that you.there go today nor tomorrow
You must not go today, nor tomorrow.

b. Il **faut ne pas** que t'y ailles aujourd'hui, *... ni demain.
it must neg neg that you.there go today nor tomorrow
int. You must not go today, nor tomorrow.

Note: Several authors have claimed that Klima tests test wide scope of negation above other operators (Payne, 1985; Collins and Postal, 2017; Penka, 2015; Horn, 1989), instead of sentential vs. vP negation. However, these authors do not adduce much convincing evidence for the claim. It seems like the main observation this relies on is that 'constituent' negation (or vP negation) is not an appropriate notion. However, this discussion is faulty because it relies on instances of constituent negation that are *not* vP negation, for example: 'John found a job not far away, #did he?' This example does not pass the Klima tests, because there is no sentential negation. It is not vP negation either, but rather a negation trapped in an adjunct phrase. However, it does not follow that vP negation is not a useful notion, as claimed by Penka (2015); Jacobs (1982); Horn (1989).

I fail to see how the definition of the wide scope of negation correlates with passing Klima tests. This would, of course, be a potentially good argument a SLI analysis of wide scope necessity modals, since in it the negation takes semantic wide scope in contrast with syntactic analyses. However, there are several other operators that seem to be able to take scope above negation without disrupting the acceptability of Klima tests. First, there is, of course, tense, that takes scope above negation in English; therefore it cannot be taken into account in this definition of Klima tests.

There are also epistemic modals, which relatively uncontroversially take wide scope because of a high syntactic position, are compatible with Klima tests, shown in (435). There are also quantifiers taking wide scope above negation, without blocking the Klima test from applying, as shown below.

(438) Half of the students didn't come, nor did half of the professors.
True in a context where exactly half of the students are here, which is only compatible with the order *half* $>$ $\neg$, not the order $\neg$ $>$ *half*.

Morphosyntactic reflexes of sentential negation In addition to Klima tests, there are language-specific markers differentiating sentential vs. vP negation. For example, as seen in the above examples, the contraction *n't* in English is only available with sentential negation, and prosody can also disambiguate the two different structural positions. In French, the position of the optional negation particle *ne* disambiguates.

Word or morpheme order Word or morpheme order can very often be a reliable test for sentential negation. In fact, I will suggest that it is a good test just in case negation appears in a higher position than the root modal at PF ('higher' generally meaning 'precedes'; if for morpheme order, it 'follows'). In principle, this order reflects a non-derived order of the elements on the clausal spine.

English and French are in fact rather rare cases in which the modal is syntactically higher than the main negation marker at PF. In French, this is due to V-to-T movement (Pollock, 1989). In English, this is due to the auxiliary status of modals, which undergo head movement to T. In

fact, any verbal or adjectival modal will find itself in a lower position with respect to sentential negation.

(439) a. You don't have to.

b. You are not allowed.

It turns out that most languages' modals are verbs, and not auxiliaries like in English.

Following verb-negation order, we can rather confidently say that sentential negation is present if it appears in a higher position than the modal at PF ('higher' generally meaning 'precedes'; this is different for bound morpheme order), since this is the non-derived order. Word or morpheme order is a useful tool in the absence of other evidence, when looking at examples from texts or the literature.

Semantic reflexes Semantically, sentential and vP-internal negation are very similar, but intuitively seem to differ in that the former negates an event, and the latter is involved in a negative event (in the sense proposed in for instance Bernard and Champollion (2018)).

I base this intuition with French *falloir*, which is useful because French unambiguously differentiates sentential and vP negation with the position of *ne*, and *falloir* takes wide scope.

Below we have *falloir* with sentential negation in (a), and with vP negation in (b).

(440) a. Il ne faut pas manger.
it neg must neg eat
'We mustn't eat.' / 'We (must not) eat.'

b. Il faut ne pas manger.
it must neg neg eat
'(We must) (not eat).'

In the first case, it is a prohibition: a rule to not engage in an event of eating. In the second, it is an obligation to engage in the negative event of not eating. The two sentences have very similar truth conditions. In fact, it seems like the first can always be used in contexts in which the second

is true. Below is a context in which both vP and sentential negation are felicitous (the intuitions are replicated with English 'must not' for sentential negation vs. 'have to not' for vP negation).

(441) Context: I am telling someone how to fast.

a. Le premier jour, il faut ne pas manger.
'On the first day, you must)(not eat.' / 'On the first day, you have to not eat.'

b. Le premier jour, il ne faut pas manger.
'On the first day, you must not eat.'

But this does not seem to be the case the other way around. Below is a context in which sentential negation is felicitous but vP negation is not.

(442) Context: An employee at a theater reminds people that eating during the play is prohibited.

a. Il ne faut pas manger durant la représentation.
'You must not eat during the play.'

b. ??Il faut ne pas manger durant la représentation.
'You must)(not eat during the play.' / 'You have to not eat during the play.'

The difference between these two contexts is whether eating is the default state of affairs. It is highly expected that the average person eats several times a day, therefore not eating during a whole day disrupts the current state of affairs; in contrast, eating during a play is not a default state of affairs for the average person. The use of an expression for a negative event seems to be licensed when one *actively* engages to break the state of affairs. This may in fact be true for all events.

This distinction cannot be captured with traditional predicate logic without events. However, in event semantics, this difference can be understood with an appropriate treatment for negative events (e.g. Bernard and Champollion (2018)). For other work on negative events, see **?** and references therein.

Without going into details, I assume that whenever negation applies to a predicate of events, it returns a predicate of events that are negative, as shown in (443).[2] In the spirit of Bernard and Champollion (2018), I write $Neg(P_{<v,t>})$ as a property of negative P-events.

(443) $[\![\text{not(rain)}]\!] = \exists e.e \in Neg(\lambda e'.rain(e'))$

To capture regular negation, an existential closure (EC) over events needs to apply to the events predicate, and 'not' amounts to classical negation.

(444) a. $[\![\text{EC}]\!] = \lambda P_{<v,t>}.\exists e.P(e)$

b. $[\![\text{not(EC(rain))}]\!] = \neg\exists e.rain(e)$

Finally, we can capture the semantic distinction between the two sentences by following Hacquard (2006, 2009) in saying that root modals are operators applying to properties of events. This means that existential closure cannot apply before the modal applies, because that would cause a type-clash. In other words, the modal of type $<< v, st >, < v, st >>$ can combine with a predicate of events $\lambda e.\text{P}(e)$ of type $< v, st >$, but cannot with its existentially closed version $\exists e.\text{P}(e)$ of type $< s, t >$).

This means that if negation is to merge below a modal, negative events must be involved, but not if it merges above the modal. This captures the distinction between the two sentences. I come back to this discussion in section 5.2.1.4, citing it as an argument for the strict order of root modals and negation in the clausal spine.

5.2.1.2.2 Methodology De Haan (1997) does not himself note the asymmetry between possibility and necessity modals in their interaction with negation. However, the type of data he presents can be used to make this observation. The data of interest for the interaction of root modality and negation is found in his Chapter 3, where he thoroughly describes the modal systems in a large number of languages, and classifies them in terms of their scope marking strategies. Therefore, his

[2]This is a different approach from Bernard and Champollion (2018), who use Champollion's (2015) continuized event semantic framework, which allows negation (and other operators like quantifiers) to merge before existential closure, but eventually scope above it.

data includes all possible scope interactions of modals and negation in each language, and therefore covers the data useful in checking which modals can take scope above negation.

I recorded each language for which De Haan described the modal system exhaustively, or had relevant examples with a root possibility modal. In many cases, there were examples with wide scope possibilities. Sometimes, De Haan himself specified sentential vs vP negation (e.g. for Yoruba), mainly in cases where he had access to informants to run Klima tests. In the rest of the examples, I relied on word order.

For all cases of wide scope possibilities, I checked whether negation was in its default position. In cases where it wasn't, De Haan described the language as using word order as a scope marking strategy, and these cases I assumed involved vP negation. Except for an unclear case in Guyanese Creole,[3] there were no cases in which a default placement of negation yielded a wide scope possibility modal, therefore confirming the generalization.

[3]The potential counterexample to the claim there are no wide scope possibility root modals was found with Guyanese Creole , in one example De Haan (1997) cites from a typological survey of predication in Caribbean English Creoles (Winford, 1993). In this example, we find a pre-verbal negation, suggesting its sentential status, and the possibility modal *kyan*.

(i) If a tumoch trobl fu yu, yu na kyan kom tunait.
'If it's too much trouble for you, you needn't come tonight.'

It is, however, difficult to draw any conclusions from this example. Since De Haan did not collect the data himself, he could not test for sentential negation, nor carefully test for the data important for his own purposes. Winford (1993) only cites this one example for a wide scope *kyan*. Moreover, he mentions that the alternative negated possibility expression *kyann* is in fact infelicitous in this example, because it has a narrow scope possibility reading (i.e. 'can't').

I found one speaker of Guyanese Creole who rejected 'na kyan' for grammatical reasons (he only accepted 'kyann' as the negation of 'kyan'), but also claiming there was no equivalent in the language. He suggested 'na kyan' could have been misunderstood as 'na ga', as suggested by my consultant, where 'ga' is 'have to'. This is not impossible, but these are of course speculations that cannot be confirmed. It is also entirely possible that the rejection of 'na kyan' by my consultant is simply due to dialectal variation.

This issue cannot be settled here, since the source only has one example of that sort, which is too little given the number of potential confounds. There are at least several good reasons to be skeptical of the example, not least the fact that it is the only wide scope root possibility modal found among so many languages.

However, whether or not this data from Guyanese Creole is accurate, the asymmetry between possibility and necessity modals is obviously still maintained, since wide scope necessity modals are very common, often several in one language, and wide scope possibility modals seem at best very rare.

5.2.1.3 Argument 2: Wide scope necessity readings are polarity sensitive

Necessity modals which take wide scope can also take narrow scope in some environments, which suggests that they originated there in the first place, and that the wide scope is a derived word order. As shown in Iatridou and Zeijlstra (2013); Homer (2011, 2015) and this dissertation, the availability narrow scope readings is polarity sensitive. Here is an exhaustive list of languages in which such modals have been described: English (I&Z, Homer, Chapter 3), French (Homer, Chapter 3), Dutch (I&Z), Greek (I&Z), Spanish (Chapter 3), Ewe (Chapter 3).

This list excludes weak necessity modals like *should*, whose distribution is different, and narrow scope readings are never observed. However, there is clear evidence that their neg-raising behavior is not syntactic, because they take obligatory wide scope even under extra-clausal negation (I don't think I should go there $\approx$ I think I should not go there). This makes it entirely possible that weak necessity modals take a low syntactic position as well. See the extensions section of Chapter 6 for a sketch of an analysis of weak necessity modals.

If wide scope readings of strong necessity modals are polarity sensitive, it is difficult to argue that wide scope readings of modals are due to them originating at a higher position. if such a high position is available, why is it only available to positive polarity modals? Furthermore, polarity sensitivity of wide scope readings excludes semantics-based explanations for wide scope, namely force, as in Cormack and Smith (2002) and Butler (2003), or participant anchoring as in Hacquard (2006) – see discussions of these accounts in 5.2.2.

Potential counterexamples I should note that I have encountered two potential counterexamples to the polarity sensitive of wide scope readings of strong necessity modals. The first is found with *must* in some dialects or idiolects of English. In Chapter 3, I explained how its low frequency could explain a separate acquisition of its positive and negated counterparts, and therefore not necessarily translating in a higher position. The other possible exception is the Turkish root necessity morpheme *-mAlI*. This modal *-mAlI* appears after the negation morpheme on the verb, correlating with its semantic scope above negation. This morpheme order indeed suggests a higher syntactic position.

(445) Ayşe git -me -meli .
Ayşe go -neg -□.3sg
Ayşe must not go. □ > ¬, ∗¬ > □

However, there are reasons to question that *-mAlI* is actually a counterexample. Its behavior is generally suspicious, and its apparent wide scope might hide a narrow scope.

The first hint is that syntactically, it cannot appear below negation. More generally, it cannot be followed by other verbal morphemes, nor a independent copula (positive or negative):

(446) Ali hastalan -malı {-y-di, *ma-, *-ir, *-iyor, *-ecek, *değil, *olur}.
Ali get.sick -□ {-cop-past, *-neg, -*aor, -*prog, *-fut, *-cop.neg, *-cop}
Ali must get sick.

Thiss means that if the morpheme is forced to appear above negation for syntactic reasons, it may still be interpreted below.

This restriction contrasts with its possibility counterpart, which has two positions (albeit with two different realizations), as shown below.

(447) a. Ali hastalan -ma -yabil -ir.
Ali get.sick -neg -poss -aor.3sg
Ali can not get sick. ◊ > ¬

b. Ali hastalan -a -maz.
Ali get.sick -poss -neg.aor.3s
Ali can't get sick. ¬ > ◊

Another reason to question that the wide scope of *-mAlI* above negation is real is that it passes Klima tests, in contrast with the apparently parallel example with the possibility modal.

(448) a. Hastalan -ma -malı, ne Ali ne Ayşe .
get.sick -neg -□.3sg, nor Ali nor Ayse
Neither Ali nor Ayşe must get sick.

b. *Hastalan -ma -yabil -ir, ne Ali ne Ayşe .
get.sick -neg -◊ -aor.3sg, nor Ali nor Ayse
int. Both Ali and Ayşe can not get sick.

The narrow scope possibility modal, in contrast does allow the Klima test to apply, as expected.

(449) Hastalan -a -maz, ne Ali ne Ayşe .
get.sick -◇ -neg.3sg, nor Ali nor Ayse
Neither Ali nor Ayşe can get sick.

This behavior with the Klima test is another sign that *-mAlI* might in fact be scoping below. I leave the full answer to this question to further work.

5.2.1.4 Argument 3: A natural semantic restriction

In this section I propose that the fixed scope between root modals and negation cross-linguistically comes from a natural semantic restriction.

In fact, this makes sense if we consider that negation can be found in a number of positions cross-linguistically, but never below root modals. It seems like while there is no universal position for negation, there is a universal restriction on its relative positions with respect to root modals.

I base my argument on particular assumptions about the semantics of root modals, negation and event semantics.

The first assumption is based on Hacquard's (2006; 2009) seminal work on the syntax-semantics interface of modals. She argues that root modals must be of type $<< v, st >, < v, st >>$, in order to later be combined with aspect, which turns a predicate of events of type $< v, st >$ to a predicate of times, of type $< i, st >$. This assumption is also adopted by Homer (to appear), in his analysis for expressions producing actuality entailments in French (which differs from that of Hacquard (2006)).

The second assumption comes from how negation works in event semantics. In a classical event semantic framework, the meanings of vPs are predicates of eventualities, that are at some point existentially closed off. For example, the LF of the sentence 'it is raining' in event semantics (ignoring aspect and tense) is shown in (450).

(450) $[\![\text{it is raining}]\!] = \exists e.rain(e)$

The negation of this sentence must have negation scoping above the existential closure, as in (451a). If it scopes below, as in (451b), then the semantics of the expression is trivially satisfied by almost any event, and therefore does not accurately capture the truth conditions.

(451) a. $[\![\text{it is not raining}]\!] = \neg\exists e.rain(e)$

b. $[\![\text{it is not raining}]\!] \neq \exists e.\neg rain(e)$

Different authors have different solutions to avoid (451b). I do not review them here, and simply adopt one way, namely that the scope must be guaranteed by the syntax, meaning that for a standard negated sentence, a predicate of events must first combine with an existential closure before it combines with negation. In the event that negation applies before existential closure, the meaning that arises is not (451b), but a predicate of negative events; I do not explain how this happens (see Bernard and Champollion (2018); Krifka (1989) for solutions).

As discussed in 5.2.1.2.1, the obligation to engage in a negative event has different truth conditions from a prohibition to engage in the event's positive counterpart.

Therefore, from a semantic point of view, a low scope negation corresponds to a very marked meaning, that involves reference to negative events, which are rather unusual. Based on this fact and the assumptions leading to it, I assume that languages do not grammaticalize a low scope negation for sentential negation, because it would not be able to express the wide majority of modal expressions that do not make reference to negative events.

In conclusion, if Hacquard (2006, 2009) and Homer (to appear) are right about the semantic type of root modals selecting for properties of events, and if negation must appear syntactically above existential closure over the event variable, then we have an explanation for the universal order of negation above root modals.

What about CP-embedding root modals? There are certain modals that are CP-embedding, in particular, French *falloir* can embed either an infinitive or a CP, whose verb is subjunctive-marked.

(452) a. Il faut partir.
expl must leave
One must leave.

b. Il faut que tu partes.
expl must comp 2s leave.subj
It must be that you go.

The ability to embed a CP questions the assumption that all root modals must be predicates of eventualities, since a CP is supposed to denote a proposition.

In any case, something must be available to also explain the possibility of saying something like the following, in which a possibility modal embeds a CP.

(453) It is permitted that the peoples and kindreds of the world associate with one another with joy and radiance.[4]

What could make this work? We can assume *falloir* always selects predicates of eventualities (which it is, as shown in (452a)), and there is an operator that can transform propositions into predicates of eventualities, which allows the CP embedding case in (452b) to be read as 'It must be that the event described by the proposition you leave'.[5] We may also imagine subjunctive as an operator that leaves the event variable open (as opposed to for instance aspectual operators that transform predicates of eventualities into predicates of times, as proposed by Hacquard). I leave this question open here.

[4]https://reference.bahai.org/en/t/b/TB/tb-4.html

[5]If this is the case, the CP should be able to combine with event descriptions, such as 'in 5 minutes'. This description can appear in front of the CP: in (ia), it could be the a result of movement from the lower clause; however in (ib), that seems less likely.

(i) a. Il faut en 5 minutes que tu fasses le déjeuner.
it must in 5 minutes that you do the lunch
You must make lunch in 5 minutes.

b. On a 5 minutes pour que tu fasses le déjeuner.
we have 5 minutes for that you make the lunch
We have 5 minutes for you to make lunch.

What is clear is that: CP embedding is available for both possibility and necessity modals, and that it does not correlate with wide scope (e.g. (453) can be negated). Therefore, even if some root modals can select propositions instead of predicates of eventualities, they do not correlate with wide scope.

5.2.2 Alternative proposals where some root modals are high

Both a PPI-raising analysis and a SLI analysis assume that the wide scope is derived from a narrow scope configuration. Based on the arguments from the previous section, this is the analysis to pursue. However, several authors have proposed alternative analyses, which I review in this section, and argue against. Note that such analyses, of course, would not take care of the data with strengthened possibilities from Chapter 3: a non-negated possibility reading of an otherwise necessity modal can't be explained by syntactic height.

In 5.2.2.1, I review Cormack and Smith (2002); Butler (2003), to account for the wide scope of certain necessity modals, who propose high positions for necessity modals based on their interaction with negation. In section 5.2.2.2, I present the proposal found in Brennan (1993); Hacquard (2006) that there are two types of root modals, and that they have a different position on the clausal spine, and extend it to possibly account for the interaction with negation. Finally, in section 5.2.2.3, I consider an alternative analysis in the framework of Collins and Postal (2014), and consider what it would mean for negation to instead originate low.

5.2.2.1 High positions for necessity modals

In this section, I review proposals by Cormack and Smith (2002) and Butler (2003), in which certain modals take wide scope from originating in a higher position, in English. This type of analysis would be of the same type proposed by Beghelli and Stowell (1997) for quantifiers over individuals, in which existentials and universals have different syntactic positions.

Cormack and Smith (2002) propose two LF positions for modal auxiliaries in English, one on either side of the LF position for sentential negation, as shown in the projection order below, cited from their paper.

(454) C T ($Modal_1$) Pol(POS/NEG) ($Modal_2$)

Modals are lexically specified to select for a polarity phrase, or not, and that determines their position. This would mean that wide scope necessity modals would be lexically specified for that position.

This proposal makes the asymmetry between necessity and possibility modals arbitrary, and cannot explain the polarity-sensitive availability of narrow scope for wide scope possibility modals.

Similarly, Butler (2003) proposes a clausal spine with four different positions for English, for epistemic necessity and possibility, and for deontic necessity and possibility, as shown in the structure below.

(455) [ForceP NecEpi [FocP Neg [FinP PossEpi [TP subject [ForceP NecDeon [FocP Neg [FinP PossDeon vP]]]]]]]

Butler also argues for two distinct positions for negation, one at the vP level and one at the CP level. The extra negation at the CP level allows one to explain facts about narrow scope epistemic possibility modal, e.g. English *can't*.

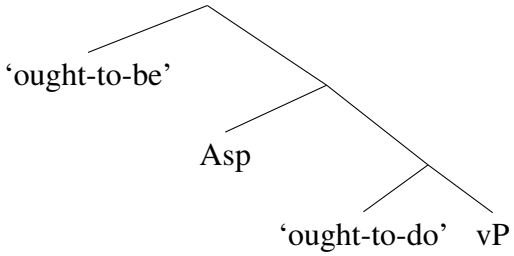
This analysis inherits the problems of the Cormack and Smith (2002) analysis. While possibly explaining the basic facts for English auxiliary modals, it would fail to be extended to a language with both wide and narrow scope necessity modals.

Therefore, these types of analyses in which modals are lexically specified to be in a position, as in Cormack and Smith (2002), or different syntactic positions are specified for force as in Butler (2003), do not go far in explaining either cross-linguistic differences or systematicities.

5.2.2.2 'Ought-to-be' vs. 'ought-to-do', high and low

In this section, I review a distinction proposed by Hacquard (2006), following Brennan (1993), in which root modals can be separated into two classes: 'ought-to-be' deontics, which scope high, patterning with epistemics, and 'ought-to-do' deontics, along with other root modals, scope low. These authors crucially do not talk about their scope with respect to negation; Hacquard only talks about how aspect scopes in between the two, and leaves open the interaction with negation. Concretely, she assumes the following order of each of these two classes of modals with respect to aspect:

(456)



Assuming negation scopes above aspect, we could imagine it scoping above or below the ought-to-be modals. In this section, I consider the strong hypothesis in which they scope above, therefore providing a potentially useful distinction to account for a high origin of wide scope necessity modals.

While, like the proposal in the previous section, it does not obviously account for the difference between possibility and necessity modals, its nuances are worth considering, as they come closest, among all the alternative analyses considered in this section, to a possible confound to a derived wide scope analysis.

What do these two classes, 'ought-to-be' and 'ought-to-do' deontics, refer to? It is Feldman's (1986) original formulation, but both Brennan's (1993) and Hacquard's (2006) understanding of it differ from his, and in fact differ from each other.

Quoting Feldman (1986), "the difference between the ought-to-be and the ought-to-do appears, roughly, to be a structural difference. The ought-to-do involves a relation between an agent and a state of affairs. The ought-to-be involves a property of a state of affairs." Therefore, the

conceptual definition from Feldman (1986) appears to be based, as per their name, on the type of eventuality described by the prejacent. However, he does not make a correlation between this distinction and syntactic height, as it is not expected.

Brennan (1993) takes this distinction to in fact correspond to raising vs. control modals, a classification first proposed by Jackendoff (1972) to distinguish two different classes of modals. 'Ought-to-be' deontics select for propositions, while 'ought-to-do' deontics select for predicates of individuals. This distinction has been argued against in the literature, by Hacquard (2006) herself and others before her (Bhatt, 1998; Wurmbrand, 1999; Hackl, 1998), based on the observation that all modals seem to allow for readings compatible with raising.

For this reason, Hacquard (2006) rejects this distinction, but adopts its consequence, where 'ought-to-be' deontics are syntactically higher than 'ought-to-do' deontics. She proposes a unified characterization of these two modals, in which they are both predicates of individuals. This difference in height, she argues, results in which individual will be selected by the modal. Low, 'ought-to-do' modals will be anchored to the subject of the sentence, while high, 'ought-to-be' modals will anchor to an event participant, just like epistemics. Epistemics are all speaker-oriented, since the epistemic modal base represents the knowledge of the speaker. 'Ought-to-be' deontics are generally addressee-oriented, and sometimes, as Hacquard notes, oriented to a larger community.

Since Feldman's definition of 'ought-to-be' vs 'ought-to-do' deontics doesn't have to do with syntactic height, and Brennan's raising vs. control distinction has been well argued against, I only consider Hacquard's proposal for participant vs. subject orientation.

If Hacquard's proposal is to be extended to height relative to negation, the hypothesis is: whenever a modal takes wide scope with respect to negation, it is participant-oriented, and whenever it takes narrow scope, it is subject-oriented.

I first show apparent advantages this analysis serves, then give evidence for why it does not hold up.

5.2.2.2.1 Advantages

Narrow scope with perfective is explained. Hacquard argues that perfective-marked modals cannot be ought-to-be modals due to their semantics. She claims that addressee-orientation essentially doubles as a performative utterance, and that perfective-marked modals are about actual events that have already happened, and therefore there cannot be an obligation about them if they have already occurred. If this is true, it immediately takes care of one otherwise puzzling fact (which, as far as I know, has not been noted by Hacquard, nor anyone discussing her framework), which I have analyzed in Chapter 4: perfective-marked modals cannot take scope above negation.

Impersonal constructions, community-orientation and wide scope Hacquard (2006) suggests that community orientation is included in participant orientation, i.e. a general obligation imposed on a community will be expressed with an 'ought-to-be' modal. Therefore, community-orientated root modals are expected to scope high. At first glance, data from French agree with this prediction, from the wide scope interpretations of *falloir*, which is an impersonal construction, and therefore easily lends itself to abstract community orientation.

Falloir is an impersonal construction, therefore the individual it anchors to is covert. Arguably, it is easier for a participant to be an covert anchor (since they generally are), rather than a non-participant, which has to be supplied by a particular context. This could explain the non-categorical nature of its wide scope: with contextual clues, *falloir* can be anchored to an individual other than a participant, and receive narrow scope.

However, there are reasons to be skeptical of this. First, a community-oriented statement will pragmatically more likely be a prohibition than the lack of an obligation – this fact therefore acts as a confound. Second, the contextual cues towards non-participant orientation don't help narrow scope. In the following example, *falloir* embeds a CP, which contains a subject, towards which the modal could be oriented.

(457) #Jean ne doit pas s'inquiéter, parce qu'il **ne faut pas** qu'il aille à l'école aujourd'hui.
int. 'Jean doesn't have to worry, because he doesn't have to go to school today.' $\Box\neg$, $*\neg\Box$

We could argue that the infelicity of this example is due to *falloir* obligatorily being participant-oriented, since it grammatically does not associate with a subject. However, if that is the case, we lose the observation that wide scope with *falloir* is not categorical.

Another argument against impersonal/community-oriented constructions modals with wide scope is Spanish impersonal expression *hay que*, which has clear variable scope with respect to negation. It is unclear why there would be this asymmetry between French and Spanish.

Embedded modals lose their performativity As already mentioned, Hacquard claims that participant-oriented modal expressions are performative statements. However, a performative statement cannot be embedded. This might suggest why narrow scope is found in embedded environments when it is not found unembedded (for those relevant modals). However, alone, this does not really explain the facts well. This should predict that narrow scope only is available in embedded contexts, which is not the case for either obligatory or optional wide scope modals. We therefore have to say that participant-orientation does not always entail performativity. In embedded contexts, for instance, participant-oriented modals are not performative. Perhaps the loss of this function gives more space for the narrow scope to be expressed.

5.2.2.2.2 Arguments against a participant vs. subject orientation split I now will show that despite apparent tendencies, the split is not categorical: there exist narrow scope participant-oriented modals, and wide scope subject-oriented ones.

Narrow scope addressee-oriented modals The most obvious data comes from possibility modals. Brennan presupposes that 'ought-to-be' modals come with their possibility counterpart 'allowed-to-be' modals. And indeed, there is in fact nothing in both Brennan's and Hacquard's definition of these modals that should exclude possibility modals. There is nothing barring a negated root possibility modal being addressee-oriented.

(458) No, you can't have a cookie.

Among necessity modals, we can also find narrow scope readings with addressee-oriented modals. This should follow if the subject is made inanimate and therefore an unlikely anchor of the obligation. The following examples are of that type, and favor addressee orientation using 'don't worry'. I give examples from French and Spanish with variable scope modals, to allow for them to take wide scope if they are forced to with addressee-orientation.

(459) a. Ne t'inquiète pas, par ici les voitures **ne doivent pas** être bien garées, tout le monde fait ce qu'il veut.

b. No te preocupes, los autos por acá **no tienen que** estar bien estacionados, todo el mundo hace lo que quiere.

c. 'Don't worry, around here cars **don't have to** be well parked, everyone does what they want.'

Wide scope subject-oriented modals We can also construct examples that favor subject orientation, but are wide scope. The French and Spanish examples are inflected to indicate a past perspective, which is incompatible with addressee-orientation (this extra step removes the confound that community-orientation could be at play).

(460) a. Amazon employees must not give up.

b. Les employés d'Amazon **ne devaient pas**$_{past}$ laisser tomber.

c. Los trabajadores de Amazon **no debían/tenian que**$_{past}$ abandonar.

5.2.2.2.3 Summary To summarize, despite some initial advantages, wide scope relative to negation does not appear to correspond to participant-orientation. As already suggested at first, this is of course not to say that Hacquard is wrong, only that if there is a higher position for these modals, it must be below negation (but can still be above aspect).

5.2.2.3 A low merge position for negation

In this section, I discuss an alternative way in which modals could originate above the first-merge position of negation. However, this case is different from the ones above in which I do not consider that root modals originate higher, but rather that negation originates lower, and that it raises except in the cases of wide scope necessity modals. Such a proposal could be naturally embedded in the framework of Collins and Postal (2014), where negation is assumed to merge in a low position, generally at the VP level, and then is assumed to raise to a derived position – presumably, the scope position of negation identified by Klima tests. For instance, for a simple negative sentence as in (461a), its structure is in (461b).

(461) a. Melissa didn't leave.

b. Melissa did NEG $[_{VP}$<NEG> $[_{VP}$ leave]]

Collins and Postal (2014) use this initial structure to explain several phenomena having to do with negation, notably the distribution of negative polarity items, and classical neg-raising phenomena. For classical neg-raising, e.g. with *think*, the negation originates in a lower clause, and raises to a higher one, as in (462).

(462) a. I don't think that Melissa left.

b. I do NEG_1 think $[_{CP}$<NEG_1>that $[_{IP}$ M. did <NEG_1> $[_{VP}$<NEG_1> $[_{VP}$ leave]]]]

Collins and Postal (2014) argue that the negation is interpreted in its original position, crucially, in this case, below *think*, yielding the well-known "neg-raising" meaning.

Neg-raising modals are not explicitly discussed, but we could imagine a similar explanation for them. However, the explanation cannot be exactly the same, because of apparently different clause structures, at least in English, where modals like *must* and *should* are auxiliaries in a mono-clausal structure. In light of the facts laid out in 5.2.1, the default interpretation of negation in the presence of a modal should be in its higher position, as in (463b).

(463) a. Melissa can't leave.

b. Melissa $[_{ModP}$NEG can$[_{VP}$<NEG> $[_{VP}$ leave$]]$

For neg-raising modals like *must* and *should*, we could imagine that because of their positive polarity, they force negation, which would otherwise raise, to stay low at LF. By making the modals polarity-sensitive, this account has an advantage over the others discussed above, in that it accounts for the polarity sensitivity of the modals.

There are, however, a few problems with this analysis. The first has to do with the fact that the whole proposal depends on the fact that there is no semantic difference between high and low negation. While this might true in cases of finite clause embedding, like it is for *think*, it is not when the neg-raiser embeds a non-finite clause. For example, the example pair (440), repeated below in (464), shows a minimal contrast between a neg-raising modal with sentential negation (a), and one with vP negation (b).

(464) a. Il ne faut pas manger.
it neg must neg eat
'We mustn't eat.' / 'We (must not) eat.'

b. Il faut ne pas manger.
it must neg neg eat
'(We must) (not eat).'

The interpretation of these two sentences, according to Collins and Postal (2014), should be identical. However, as argued in section 5.2.1.2.1, the interpretation differs in between the prohibition of an event, and the obligation to engage in the negative event of not eating, which differ, albeit slightly, in their truth conditions.

Note that although this point does not hold with *think*, it does with *want*, where there is a meaning difference between 'not wanting' and 'wanting not', where the latter conveys a desire for a negative event.[6]

[6]This means that in order to save an account of neg-raising modals and desire predicates based in this framework, we would have to say that the presence of a negative event does not affect the compositional semantics, but rather a marked pronunciation of negation in its low position would have pragmatic effects. I fail to see, however, how that explanation would go.

Another problem with this account comes from the fact that a polarity-sensitive account has a difficult time dealing with the difference between obligatory and optional scope taking of necessity modals. I discuss this point in more detail in section 5.3.3.2.2 (where the PPI-raising analysis encounters the same problem). Another problem shared with PPI-raising analyses is that it does not explain why possibility modals cannot be PPIs (though see Zeijlstra (2020) for an explanation).

5.2.3 Interim conclusion

To conclude this section, I have argued for a universal order where sentential negation is merged in a position above the position of root modals. I have done so in several ways: by showing that no root possibility modal scopes above negation, suggesting that semantic properties other than those specific to universal force cannot drive a higher position; since no semantic property specific to necessities but absent in possibilities has been described, we currently lack a principled reason for a higher syntactic position. Neither can it be a non-principled UG universal having to do with a unexplainable strict order on the clausal spine, since many necessity modals scope below negation. Furthermore, the availability of narrow scope in at least some linguistic environments for virtually all necessity modals suggests they do not have a categorically high position above negation. As a third argument, there can be a plausible semantic basis for a universal negation > root modal order that follows from proposals about the semantic type of root modals as predicates of eventualities and the interaction of negation and event semantics.

What is more, alternative analyses that ascribe a root modal > negation base order are fraught with problems, from being unable to explain the possibility-necessity asymmetry in the interaction with negation, to not accurately capturing the facts.

5.3 No interpretable movement of modals (with Gary Thoms)

Previous accounts have argued for wide scope interpretations of modals crosslinguistically (including *must*, *should*, *falloir* and *devoir*), as originating below negation, but undergoing interpretable

syntactic movement above it, licensed by the positive polarity sensitivity of the modals: Iatridou and Zeijlstra (2013); Homer (2015); Zeijlstra (2017). These proposals therefore stand in contrast with the a scaleless implicature analysis of such modals as presented in Chapter 3. While both proposals accurately account for the main facts surrounding the modal expressions' polarity sensitive behavior, they differ on one important point: the SLI analysis does not require any syntactic movement, while the PPI analyses do. This assumption is in fact far from trivial from a syntactic point of view.

In section 5.3.1, I present the PPI analyses, and in the following sections 5.3.2, 5.3.3 and 5.3.4, I give arguments against these proposals. These sections are almost entirely based on joint work with Gary Thoms (Jeretič and Thoms, 2020) (except for section 5.3.4.2); modifications from our independent paper were made to fit the narrative of this chapter and the dissertation.

5.3.1 Wide scope necessity modals as PPIs

Both I&Z and Homer assume that all root modals originate below negation. The variation with necessity modals is then tied to essentially lexical properties of the individual modals. I&Z follow van der van der Wouden (1994, 2001) by taking the negation-sensitivity of *need*-type modals to indicate that they are NPIs, much like quantificational determiners such as *any*.

This position is supported by the fact that *need* and its kin are licensed not just in the scope of negation, but in the same range of non-upward-entailing contexts that license NPI determiners, such as in the restrictor of a universal quantifier and the complement of negative verbs like *doubt* (see van der van der Wouden 2001 for many more environments, for *need* and its equivalents in Dutch and German).

(465) All he need do is state his opinion clearly. (van der Wouden, 2001)

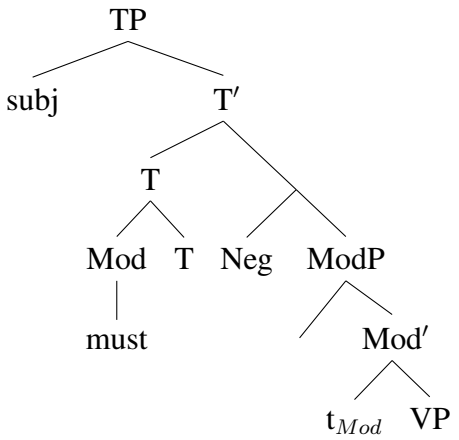
If some necessity modals are NPIs, we can expect others to be positive polarity items (PPIs). I&Z and Homer argue that this expectation is met by modals that scope above negation, such as *must*, which are generated below negation but cannot take scope there due to their polarity sensitivity,

and therefore have to move above negation, where they can (following similar claims by Israel (1996)). Just like with PPIs like *some*, PPI-hood is taken to be a lexical property of these modals, and additional syntactic mechanisms are taken to be at play when the PPI manages to outscope negation.

Having established the polarity sensitivity of wide scope necessity modals, I&Z and Homer both argue that they must undergo LF movement above negation to avoid ungrammaticality below it. However, their proposals differ in the nature of the movement of the modal.

I&Z argue that these modals undergo interpretable head movement, as follows. In English, *must* precedes negation, and so I&Z follow Pollock (1989) and many others in assuming that it has undergone head movement from first-merge position below negation (call this ModP) to a higher head position, namely T.

(466)



It is this instance of head movement, they claim, that is responsible for allowing the PPI modal to scope above negation, and since it is scope-extending head movement, it cannot plausibly be analysed in terms of PF movement or any other such terms. The fact that other modals such as *can* scope below negation even when they precede it is attributed to obligatory reconstruction of the raised modal. Thus I&Z propose that modals reconstruct obligatorily by default, unless it gives rise to semantic anomaly. The fact that *must* can in fact scope below negation in the contexts described above is to be expected, since reconstruction would not lead to anomaly in these cases. In short, the polarity sensitivity pattern implicates two distinct scope positions for *must*, and these can readily be understood as the head and the tail of the movement chain.

Homer, on the other hand, assumes that modals do not undergo LF movement by default. However, if a modal is a PPI and originates in a negative polarity environment, it will move to escape it. In contrast with I&Z, it does so by phrasal movement of the ModP. We come back to what such phrasal movement might entail, and the problems it raises, in section 5.3.3.1.

5.3.2 Challenges for a head movement analysis of wide scope modals

We present data from various languages and configurations which challenge Iatridou and Zeijlstra's (2013) claim that wide scope for modals is derived by head movement. We examine a range of cases with preverbal sentential negators (5.3.2.1), modals embedded under an auxiliary (5.3.2.2), and modals scoping above higher negation operators, namely subject negative DPs, high covert negative operators, and negative coordinators (5.3.2.3).

5.3.2.1 Preverbal sentential negation

Here we examine cases where negation precedes a finite modal, but scopes below it. We consider several subcases, each calling for new assumptions to account for the modal's wide scope with head movement.

First, there are languages such as Russian which do not seem to exhibit V-to-T movement, since the finite verb follows adverbs (Bailyn 1995, but see Koeneman and Zeijlstra 2014), in which negation also precedes the verb. The deontic necessity modal still scopes over negation, even though it seems not to raise over it.

(467) Tebe ne sleduet ostavat'sja.
you.DAT NEG must stay
'You must not stay.' $\Box > \neg$ (Russian)

Second, there are languages such as Swedish and the other mainland Scandinavian languages, in which negation is a phrasal adverb and the finite verb precedes it in main clauses but follows it in embedded clauses, due to the clause type-dependence of V2. Swedish has a necessity modal *borde* which translates as "should" and which scopes over negation in main and embedded clauses,

irrespective of its position. We provide an embedded example involving a relative clause, since these strongly resist embedded V2.

(468) a. Isac borde inte äta.
Isac should NEG eat
'Isac shouldn't eat.' $\Box > \neg$ (Swedish)

b. personen som inte borde äta
person REL NEG should eat
'the person who should not eat' $\Box > \neg$ (Swedish)

Third, there are those languages such as Greek, Spanish and Italian which do show independent evidence for V-to-T movement, since the finite verb precedes adverbs (see e.g. Belletti 1990), but which mark sentential negation with a preverbal negative marker. *Must*-type modals scopes over this preverbal negative marker in these languages too, as noted by I&Z; we provide the Greek example here.

(469) Dhen prepi na to kanume afto.
NEG must NA it do this
'We must not do this' $\Box > \neg$ (Greek; I&Z, 530)

Fourth, there are languages such as Scottish Gaelic, in which sentential negation is expressed not with a clause-internal operator but instead with a complementizer which precedes the verb and all other material within the TP.[7] Although most modal expressions involve non-verbal predication in this language, it has a verbal deontic necessity item *feumaidh/fheum*[8] which translates as "must". Interestingly, this modal's scope with respect to a higher negation is subject to

[7]See McCloskey (1996) for extensive arguments in favour of analysing these initial negative elements as complementizers in Irish. The argumentation extends to the equivalent elements in Scottish Gaelic.

[8]The morphological alternation here is between the "independent" form *feumaidh*, which occurs in matrix clauses and under relative complementizers, and the "dependent" form *fheum*, which occurs under most other embedding complementizers, including negation. This is an alternation that we see in Goidelic with all verbs, and indeed it is an indicator of the verbal status of this modal, as non-verbal predicates (including the other modal ones) do not show such an alternation.

variation: while most speakers only get a reading where the modal scopes below negation, for some speakers the modal scopes above negation.[9]

(470) a. Feumaidh mi falbh.
must-IND I leave-INF.
'I must leave'

b. Chan fheum mi falbh.
C-NEG must-DEP I leave-INF
'I must not leave' % $\Box > \neg$

To summarize, we find that deontic necessity modals outscope negation in a wide range of languages, and various aspects of clause structure seem not to condition the availability of such readings. This includes cases where the verb is particularly low, as in Russian and Swedish, and where negation is particularly high, as in Scottish Gaelic. Taking a broader typological view, we are not aware of any generalizations regarding the kinds of clause structures which are conducive to wide scope deontic necessity modals. This makes the tie between head movement and the extension of a modal's scope look somewhat tenuous.

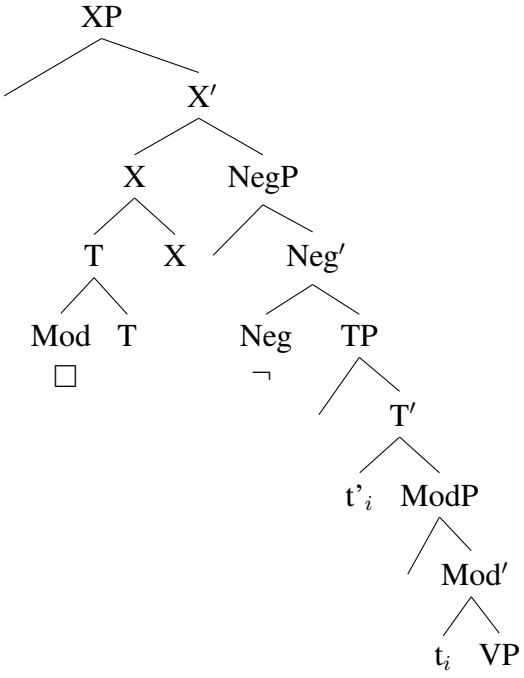
How, then, can modals outscope negation in all of these different structures? In their discussion of Greek, I&Z (p.551) suggest that the modal undergoes *covert head movement* to some head position above negation, from which it can scope. For languages in which NegP is above ModP but below TP, like Russian, the modal would need to covertly raise to TP, and the analysis would be much like what was schematized in (466) for English, except that the head movement in question is covert. The analysis of Swedish would be broadly similar: in V2 clauses, the modal would either take scope in C or in T, while in embedded clauses the verb would need to raise to

[9]There is a bit of murkiness to this observation. De Haan (1997) claims that the Scottish Gaelic *must*-type modal scopes over negation; he cites MacAulay (1992) for the observation, and also notes that he has gathered his own data confirming this observation via the 'GAELIC-L' internet list. But the MacAulay (1992) citation seems to be incorrect, as there (p.188) is actually reported that *chan fheum* translates as "need not", with the modal scoping below negation. In our own consultation with speakers, most confirm Macaulay's observation, but some speakers report that they have the "must not" reading reported by De Haan's informants. In addition, Gille-chrìòst MacGill-Eòin (p.c.) informs us that in Manx Gaelic, a closely related language in the Goidelic family, the cognate modal element *shegin/negin* is interpreted above negation. We conclude, then, that the scope of these modals is subject to dialectal variation in this language family. This variability is redolent of the variation we see for Dutch *moeten* which is noted by I&Z (p.530 fn.3). We leave ascertaining the nature of this variability to future research.

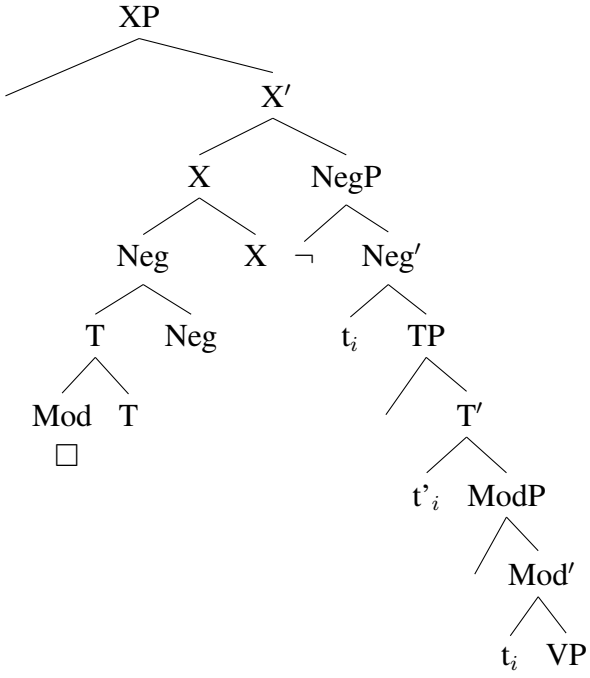
one of these head positions covertly.[10] In languages in which the verb raises past adverbs but not negation, like Greek, we assume that the NegP projection which hosts the overt negative head is above TP (see Zanuttini 1997).

I&Z do not commit to a specific clause structure for their analysis, so we will consider two possible implementations with a conventional phrase structure: (i) the modal raises covertly over the NegP to some higher (semantically vacuous) head X, skipping the Neg head completely, as shown in (471a); (ii) the semantically interpreted negation is a phrasal specifier of NegP and the modal moves through its semantically vacuous head to a higher (also vacuous) X position, as shown in (471b).[11]

(471) a.



b.



[10]It is an open question if V-to-C in mainland Scandinavian stops at T; see Arregi and Pietraszko (2021) for a discussion.

[11]A third option is that the modal moves to adjoin to the NegP head and then takes scope over it from this position, on the assumption that adjoined elements c-command their host constituents (as in e.g. Kayne 1994). This does not seem to be compatible with the syntax-semantics mapping assumed by I&Z, where negation first composes with the VP/ModP from which the modal has raised, and it is not clear how one could get the modal to compose with the negation appropriately in the complex head formed by head movement, as noted by Homer (2015).

Finally, for languages like Scottish Gaelic, negation would be in some C position immediately above the highest head in the inflectional layer (cf. Bennett et al. 2019 on Irish), and there would need to be covert head movement to some X which would be a higher complementizer in the CP layer.

For each of the cases outlined above, we must assume some type of interpretable covert head movement of the modal in order for I&Z's proposal to apply. We address the general challenges that such an assumption faces, and return to the differences between these cases where relevant. First, there is little to no empirical evidence for covert head movement independent of the proposal at hand. Covert head movement features prominently in early Minimalist work such as Chomsky (1995), but there was little in the way of empirical motivation for this component of the theory, and none of this was retained in subsequent developments of the framework (e.g. Chomsky 2001). Arguably, the burden of proof for covert head movement should be set particularly high, since calls for the elimination of covert movement are as prominent as the calls for the elimination of head movement (see e.g. Chomsky 1995, Kayne 1998), and the addition of theoretical technology such as Agree (Chomsky 2001) renders covert head movement suspiciously redundant. Second, covert head movement of modals, so construed in line with I&Z's proposal, would be markedly different from QR of DPs, since DPs can often QR for no reason other than to take wide scope (Fox 2000), while covert head movement would only be permitted to rescue a polarity clash. Recall that the default for non-PPI modals is to scope below negation obligatorily, so allowing optional covert head movement of modals (without obligatory reconstruction) would lead to overgeneration. It's not clear why covert head movement would differ from covert phrasal movement in this way.

There are also problems with the specifics of the structures in (471). First, consider the structure in (471a). This involves a violation of the Head Movement Constraint (HMC), since the modal crosses Neg without adjoining to it, and it has been shown by Zanuttini (1997) and Zeijlstra (2004) that negation of the Greek/Italian type is a head in the clausal spine which blocks head movement of the finite verb to C; in this respect, it is different from the negation of languages such as Swedish, which behaves like a phrasal category (i.e. an adverb) with respect to a number of other

independent diagnostics. Given the analysis of Greek/Italian negation as a head, the fact that the modal must move over this head covertly in analysis such as (471a) forces us to say that the HMC must only hold of overt movement. This is somewhat suspicious, and to some extent is akin to stating that the HMC holds at surface structure;[12] such a theoretical move ought not to be possible if we assume (as is standard in the Minimalist framework that we adopt) that surface structure does not exist as a distinct level of representation. Besides this theoretical concern, we are not aware of any independent evidence for HMC holding only of overt movement, although this is unsurprising, since evidence for covert head movement is difficult to come by in general. As for the analysis in (471b), its main problem is that it requires us to analyse the overt negative element as a phrasal specifier. As noted above, Zanuttini (1997) and Zeijlstra (2004) provide a number of arguments for analysing the overt negators in Greek/Italian type languages as heads, distinguishing them from the adverb-like negatives of languages such as Dutch; for instance, adverbial negation may topicalize and occur in *why not*-type questions, but head negation may not. In addition, Zeijlstra (2004, 2008) argues that the availability of negative concord across languages can be accounted for, and indeed explained, on the basis of the division of languages into head negation vs non-head negation languages (i.e. Italian vs Dutch), and so by adopting the analysis in (471b) we would have to give up on this as well, since it would effectively collapse this distinction.

Finally, an empirical problem for the covert head movement analysis comes from the case of Scottish Gaelic in particular. Both analyses require that the modal moves covertly to some position above negation, and in the case of Scottish Gaelic this landing site needs to be particularly high, since negation in this language is a complementizer. Accepting that a landing site of some kind is available, the empirical problem is that this instance of covert movement would need to be

[12] An alternative approach along these lines which avoids the 'surface structure' problem is Bošković (2011, 2013), where it is proposed that all locality constraints effectively hold at PF. On this theory, non-local movements (including HMC violations) result in a star diacritic being appended to intervening elements, and these stars result in a crash if they are realised at PF; this is an extension of the logic of Lasnik's (2001) approach to island repair under sluicing. While this is theoretically consistent, it has its own problems. First, it is built on the assumption that deletion at PF may repair locality violations, and yet this foundational assumption has been criticized in subsequent work (Barros et al. 2014). Second, it requires the introduction of star diacritics which seem to be in violation of the Inclusiveness Condition (Chomsky, 2001). Third, it leads us to expect that covert movement would in general be less restricted by locality, whereas in fact covert movement seems to be more restricted than overt movement.

unique in the language, as no other quantifiers have the capacity to scope over sentential negation.[13] Universal quantifiers in the subject and object position obligatorily scope under negation, even though QR is otherwise available (for e.g. object>subject scope):

(472) Chan fhaca a h-uile duine e.
C-NEG see.PST-DEP every person him
'Not everyone saw him'; doesn't mean 'everyone is such that they didn't him'

(473) Chan fhaca e a h-uile duine.
C-NEG see.PST-DEP he every person
'He didn't see everyone'; doesn't mean 'everyone is such that he didn't see them'

Accounting for this data in I&Z's terms would require us to say that covert head movement is able to target some position above the CP-negation, but covert phrasal movement is not. This is a further step in the direction of disunity, and it is not clear what it would derive from.

In summary, we have explored a number of languages in which the sentential negation marker is preverbal with substantial differences in clause structure and positions of negation. Clause structure seems not to condition the availability of wide scope for modals, and accounting for those readings with I&Z's movement account ends up requiring a number of costly assumptions about how (covert) head movement works.

5.3.2.2 Embedded modals

If wide scope of the modal is achieved by semantically active head movement, we would expect the availability of wide scope to be blocked in instances in which head movement is blocked by some other immediately dominating auxiliary. In this section, we give examples of modals in non-finite forms in these kinds of configurations where we see that wide scope readings nevertheless persist.

In simple cases, French verbs move to T (Pollock, 1989). French has several necessity modals that can take scope above negation. In particular, *falloir* takes obligatory wide scope, as

[13]These facts are arguably part of a more general pattern whereby negation in the CP-domain obligatorily takes scope QPs in the clause that the C embeds. Potsdam (2013) shows that this is so for English, with data from cases where negation occurs in C in negative imperatives and interrogatives and negative inversion clauses. We come back to this data in section 5.3.2.3.

shown in (474) (similar facts and arguments presented in this section hold for *devoir*, that takes optional wide scope).

(474) Il ne faut pas fumer ici.
expl neg must neg smoke here
One must not smoke here.

Following an analysis of the I&Z type, the wide scope of *falloir* is achieved by head movement of the modal to T, above the negation marker *pas* (though still below the second, optional negation marker *ne*). However, we show that these modals can also be used in constructions that clearly don't have movement to T, i.e. in infinitival constructions, as in (475a), and in compound tenses, as in (475b). Wide scope of the modal is still available in these cases, despite the lack of overt head movement.[14]

(475) a. Ne pas falloir fumer, c'est normal.
neg neg must smoke it's normal
'Being required not to smoke is normal.' $\Box > \neg$

b. Il n'aurait pas fallu fumer.
expl neg'have.subj neg must smoke
'You shouldn't have smoked.' $\Box > \neg$

The strong challenge here comes from (475b), where the modals are dominated by another auxiliary; if we were deriving the wide scope by head movement, this would require quite an unusual type of non-local head movement that is not recognisable from French grammar.

Before we get into the specifics, let us first show that modals that are embedded under another auxiliary in this manner can scope over higher negations in other languages as well. As discussed in the previous section, Spanish tensed verbs undergo V-to-T, as they appear before adverbs, despite appearing after negation. However, they appear after adverbs when in their nonfinite

[14]Careful: some compound tenses in French in fact only allow narrow scope, and could initially appear to be compelling evidence for head movement correlating with wide scope. However, as argued in Chapter 4, this narrow scope is due to the actuality entailment that appears with perfective marking, instead of the lack of head movement. The availability of wide scope in compound tenses as shown above lends support to such a non-syntactic analysis, and is enough to make our point.

forms, e.g. the near future, (476a), and conditional, (476b). As in French, these involve a finite verb in T which embeds the modal. Despite the fact that T is filled and the modal is embedded well below NegP, the modal can still take scope over negation.

(476) a. No habría debido separarme de ella.
neg have.cond.1sg must.part break.up from her
I shouldn't have broken up with her. $\Box > \neg$

b. No vas a tener que salir hoy.
neg go.2sg to have.inf to go.out today
You will be required not to go out today. $\Box > \neg$

Dutch modals also have non-finite forms that can be embedded under other auxiliaries. (477) shows cases where the necessity modal *moeten* is embedded under *zullen* 'will' and *had* 'had' (past perfect). In these cases, the modal may scope over negation, just like it does in simpler cases where it is finite.[15]

(477) a. Jan zal niet moeten vertrekken.
Jan will not must.INF leave.INF
'Jan shouldn't leave' $\Box > \neg$

b. Jan had niet moeten vertrekken.
Jan had not must.INF leave.INF
'Jan shouldn't have left' $\Box > \neg$

Finally, there is the case of English *supposed (to)*, which, as noted by Homer (2011), is a necessity modal which takes wide scope with respect to negation, despite always occurring below it.[16]

(478) You're not supposed to leave. $\Box > \neg$

The argument from *supposed* is less clear-cut than the other cases reviewed so far, since one might claim that the locus of the construction's modal force is the *be* which it typically occurs with; such

[15]Recall that wide scope is only available for *moeten* in certain Dutch dialects. We focus on those varieties here.

[16]*Supposed* has been labeled a neg-raiser (Horn 1989, 1978; Collins & Postal 2014). Homer 2011 analyzes it as both a neg-raiser and PPI, on a par with English *should*, which I&Z analyze as a PPI, hence the relevance of *supposed* here.

an analysis might lean on comparison with the modal *is to* construction (as in *John is to be here by five*), which also scopes over negation (I&Z p.530). But there is evidence that the locus of modal force in this construction is *supposed*. This comes from examples such as (479), where the *supposed* occurs without a verb in a small clause construction but still contributes the same modal interpretation and still scopes over negation.

(479) Italy, of course, remains in lock-down with people not supposed to leave their homes and there's little knowledge of snow conditions presently.[17]

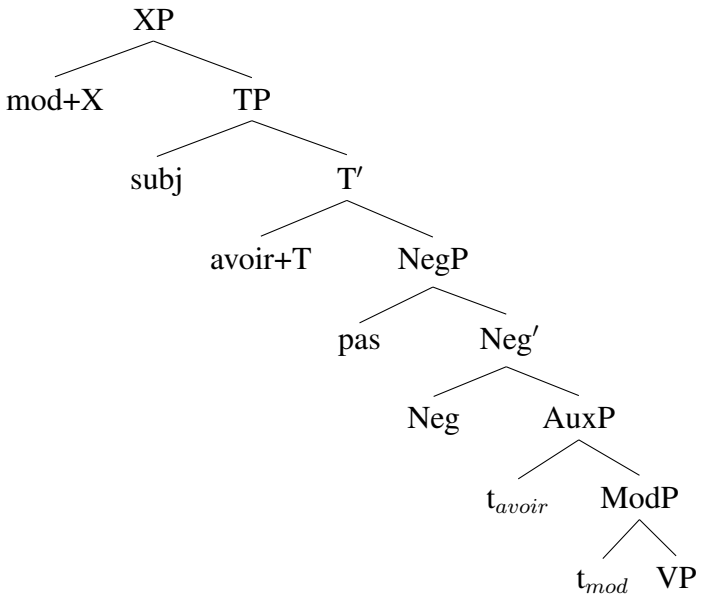
Given that *supposed* is embedded under a finite *be* in T in examples such as (478), it would seem to pose the same sort of challenge as the other case.

Let us now consider the specifics of the challenge that embedded modals pose for I&Z's account. In all cases, the modal occurs in some low position below negations of different kinds (high negation in Spanish, most likely low negation in the others), and so in order for them to scope over negation they must be undergoing covert head movement to some higher head position above the NegP projections. (480) shows how this might work for French, where T is occupied by *avoir*, which has moved from some lower position where it embeds a constituent containing the modal (which we represent as ModP here).[18]

[17]Example from https://www.snow-forecast.com/whiteroom/world-snow-roundup-131/. Accessed on August 9th 2020.

[18]For simplicity we are ignoring Pollock's (1989) split IP, which breaks up the tense/inflection domain into two projections.

(480)



The main problem here is that movement of the modal incurs at least two violations of the HMC: one by crossing the base-generated position of the auxiliary, and one by crossing T. There may be an additional violation for crossing the Neg head, but establishing that would require a fuller analysis of French negation. The landing site for movemment of the modal must be some higher head position, since T is filled by *avoir*. In addition, the identity of the X projection is not evident, and it is unclear whether we would expect it to always be available, for instance in cases like (479), where there is no apparent TP layer at all. These considerations taken together, (480) looks like quite an unlikely analysis for the wide scope reading of the modal. A similar cluster of problems besets the analyses for the data from Spanish, Dutch and English.

A potential way out for this account may be to confront the HMC head-on (Harizanov and Gribanova, 2017), in light of cases in other languages where it seems not to apply. One class of cases which is particularly relevant is the so-called *long head movement* (LHM) construction, where we see a participle moving over a local auxiliary to some higher position in the same clause (see e.g. Rivero 1991, 1994). LHM is found in southern and western Slavic, Balkan languages and in Old Romance, and it is illustrated for Bulgarian in the following example, in which the participle occurs to the left of the auxiliary.

(481) Procel e knigata.
read has book.DEF
'He has read the book' (Bulgarian; Rivero 1991)

One possible analysis of the embedded modal facts outlined above might be to say that the covert syntax of these modals is the same as the overt syntax of LHM, with the only difference being in patterns of pronunciation. While this line of reasoning is familiar and in principle capable of accounting for some of the data, it is still limited, since LHM is much more restricted than whatever mechanisms are involved in providing embedded modals with wide scope. One restriction on LHM is that it only applies in finite matrix clauses, much like V2 movement in Germanic (Rivero 1991). If wide scope for modals was derived by LHM, then we would incorrectly predict no wide scope in the French example (475a), in which the modal occurs in a non-finite embedded subject clause, as well as English (479). In general, the clause structure of the clause containing these modal seems not to affect their scope possibilities, a point that we made in the preceding section in our review of different sentential negatives. A second restriction that often applies to LHM, which is particularly relevant here, is that it is often blocked by negation. Rivero (1991) discusses this at length and shows that in languages such as Bulgarian, LHM is impossible in negative clauses.

(482) a. *Procel ne sum knigata.
read NEG has book.DEF

b. *Ne procel sum knigata.
NEG read has book.DEF
'He hasn't read the book' (Bulgarian; Rivero 1991)

This restriction does not apply to all LHM languages however, as Slovak differs from Bulgarian in allowing LHM in negative clauses if the negative marker attaches to the fronted participle.

(483) Ne-napísal som list.
NEG-written have.1SG letter
'I have not written a letter' (Slovak; Rivero 1991)

Rivero shows that the possibility of LHM in negative clauses correlates with the type of negation, such that it is impossible in languages with 'high' negation (where NegP occurs above TP, Zanuttini 1991, Zanuttini 1997) but possible in languages with 'low' negation ('English-type' languages, according to Rivero). These are the kinds of interactions between negation and head movement that we might expect to find, but we did not find any such interactions in our overview of wide-scoping modals in the previous section, and so this makes LHM and modal scope seem quite distinct. In particular, it is hard to see how invoking covert LHM would derive wide scope for the embedded modals in Spanish, given that it is a 'high' negation language.

We conclude that invoking LHM of the Slavic/Balkan type is unlikely to provide us with a means by which to understand the ability of embedded modals to scope over clausemate negatives, and so the problems outlined above still stand. Of course, it is possible to draw another, perhaps more nihilistic conclusion from the LHM phenomenon, namely, that the HMC is not a real restriction on syntax at all, and that any argument for or against specific analyses of head positions that is build on the HMC is doomed from the start. This would strip our argument in this section of much of its potency, and so we should acknowledge it. But any move in that direction would leave unaccounted for a great number of restrictions on rules that affect heads, and it would ultimately constitute an abandonment of much of the empirical base of syntactic theories of head movement, thus making it look decidedly less syntactic. This doesn't seem to be a productive move for defenders of syntactic head movement to make.

5.3.2.3 High negative operators

In this section we present data that show that wide scope of the modal is available with a variety of negative operators which are in a position higher than sentential negation: negative quantifiers in subject position, high covert negative operators present in analyses of negative concord languages, negative inversion constructions and negative coordinators.

5.3.2.3.1 NegDP subjects Iatridou and Sichel (2011) show that NegDPs in subject positions interact scopally with deontic modals in exactly the same way as sentential negatives in English.

Thus possibility and necessity modals *can*, *may*, *have to*, *need to* scope below both subject NegDPs, and *-n't*, while necessity modals *must*, *should* and *ought to* scope over them both. We have confirmed that the same facts hold for deontic possibility modals in a number of the languages with NegDPs discussed above, such as French, Italian and Swedish.

(484) a. No one {can/has to/may/need} leave. $\neg > \text{mod}$

b. No one {must/should/ought to} leave. $\text{mod} > \neg$

Iatridou and Sichel argue that this follows from an approach to NegDPs where the scope of their negative component is determined by the same syntactic element as sentential negation. We do not get into the details here, but they predict that the scope of NegDPs will always be identical to that of sentential negation, and so it accounts for their generalization straightforwardly, and without recourse to reconstructing semantically negative determiners (which they show to have numerous problems, arguing against Lasnik 1999).

Our contention here is that it is not correct to say that NegDPs always have the same scope as sentential negation, as there are cases involving operators other than modal verbs where we see differences between the two negatives. Consider the case of *probably*, a 'high' adverb which is shown by Nilsen (2004) to be a PPI. In non-negative clauses, *probably* can occur before or after the finite auxiliary (after is typically preferred), but in negative clauses with *-n't* it can only occur before the sentential negation.

(485) a. She will probably lose.

b. She probably will lose.

(486) a. She probably won't lose.

b. *She won't probably lose.

If NegDP subjects scoped in the same position as sentential negation, we would predict that *probably* should be possible in a pre-verbal position but following a NegDP. However this is not borne out, as (487) shows.[19]

(487) *Nobody probably will lose.

Similar facts obtain in French with *sûrement*, with the difference that it always occurs after the finite verb.

(488) a. Elle ne va sûrement pas perdre.
she neg will probably neg lose
She probably won't lose.

b. *Personne ne va sûrement perdre.
Nobody neg will probably lose

These facts indicate that the negation of NegDPs is not identical to sentential negation, but rather is higher, presumably as high as the subject position. This result dovetails with proposals in Zeijlstra (2011) and Collins and Postal (2014), who argue for NegDPs as semantically negative elements which encode negative scope from the subject position, rather than non-negative indefinites with special licensing conditions.

We therefore take it as established that NegDPs are associated with semantically negative operators which don't reconstruct to the subject's base position, for reasons that remain to be seen. Accounting for Iatridou and Sichel's observations on the interaction of modals and negation

[19]The same point can also be made with NPI adverbials, in particular *ever*. Like *probably*, *ever* seems to be able to occur both before and after the finite auxiliary, so long as it has an appropriate licensor, for instance a superordinate negation. It can occur in this position with a clausemate NegDP subject too, but not sentential negation, once more indicating the two do not have identical scope.

(i) a. I don't think he ever has been known for being tactful.
b. I don't think he has ever been known for being tactful.

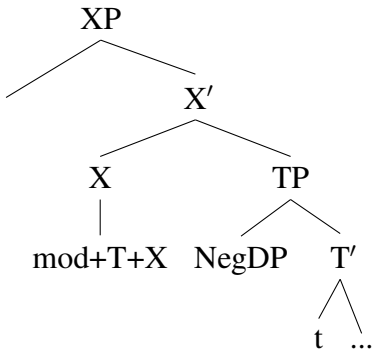
(ii) Nobody in my family ever has been known for being tactful.

(iii) *He ever hasn't been known for being tactful.

The force of this argument is tempered by the fact that the pre-verbal position for the adverb is sometimes dispreferred, and so this may be a substantial contributing factor in the judgment of the crucial example (iii).

now becomes more difficult. As before, the only option that seems to be available within I&Z's framework is for the modal to move covertly over the NegDP to some higher head position. Such a head position will have to be available in all the languages in question, including languages in which modals first undergo overt head movement, like English.

(489)



This might seem like an innocuous move, but it raises further questions. Again, we have to extend I&Z's proposal to integrate covert movement: covert head movement is impossible unless not doing it would lead to ungrammaticality. As previously discussed, covert head movement differs from covert phrasal movement, which is typically optional and not always contingent on avoiding semantic anomaly. Here we observe an additional difference: covert head movement can rescue a PPI, but covert phrasal movement cannot. If covert phrasal movement was always available to alleviate problems for PPIs, we would expect that PPI adverbs like *probably* would be able to move covertly in examples such as (487) to a position above the NegDP subject, not least since examples like (490) show that this is possible with *overt* movement. This begs the question: if this phrasal movement of PPI adverbs can occur overtly, why can't it be done covertly?

(490) Probably nobody will lose.

Returning once more to clause structure considerations, an additional problem is that the X position which has been posited in (489) needs to be made available in general, in all clause types, and in a wide range of languages. It needs to be available in small clauses, since *supposed* can scope over NegDP subjects in variations on (491) from the previous section.

(491) Now, with no one supposed to leave home, there are no errands to run, grace periods have been granted on mortgage, utility and tax bills.[20] □ > ¬

It also needs to be available in a wide range of languages, possibly universally, because the same NegDP scope facts appear to hold of any other language that allows them. We observe the same behaviour in French, Swedish, Spanish and Italian, all languages which allow NegDP subjects in the absence of any other overt negative, as shown in (492) and (493).

(492) a. Personne ne doit y aller.
nobody neg must there go
Nobody should go.

b. Ingen bör gå.
Nobody should go.

(493) a. Nadie debe ir.
Nobody should go.

b. Nessuno deve andare.
Nobody should go.

The languages in (493) are arguably distinct from those in (492), as they display "non-strict" negative concord, meaning they allow a Negative Concord Item (NCI) in subject position without an accompanying overt negator. As it happens, the same facts obtain with modals in "strict" NC languages such as Russian (494a), Greek (494b) and Ewe (494c), where the sentential negation is required for licensing of subject NCIs; in these languages, the necessity modals may take wide scope as they do in negated clauses without NCI subjects.

(494) a. Nikomu ne stoit uxodit'.
nobody.dat neg should leave
Nobody should leave. □ > ¬

b. Kanenas den prepi na to kani afto.
nobody neg must na it do this
Nobody must do this. □ > ¬

[20]https://www.thenewstribune.com/opinion/article241181366.html. Accessed on August 12th 2020.

c. M-ele be amea deke ne-yi o.
neg-be comp nobody JUS-go neg
Nobody must go. □ > ¬

The challenge from strict NC languages is arguably even stronger than that which arises from the NegDP data from the other languages discussed in this section so far, as it has been argued that negation in these languages takes wide scope with respect to the subject from some high adjoined position (Zeijlstra 2004). Thus, even if it turned out that NegDP subjects actually do scope as sentential negation in English (i.e. if the data in (485)-(488b) were submitted to some other analysis), the point of this discussion would still stand.

5.3.2.3.2 Negative inversion Another construction where negation takes high scope is negative inversion (NI; see Emonds 1976; Haegeman 2000; Collins and Postal 2014). The fact that negation takes particularly high scope in NI is shown by the following examples. (495) demonstrates that the fronted negative operator licenses subject NPIs, and the triplet in (496) shows that *because*-clauses may outscope sentential negation and NegDP subjects, but not fronted negative operators in NI.

(495) At no point did anyone think to inform me of the plans.

(496) a. I didn't leave because it started raining. neg>because, because>neg
b. Nobody left because it started raining. neg>because, because>neg
c. At no point did I leave because it started raining. neg>because-p, *because>neg[21]

The above-cited authors analyze negation in these constructions as sitting in the specifier of the CP or FocP (see alson Potsdam 2013), and so the fact that this negation scopes over subjects and *because*-clauses (which we presume to be TP-adjuncts) is not particularly surprising. However, as Francis (2017) notes, *must* is surprisingly still able to scope it, in contrast with other scope-taking elements.

[21]This reading does become possible if there is a big pause before *because*, but no such pause is required for (496a)-(496b).

(497) At no point must the server's feet move in front of the baseline on the court prior to hitting their serve. https://www.rulesofsport.com/sports/tennis.html

Therefore, if the modal undergoes head movement – specifically, some covert step of head movement to a higher position than its landing site after T-to-C movement – it must do so to a projection above the FocP or CP, depending on the analysis, and such a movement must be forbidden for phrasal categories such as *because*-clauses, which must scope below negation in this construction. Like for Scottish Gaelic, it sounds particularly suspicious that phrasal elements behave differently and cannot raise above this high negation.

5.3.2.3.3 Negative connectives Finally, we consider the behavior of modals with negative connectives, i.e. *neither...nor* and its equivalent in other languages. We observe that wide-scoping modals such as English *must*, French *devoir* can produce a wide scope interpretation when present in negative coordinations.

(498) a. Coronavirus knows no international borders, neither must its eventual cure.[22] $\Box > \neg$

b. Tu ne peux ni ne dois sortir.
you neg can.2sg nor neg must.2sg go.out
You cannot nor must go out. $\Box > \neg$, French

In these examples, the necessity modal in the second coordinand can be interpreted above the negative operator introduced by the negative coordination. Not only do we have a high negative operator, but it turns out to be difficult to argue for the possibility of any kind of movement in these configurations; I come back to this problem in section 5.3.3.3.2.

For all of the cases described in this section, either deriving wide scope via head movement requires either a landing site above TP, or it is outright impossible, as in the negative disjunction case. Therefore, the surface position of a modal is never a satisfactory landing site for interpreta-

[22] https://www.theguardian.com/commentisfree/2020/apr/18/coronavirus-knows-no-international-borders-neither-must-its-eventual-cure

tion, and covert movement must be adopted, with limited success. This is an unwelcome conclusion for I&Z's theory, given that the impetus for treating head movement as crucial to modal scope comes from the fact that modals move overtly over negation, and it is arguably in strong contrast with QR (Bobaljik and Wurmbrand, 2012). If wide scope for modals has no clear connection to the surface positions of heads, it is not clear why head movement, a syntactic rule which is under intense theoretical scrutiny, should be the one which is used to derive those facts.

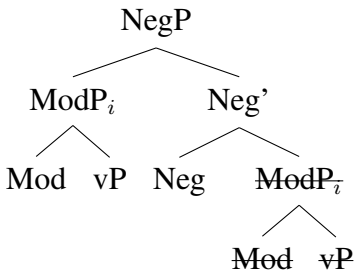
5.3.3 Challenges for any movement account

We have put forward a variety of arguments for the implausibility of interpretable head movement of the modal to account for scopal interpretations of necessity modals above negation across languages and syntactic configurations. We now review arguments for and against any syntactic movement of PPI modals, building off of a claim by Homer (2011, 2015) that PPI modals undergo phrasal movement. We conclude that an account that relies on syntactic movement of the modal is untenable. An in-situ, purely sematnic account is thus preferred.

5.3.3.1 Challenges for phrasal movement as an alternative

If head movement is not the right way to derive wide scope for necessity modals, what about phrasal movement? We first note that such an analysis would have to be adopted with caution, given the differences discussed in the above sections between known behavior of phrasal movement and movement of wide scope modals. Phrasal movement is a suggestion that Homer (2015) (pp.31-32, and Appendix III) briefly entertains to account for wide scope modals. For Homer, the ModP undergoes phrasal movement to a position above negation, if and only if it is ungrammatical below negation. He doesn't give any particular details about the structure, but we infer that it would be something like (499), where the ModP moves to a position above the Neg head, say spec-NegP.

(499)



An initial question is how to interpret this structure. Interpreting the ModP in its derived position does not ensure its wide scope with respect to negation: composing it back with Neg' inescapably makes it take narrow scope again, which results in the same initial polarity clash. Therefore, in order for the structure to be interpretable, the vP must reconstruct back to its original position, where it can compose with negation, leaving Mod in its derived position, that later composes with and scopes above the negated vP. Further details of such an analysis and the issues it brings up are beyond the scope of this paper.

A general point we take issue with is the existence of polarity-driven phrasal movement of PPIs, which is what Homer invokes in this analysis. There are other instances of polarity items that cannot undergo movement to rescue their grammaticality. For example, we saw that *probably* is ungrammatical under negation, as seen in example (486b), repeated below:

(500) *She won't probably lose.

One could argue that since overt movement is available to rescue the grammaticality of this sentence, covert movement cannot be (cf. Bobaljik and Wurmbrand 2012). However, there are other instances in which overt movement is not available, yet movement does not save the grammaticality of a polarity-sensitive item. One is in a sentence containing negation, an NPI, and an intervening element blocking the NPI's licensing – i.e. a configuration that violates Linebarger's (1980) Immediate Scope Constraint. We give a known example of such a configuration with *anything* in (504), and one with the NPI modal *need* in (505a).

(501) She didn't (*always) like anything.

(502) a. She didn't (*always) need go there.

b. She didn't (always) need to go there.

The grammaticality of these sentences would be rescued if the NPIs *anything* and *need* moved between negation and *always*, where they would satisfy the Immediate Scope constraint. However, we do not observe this. Why then can *must* move to satisfy its polarity requirements, but not *need*?

5.3.3.2 Challenges for any polarity-driven movement

5.3.3.2.1 Covert movement doesn't always rescue a polarity clash A general point we take issue with is the existence of polarity-driven phrasal movement of PPIs, which is what Homer invokes in this analysis. There are other instances of polarity items that cannot undergo movement to rescue their grammaticality. For example, we saw that *probably* is ungrammatical under negation, as seen in example (486b), repeated below:

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5.3.3.2.2 Obligatory vs optional behavior The difference between obligatory and optional behavior of certain wide scope necessity modals is difficult to account for in a PPI-based analysis. Homer (2011) seems to explain these cases with different flexibility on the polarity licensing operator. For example, the polarity licensor can be close to optionally scoping *devoir* to check its polarity before it combines with negation – this accounts for *devoir*'s narrow scope. Its wide scope occurs if the licensor has not been inserted in that position, and there would be a polarity clash if the modal did not move above negation.

First, this is already a doubtful mechanism, when compared to other well-known PPIs. For example, *some* simply has no escape but to not scope below sentential negation, in absence of shielding or rescuing, even with strong contextual support, as shown in the following contrast between 'any' and 'some'.

(506) a. – Did you see any rhinos there?
– No, we didn't see any rhinos, unfortunately.
b. – Did you see some rhinos there?
– No, we didn't see some rhinos, unfortunately.

Some cannot be understood as non-specific in this example, which is difficult to accommodate if it is non-specific in the question. The complete unavailbility of *some*'s narrow scope is surprising in contrast with the possibility of narrow scope with *devoir* and even sometimes *falloir*. *some* is clearly further from negation than the modals, so we would expect local polarity licensing to be even more available. But it is not.

Another problem with the availability of this super-local polarity licensing is that it does not explain the difference between the completely optional wide scope of *devoir* (and others of its kin), and the almost obligatory wide scope of *falloir* (and others of its kin).

The best argument to save this is to say that *falloir* can also take narrow scope sometimes, and pragmatic reasons, due for example to the impersonal construction it forms as argued in section 5.2, make it scope above negation in most cases. The same arguments against this pragmatic source hold here. The explanation of the difference between 'almost obligatory' and 'completely optional' is therefore lost, in contrast with a SLI-based analysis which explains that difference in a systematic way.

Furthermore, Chapter 3 establishes a correlation between obligatory and optional wide-scope taking– this connection is completely lost if both types of modals are conflated. We could imagine finding a relationship between In addition, while no-one has investigated this thoroughly, PPI-hood in general seems independent of available scalemates in the lexicon.

5.3.3.3 Challenges for any movement account

5.3.3.3.1 Ellipsis. We can diagnose the LF position of an element using ellipsis, where there is a requirement for the position of the elided element to match that of its antecedent, dubbed as Scope Parallelism (Sag, 1976; Fox, 2000 a.o.).[23] We can observe this requirement in action in the following sentence, in both its French and English counterparts. The first sentence contains two scope taking elements, 'no doctor' and 'two patients', in subject and object positions; either scope order, reflected in (a) and (b), is possible.

(507) Aucun docteur n'a examiné deux patients, une infirmière – si.
'No doctor examined two patients, but a nurse did.'

a. no doctor $>$ 2 patients; one nurse $>$ 2 patients

b. 2 patients $>$ no doctor; 2 patients $>$ one nurse (covarying nurses possible)

c. *no doctor $>$ 2 patients; 2 patients $>$ one nurse

d. *2 patients $>$ no doctor; one nurse $>$ 2 patients

[23] See Bassi and Bar-Lev (2016) for similar detection of a scaleless implicature using ellipsis of *devoir*.

The scope order of the subject of the second sentence, 'a nurse', must match that of the subject of the first sentence 'no doctor'. Given the possibility of covariation in (b), it appears that the scopal readings can indeed be a result of QR movement. The scopal configurations in (c) and (d) are not available, meaning no mismatch is possible, i.e. if there is movement in the antecedent, there is movement from the ellipsis site.

Based on this data, one would expect that the scope of a subject and the modal will follow the same requirement. Given this reasonable assumption, I show that an apparent scope mismatch is observed with necessity modal *devoir*, that lends support to the scaleless implicature theory, in which the modal stays *in situ*, below negation at LF.

We take the sentence pair in (508), in which there is an apparent scope mismatch of the necessity modal, elided in the second sentence, and the subjects.

(508) Aucun enfant ne doit aller en prison. Au moins un adulte dans cette ville – si.
'No child must go to prison. At least one adult in this city – yes.'
interpretation: **must>no child; at least one adult>must**

Crucially, the antecedent sentence contains a negated subject, 'no child'. The sentence alone can be interpreted with the modal scoping above the negation of the subject.

(509) a. EXH^2 [no child] [must] (scaleless implicature)
b. [must] [no child] ~~[must]~~ (movement of 'must')
c. <*no child*> [must] [no child] (reconstruction of 'no child')

Option (c) is presumably available under both theories of wide scope interpretations of negated modals, since it is independent of them. Options (a) and (b) are dependent on whether scaleless implicatures or modal movement are available options.

However, if Scope Parallelism holds for these modals, as we assume, (a) is the only viable option, i.e. it is the only one that allows the modal to scope below the subject at LF in both the

antecedent and elided sentence. I thus take this to be an argument for a theory of wide scope necessity modals in which the modal stays *in situ*, such as the one presented in this paper.

5.3.3.3.2 Negative connectives. As already mentioned in section 5.3.2.3.3, wide scope necessities can be embedded in a proposition coordinated by the negative connective *ni*, and still give a wide scope interpretation.

This is problematic if we take negative coordinations to be negations of disjunctions. For two propositions p and q, the logical form of negative coordinations can be analyzed as one of two truth-conditionally equivalent possibilities: a conjunction of negative elements $(\neg p) \wedge (\neg q)$, or a negation of a disjunction $\neg(p \vee q)$. Following Gonzalez 2020, we take the negative connective *ni* in French to follow the disjunction analysis (as appears to be common cross-linguistically – see Gajić 2016 for BCS and Jeretič 2018, to appear for Turkish).[24] Take p and $\Box q$ to be the coordinated propositions as in the examples given in (498). In a disjunction analysis, negation scopes above the coordination. Therefore, if the modal is to take wide scope with respect to negation, it must raise above the entire coordination, resulting in an LF of the type $\Box\neg(p \vee q)$. This LF, however, does not correspond to the intended reading, since the modal only applies to one of the disjuncts. Thus, there is simply no way of achieving the desired reading by any movement of the modal, whether it be head movement or something else. Assuming that the disjunction analysis is the correct one for negative coordinations in at least some languages, as the above-cited authors argue, a movement approach to derive a wide scope interpretation is not viable.

Note that the scaleless implicature analysis, in contrast, can account for the wide scope interpretation of the modal in a negative disjunction, as shown in the derivation below.

(510) $S = \neg(q \vee \Box_{\{w_1,w_2\}}p)$

(511) $Alt(S) = \{\neg(q \vee \Box_{\{w_1,w_2\}}p), \neg(q \vee \Box_{\{w_1\}}p), \neg(q \vee \Box_{\{w_2\}}p)\}$

[24]The conjunction analysis appears to be less prevalent in the literature: a short paper by Wurmbrand 2008 argues that English and German negative coordinations are conjunctions, but we remain skeptical of it in light of the suggestive morphology of 'neither..nor' as a negative disjunction. While a conjunction analysis can in principle be made compatible with a modal movement, it can't without introducing new assumptions about the syntax of negative coordinations. We do not go into the details of it here.

The set of alternatives of the negative coordination contains no IE alternative. I show this by contradiction below:

(512) $\neg(q \vee \Box_{\{w_1,w_2\}}p) \wedge (q \vee \Box_{\{w_1\}}p) \wedge (q \vee \Box_{\{w_2\}}p)$
$\equiv \neg(q \vee \Box_{\{w_1,w_2\}}p) \wedge \Box_{\{w_1\}}p \wedge \Box_{\{w_2\}}p$ (because q is false)
$\equiv \bot$ (because $\Box_{\{w_1,w_2\}}p \equiv \Box_{\{w_1\}}p \wedge \Box_{\{w_2\}}p$ is false)

(513) $S' = \text{EXH}\ [Alt(S)][S] = \neg(q \vee \Box_{\{w_1,w_2\}}p)$

(514) $Alt(S') = \{\neg(q \vee \Box_{\{w_1,w_2\}}p),$
$\neg(q \vee \Box_{\{w_1\}}p) \wedge (q \vee \Box_{\{w_2\}}p)$
$\neg(q \vee \Box_{\{w_2\}}p)\} \wedge (q \vee \Box_{\{w_1\}}p)\}$

The second EXH application, in contrast, yields strengthening.

(515) $S'' = \text{EXH}[Alt(S')][S']$
$\equiv \neg(q \vee \Box_{\{w_1,w_2\}}p) \wedge \neg(\neg(q \vee \Box_{\{w_1\}}p) \wedge (q \vee \Box_{\{w_2\}}p)) \wedge \neg(\neg(q \vee \Box_{\{w_2\}}p) \wedge (q \vee \Box_{\{w_1\}}p))$
$\equiv \neg(q \vee \Box_{\{w_1,w_2\}}p) \wedge ((q \vee \Box_{\{w_2\}}p) \leftrightarrow (q \vee \Box_{\{w_1\}}p))$
$\equiv \neg(q \vee \Box_{\{w_1,w_2\}}p) \wedge \Box_{\{w_2\}}p \leftrightarrow \Box_{\{w_1\}}p$ (because q is false)
$\equiv \neg q \wedge \Box_{\{w_1,w_2\}}\neg p$ (because $\Box_{\{w_1,w_2\}}p$ is false)

5.3.3.3.3 No explanation of the asymmetry A PPI movement theory does not predict the possibility-necessity asymmetry (though see a recent attempt by Zeijlstra (2020) to explain the lack of deontic existential PPIs).

5.3.3.3.4 Scope facts with AEs unexplained. Finally, accounts of modals as PPIs do not explain the scope facts in AE sentences. Homer (2015) says PPIs are 'anti-licensed' under negation, leaving open why they must remain below negation in anti-AE sentences. In Zeijlstra's (2017) account, he assumes that *'must'* invokes a covert exhaustifier, that negates all stronger domain alternatives (and not just IE alternatives), yielding ungrammaticality if the result is inconsistent.

Under negation, *must* is ungrammatical, since it yields an inconsistent result, as shown in (516). Therefore, *'must'* must raise above negation, where it is grammatical.

(516) EXH $\neg$ *must*$_{\{w_1,w_2\}}p \equiv \neg\Box_{\{w_1,w_2\}}p \wedge \neg\Box_{\{w_1\}}p \wedge \neg\Box_{\{w_2\}}p \equiv \bot$

Extending this analysis to *falloir*, it yield the wrong results with AEs. The alternatives $\neg\check{\Box}_{\{w_1\}}p$ and $\neg\check{\Box}_{\{w_2\}}p$ are stronger than $\neg\check{\Box}_{\{w_1,w_2\}}p$, therefore negated. The result, shown in (517), is again inconsistent, incorrectly predicting ungrammaticality of the modal below negation. (I adopt the notation used by Alxatib (2019) to represent an AE-triggering modal).

(517) EXH $\neg$ *fallu*$_{\{w_1,w_2\}}p \equiv \neg\check{\Box}_{\{w_1,w_2\}}p \wedge \neg\check{\Box}_{\{w_1\}}p \wedge \neg\check{\Box}_{\{w_2\}}p \equiv \bot$

5.3.4 Disproving arguments for modal movement

Both Iatridou and Zeijlstra (2013) and Homer (2011, 2015) have a couple arguments suggesting that modal movement indeed exists. In this section, I disprove their validity.

5.3.4.1 Against the *de dicto* indefinites argument

There is one argument that both I&Z and Homer use to back the movement analysis of modal scope: *de dicto* readings of indefinites that are meant to diagnose wide scope readings of modals (this is referred to by Homer as the 'pin test'). They note that the movement approach predicts the availability of *de dicto* readings for indefinites which scope above negation, since the modal has moved to a higher position where it may scope over the subject as well as negation. Thus, if a subject scopes below a necessity modal and above negation, then we can be quite sure that the modal has undergone movement. I&Z and Homer argue that this can be the case with subject indefinites in negated modal sentences. In (518) and (519), the DPs may be interpreted as non-specific, or *de dicto*, which is a diagnosis for an intensional operator outscoping them. In these sentences, the only apparent possibility for this intensional operator is the necessity modal *must*.

(518) Some students must not leave. [from I&Z]

available reading: must > some students > not (wide scope of the DP with respect to the modal)

(519) *Context: The rules of this bowling game state that exactly one pin must remain standing, no matter which one...* [from Homer (2011, 2015)]

Exactly one pin mustn't be knocked down. *available reading:* must > exactly one pin > not

These indefinites are not interpreted below negation, therefore, the only scopal construal that achieves the desired interpretation is one in which the modal has moved from below negation to above the indefinite.

As argued in Jeretič (in prep.), the validity of this argument is questioned by similar examples that involve modals that scope below negation.

(520) *Context: In this bowling game, exactly one pin must remain standing, no matter which one.*

Exactly one pin can't be knocked down.

(521) *Context: A room only fits 30 people. Around 40 students show up to the class.*

Unfortunately, about 10 students can't fit into this room. (I will pick at random who gets to stay.)

(522) Some things don't need to be said.

In these three different scenarios, there is a clear available *de dicto* reading of the subject indefinite. Strikingly, this reading cannot be achieved by manipulating the scope of the three elements. The modals (*can* or *need*) all have unambiguous narrow scope with respect to negation (*neg*>*mod*), and the subject indefinites all unambiguously scope above negation in these scenarios. This means we end up with the only possible scope construal to be *subj*>*neg*>*mod*. However, this

configuration is at odds with the *de dicto* interpretation of the indefinite to correspond to a narrow scope of the indefinite with respect to the modal.[25]

We take this to be evidence that the *de dicto* reading of the indefinite can come from a source other than the modal. Examples (520) and (522) are generic statements: a high scoping generic operator can thus provide the source of the *de dicto* reading, allowing the modal to stay below the indefinite. In (521), the statement holds of the (near) future, which can also be analyzed intensionally. We do not make any claims about what the final analysis for these sentences is, only that the source of the *de dicto* reading may be different from the modal, and thus it cannot be used as a diagnostic for movement of the modal in any of these sentences.

5.3.4.2 Against using *plus* as a diagnostic for movement.

Homer (2011) uses *plus* as a diagnostic for movement, by showing an example in which the presupposition of *plus* appears to apply below the modal.

(523) Il ne faut plus que tu fumes.
it neg must no.longer that you smoke
You must no longer smoke.

Homer (2011) assumes that *plus* is inherently negative, and carries the presupposition that its prejacent used to be true. In sentence (523), the most pragmatically plausible context is such that the presupposition applies to "you smoke" and not to "you must smoke." Such a reading appears to be available. While this data point appears at first sight to be a convincing diagnostic for movement of the modal, I will show that it is not valid, by showing that (a) there are good reasons to think

[25]Note that I&Z do contrast their example cited in (518) with an example with *may*, in which it scopes below negation.

(i) Some students may not leave. some students > not > may

While it may be true that the *de dicto* interpretation of *some students* in this particular example sounds marginal, it is unclear how big the contrast is with (518), or what the source of the strangeness is. In particular, flavor may play a role: deontic *may* appears to require that the permission applies to a specific individual, which is not the case for deontic *must*. We can check this by looking at the availability of deontic *must* in the sentence “it must be the case that some students leave”, but not deontic *may* in the sentence “it may be the case that some students leave” (only epistemic *may* is available). In contrast, deontic *can* is available in "it can be the case that some students leave".

that *plus*, as a negative concord item, is not inherently negative, which means that its non-negative semantic contribution, i.e. the presupposition that its prejacent used to be true, is separable from negation, and (b) it is a curious property of *plus*, shared with other adverbials, that they can apply to the embedded clause directly, instead of the matrix clause in which they syntactically appear – in a phenomenon known as adverb climbing Edelstein (2015).

If *plus* can indeed attach to the embedded clause, then movement is not a necessary component of the analysis of (523), as the following analysis would be available: $\text{EXH}^2\ \neg\Box$ *plus* p.

***Plus* is not inherently negative.** *Plus* ('no longer') is a negative concord item (NCI), and NCIs are argued to be non-negative, only requiring to appear below a (potentially covert) negation. This makes their non-negative semantic contribution separable from the semantic negation.

This can be seen in the following data, in which *plus* co-occurs with other NCIs, yielding only one semantic negation.

(524) a. Personne ne voit plus personne.
No-one neg see no.longer no-one
No-one doesn't see anyone anymore.

b. Personne ne voit (#pas) personne.

(525) a. Je ne veux plus jamais te voir.
I neg want no.longer never you see
I don't want to ever see you anymore.

b. Je ne veux (*pas) jamais te voir.

(526) a. Fais ta vie sans plus te soucier de lui.
make your life without no.longer you worry about him
Keep living without worrying about him anymore.

b. Fais ta vie sans (*pas) te soucier de lui.

This means that while negation must cooccur with *plus* somewhere in the clause, it is potentially scopally separable from it.

***Plus* can apply to the embedded clause.** We can find unambiguous cases in which *plus* syntactically appears on a embedding predicate, but its semantics applies to the embedded clause, while negation appears on the matrix clause, in a phenomenon that appears to be what has been described as 'adverb climbing' (this is a phenomenon, which, to my knowledge, has only received limited attention in the literature, see Edelstein (2015)). In particular, this is possible to do with with a possibility modal.[26]

(527) Context: *There is a strict no smoking policy a teenager's home. But one day she is caught smoking; her parents get angry.*
Arrête, tu sais que tu n'as pas le droit de fumer! Tu **ne peux plus** le faire!
*Stop, you know that you're not allowed to smoke! You **cannot** do it **anymore**!*

In this example, the negation unambiguously scopes above the modal, but the presupposition of *plus* applies to the embedded clause only– in this context, it is not true that the teenager was allowed to smoke before, but it is true that she did smoke before. Therefore, it appears that the semantics of *plus* can indeed compose with the embedded clause, while negation still scopes above.

We can see this phenomenon replicated with other, non-negative, adverbials. Here are some examples with *à nouveau* ('again'), where its presupposition applies to the embedded clause.

(528) Context: *We haven't talked in a while, and you called me yesterday, without me needing/wanting you to call. Today something happened, and I need/want you to call again.*

[26]Note that the splitting is not replicable with any embedding predicate. For example, we can test whether *plus* can apply to the embedded clause when combining with other neg-raising predicates.

(i) Jean ne pense plus qu'elle le déteste.
intended reading: ?? Jean doesn't think that she hates him, and she used to hate him.

(ii) Jean ne dit plus qu'elle le déteste.
intended reading: ?? Jean doesn't say that she hates him, and she used to hate him.

See Edelstein for how adverb-climbing differs from predicate to predicate.

a. Il faut à nouveau que tu m'appelles.
it must again that you me'call.
You have to call me again.

b. Je veux à nouveau que tu m'appelles.
I want again that you me'call.
I want you to call me again.

The availability of these examples is an additional point against using the original (523) as an example in which the modal has moved. If it has, then we would expect the same of the examples here with (528). However, Homer (2011) must make an important assumption, the 'laziness principle', in which a modal moves only as a last resort. In these sentences with *à nouveau*, there is no need for the predicate to move: there is no polarity clash, and these sentences are in fact ambiguous between the adverb applying to the matrix or embedded clause. Thus, we must assume some syntactic or semantic mechanism for these adverbials to apply to the embedded clause, independent of polarity-driven modal movement.

5.3.5 Interim conclusion

We have argued against the availability of interpretable head movement of modals past negation.

We first argued that head movement is unlikely to be the source of wide scope readings of necessity modals in all languages. We showed that the availability of wide scope interpretations does not correlate with a language's clausal structure, that would be expected to affect the availability of head movement. Instead, a number of additional tenuous assumptions would have to be taken to account for the data in such languages, namely covert head movement, and movement to a high, unclear position that would violate the HMC, and a movement that differs in its properties from overt head movement and QR. Then, we showed that even in the languages claimed to have interpretable head movement of the modal, certain configurations call for additional contentious assumptions. These configurations include wide scope interpretations of non-finite modals, embedded under an auxiliary, in which overt head movement is blocked, and covert head movement wouldn't have a clear landing site, and would incur several instances of the HMC. Other configura-

tions include those in which a negative operator appears higher than standard sentential negation; in no cases does it affect the availability of wide scope of the modal.

Therefore, an in-situ analysis like the one proposed in Chapter 3 that avoid all these problems is most desirable.

5.4 Conclusion

This chapter has given arguments for an important set of assumptions for the SLI analysis, namely that root modals originate below negation, and cannot undergo any interpretable syntactic movement. In doing so, I have argued against major previous analyses of wide scope necessity modals.

CHAPTER 6

Conclusion and extensions

6.1 Conclusion

I conclude by summarizing the main contributions of this dissertation. In short, this dissertation is an account of neg-raising root modals as triggering scaleless implicatures.

First, it establishes scaleless implicatures as both a prediction of existing theories of scalar implicatures, and as an empirical phenomenon observed in various forms, whose distribution is sensitive to various factors. Scaleless implicatures have been recognized in the literature as a phenomenon only relatively recently, and therefore only observed in a sparse and disconnected way. This is the first study comparing several scaleless implicature phenomena and identifying common characteristics, developing a robust set of tests to run on items suspected to be scaleless implicature triggers.

Second, it claims that the empirical behavior of a scaleless implicature trigger is in direct correlation with the presence or absence of scalemates in the lexicon of the language, thus providing a rich empirical ground to develop the definition of a scalar alternative and contributing to the literature on alternatives.

Third, it contributes to the literature on the interaction of root modals and negation, at the syntax-semantics interface. In particular, it argues that root modals must originate below negation, and cannot undergo interpretable syntactic movement, therefore taking a stance against previous accounts of neg-raising modals as polarity-sensitive items, whose wide scope interpretation depended on syntactic movement past negation.

I detail the main points of each of these contributions below.

6.1.1 Scaleless implicatures

6.1.1.1 Scaleless implicatures as implicatures

This dissertation explicitly unifies scaleless implicatures (SLIs) with other types of implicatures, both theoretically and empirically. Theoretically, SLIs are predicted by grammatical theories of scalar implicatures, namely Fox (2007) and Bar-Lev and Fox (2020). Empirically, they have the same licensing conditions, meaning their obligatoriness depends on the polarity of the environment and the QUD in the discourse.

6.1.1.1.1 Scalar and scaleless implicatures, derived in the same system I summarize the main results here. The difference between a scalar implicature trigger like English *can* and a SLI trigger like Siona *ba'iji* is the alternatives they have.

English *can*, and any scalar implicature trigger, has a scalar alternative.

(529) Alt(can p) = {can p, have to p}

Siona *ba'iji* (an existential quantifier over a modal base W), and any SLI trigger, has subdomain alternatives.

(530) Alt(ba'iji$_W$ p) = {ba'iji$_{W'}$ p|$W' \subseteq W$}

There are some items that have both scalar and subdomain alternatives, and are both scalar and scaleless implicature triggers – these are what I've called optional SLI triggers, which I come back to in section 6.1.1.3.

The results of exhaustification of utterances with scalar and SLI triggers are shown below. Let EXH be the exhaustifier from Fox (2007) applied twice. The results are the same if the exhaustifier from Bar-Lev and Fox (2020) is used instead.

(531) $[\![\text{EXH}_{Alt(\text{can } p)}\ [\text{can } p]\ ]\!] \equiv \Diamond p \wedge \neg\Box p$

(532) $[\![\text{EXH}_{Alt(\text{ba'iji } p)}\ [\text{ba'iji } p]\ ]\!] \equiv \Box p$

6.1.1.1.2 Polarity sensitivity and conditions on EXH application The licensing conditions of scalar and scaleless implicatures are the same. In unembedded and QUD-neutral contexts, the implicature is obligatory. Under clausemate negation, no implicature is computed.

(533) a. 'not can p' $\not\rightsquigarrow$ *it's not the case that you can and don't have to p*

b. $[\![\text{EXH [not can } p]\ ]\!] \equiv \neg\Diamond p$

c. Unavailable parse: [not [EXH [can p]]]

(534) a. 'not ba'iji p' $\not\rightsquigarrow$ *it's not the case that you have to p*

b. $[\![\text{EXH [not ba'iji } p]\ ]\!] \equiv \neg\Diamond p$

c. Unavailable parse: [not [EXH [ba'iji p]]]

Under non-UE operators separated from the implicature trigger by a TP boundary (e.g. conditional antecedents), the implicature is optional.

(535) a. 'If you can go, that means you don't have to.' SI computed

b. 'If you can go, that doesn't mean you don't have to.' SI not computed

c. Available parses: [if [(EXH) [can p]]]

(536) a. 'I don't want to go, but if I ba'iji go, I will.' SLI computed

b. ‘I want to go, so if I ba’iji go, I will.’ SLI not computed

c. Available parses: [if [(EXH) [ba’iji p]]]

The above distribution is captured if we adopt the following conditions on EXH application.

(537) Assumptions on EXH application:

a. EXH must apply when it makes the utterance or the utterance’s alternatives globally stronger relative to the non-exhaustified version

b. EXH can adjoin to any TP, and nowhere else

6.1.1.1.3 QUD sensitivity and conditions on alternative pruning If the QUD is {$\Diamond$,$\neg\Diamond$}, the implicature is not computed (these contexts are those that are not ‘QUD-neutral’).

(538) a. *‘QUD-neutral’ context: A teacher announces daily covid-related rules.*

Teacher: Today, kids are allowed to go to school. SI computed

Kid: Great, I don’t have to go, so I won’t!

b. *Non ‘QUD-neutral’ context.*

A: Are kids are allowed to go to school today?

B: Yes, they are allowed to. SI not computed

Kid: #Great, I don’t have to go, so I won’t!

(539) a. *‘QUD-neutral’ context:*

If you want, you ba’iji cross the river. SLI computed

b. *Non-‘QUD-neutral’ context: A and B want to get to the other side of the river.*

A: Can we cross the river?

B: Yes, we ba’iji cross the river. This is good. SLI not computed

This QUD sensitivity is captured if we adopt the following condition on alternative pruning.

(540) Constraint on pruning:

Prune all members of $A \subseteq Alt(S)$ if the result of exhaustification with $Alt(S) \backslash A$ is equivalent to a possible answer to the QUD.

6.1.1.2 Existential and universal SLI triggers

Just as there are universal items which trigger scalar implicatures when negated, there are universal items which triggers SLIs when negated. The conditions are the same, i.e. a universal item triggers a SLI if it lacks a scalar alternative and has subdomain alternatives.

A neg-raising item can receive one of two analyses, one where it is underlyingly existential, and the other where it is underlyingly universal. I show this below for modals.

(541) Possibility SLI trigger

a. Non-negated: kan $\rightsquigarrow \Box$ (SLI)

b. Negated: $\neg$kan $\equiv \Box\neg$ (no SLI)

(542) Necessity SLI trigger

a. Non-negated: haf to $\equiv \Box$ (no SLI)

b. Negated: $\neg$haf to $\rightsquigarrow \Box\neg$ (SLI)

Existential and universal SLI triggers can be distinguished in other environments, as shown in the table below.

SLI trigger	unembedded QUD-neutral	unembedded QUD = {W,$\neg$W}	under negation	under other non-UE operators	perfective-marked
Possibility	$\Box$	$\Diamond$ (= W)	$\Diamond$	$\Box$ or $\Diamond$	$\Diamond$
Negated necessity	$\Box\neg$	$\neg\Box$ (= W)	$\neg\Box$	$\Box\neg$ or $\neg\Box$	$\neg\Box$

Table 6.1: Distribution of readings of possibility and necessity SLI triggers

6.1.1.3 Obligatory and optional SLI triggers

There are obligatory and optional SLI triggers. These two types of items differ in unembedded and QUD-neutral contexts, where obligatory SLI triggers obligatorily trigger SLIs, and optional SLI triggers license either a SLI or a scalar implicature.

The various ways of pruning alternatives capture the typology, which I summarize in the following table.

		default	scalar alt pruned	all alts pruned
Possibility	obligatory	$\Box$	na	$\Diamond$
	optional	$\Diamond \wedge \neg\Box$	$\Box$	$\Diamond$
licensing QUD		none	$\{\Box, \neg\Box\}$	$\{\Diamond, \neg\Diamond\}$
Necessity	obligatory	$\Box\neg$	na	$\neg\Box$
	optional	$\neg\Box \wedge \Diamond$	$\Box\neg$	$\neg\Box$
licensing QUD		none	$\{\Box\neg, \Diamond\}$	$\{\neg\Box, \Box\}$

Table 6.2: Readings of obligatory and optional SLI triggers in unembedded contexts, according to which alternatives are pruned, and in which licensing conditions

Pruning is always available, as long as the right QUD can be accommodated. Accommodating QUDs from maximally strong readings (of modals, at least) needs less contextual support than from weak readings. This means that the SLI reading of an optional SLI trigger is readily available with no contextual support, while weak readings (without any implicature computed) of any SLI trigger need contextual support.

6.1.1.4 The typology of SLI triggers

In sum, there are two dimensions along which SLI triggers varies: quantificational force and obligatoriness. Each cell of this typology is filled by the various modal items studied in this dissertation.

	obligatory	**optional**
possibility	Siona *ba'iji* Slovenian *moči* French *avoir (à)*$^{\%}$	Swedish *få* obsolete Slovenian *moči*
necessity	French *falloir* Spanish *deber* English *must*$^{\%}$ Ewe *ele be*	French *devoir* Spanish *tener que*, *haber que* Russian *nužno*, *nado*

Table 6.3: Typology of modal SLI triggers according to force and obligatoriness of SLI

6.1.2 The nature of scalar alternatives

6.1.2.1 Lexical scalar alternatives

This dissertation has provided a new type of empirical domain to study the nature scalar alternatives. The single theoretical difference between obligatory and optional SLI triggers is that the former lacks a scalar alternative and the latter has one. With 7 obligatory and 7 optional SLI triggers at hand, I have checked this theoretical claim, and provided a new lexicon-based definition of scalar alternatives in (543).

(543) Lexical scalar alternative (descriptive definition):
an item B can be a scalemate to an item A if A and B are lexical items and if A can be replaced by B in any sentence without affecting its grammaticality (except polarity licensing), contextual felicity, or semantics modulo quantificational force.

This generalization is based on the results from Table 6.4.

6.1.2.2 A hybrid theory of scalar alternatives

Lexical scalar alternatives cannot explain the presence of scalar implicatures in certain cases, in particular with negated English *have to* and Siona *deoji* (a non-SLI triggering possibility modal), which do not have items corresponding to scalemates which have the same syntactic and semantic properties as them. I conclude that lexical scalar alternatives are not the only scalar alternatives

SLI trigger			potential scalemate	SEMANTICS flavors	tense	aspect	SYNTAX pos	as	c-type	other
obligatory			*ba'iji*	∅						
	◊		*moči*	*morati*	=	=	=	=	=	=	infrequent
			·	*treba*	=	=	=	≠	=	=	
			avoir (à)	*devoir*	=	=	=	=	=	≠	
			falloir	*pouvoir*	=	=	=	=	≠	=	
			·	*être possible de*	=	=	=	=	=	=	*ê.p.d.* not in lexicon
			ele be	*ateɲu*	=	≠	=	=	≠	=	
	□		·	*moɖeɖe le be*	=	≠	=	=	=	=	
			deber	*poder*	=	=	≠	=	=	=	
			must	*can*	=	≠	=	=	=	=	
			·	*may*	⊃	=	=	=	=	=	
optional	◊		†*moči*	*morati*	=	=	=	=	=	=	*morati* PPI
			få	*behöva*	⊂	=	=	=	=	=	
	□		*devoir*	*pouvoir*	=	=	=	=	=	=	
			tener que	*poder*	=	=	=	=	=	=	*t.q.* in lexicon
			haber que	*se-poder*	=	=	=	=	=	=	*h.q.* in lexicon
			nado,nužno	*možno*	=	=	=	=	=	=	*možno* PPI

Table 6.4: Comparing properties of SLI triggering modals and their potential scalemates (pos: part of speech; as: argument structure; c-type: complement type)

around. There needs to be a mechanism that allows for scalar alternatives to be derived in a less constrained way.

(544) Clausal scalar alternative (descriptive):

An utterance U containing a quantifier has a clausal scalar alternative U' if U and U' are contextually equivalent modulo force.

These scalar alternatives are only relevant to the computation if no alternative is projected from the lexical item. In other words, if an item has lexical scalar alternatives or subdomain alternatives, EXH will apply, and the relevant implicature will be computed. If EXH has already applied, the meaning is already maximally strong, and clausal scalar alternatives have no effect. As a consequence, only lexical scalar alternatives can be responsible for distinguishing optional and obligatory SLI triggers.

I argue that this picture is suggestive of a theory of grammar in which pragmatic mechanisms are grammaticalized to reduce processing costs, and lexical scalar alternatives can be seen as a grammaticalized approximation of pragmatically derived scalar alternatives.

6.1.2.3 The typology

Utterances with quantifiers are associated with three types of alternatives: subdomain alternatives, which are lexically specified, and lexical and clausal scalar alternatives, which rely on what the language provides.

Having defined these three types of alternatives, we can draw a typology of modal items depending on the type of alternative they project.

	subdomain alts	**no subdomain alts**
lexical Scalar Alts	◇: *få*, †*moči* □: *devoir*, *tener que*, *haber que*, *nužno*, *nado*	◇: *permitted;* □*: required* ◇: *moći*$_{BCS}$; □: *morati*$_{BCS}$
no lexical Scalar Alts	◇: *ba'iji*, *moči*, *avoir (à)*$_1^{\%}$ □: *falloir*, *deber*, *must*$^{\%}$, *ele be*	**clausal Scalar Alt:** ◇: *de'oji*; □: *have to* **no clausal Scalar Alt**: ◇: *o'qa*

Table 6.5: Typology of modals according to type of alternative projected
(modals from Swedish, Slovenian, French, Spanish, Russian, Siona, English, Ewe, Bosn/Croat/Serbian, Nez Perce)

6.1.3 SLIs blocked by actuality entailments

In Chapter 4, I showed that of all the SLI triggers studied in this dissertation, those that can be perfective-marked cannot license a SLI when marked by the perfective. These SLI triggers include obligatory SLI triggering possibility Slovenian *moči*, French *avoir (à)*, obligatory SLI triggering French *falloir*, optional SLI triggering French *devoir*, Spanish *tener que* and *haber que*. This fact provides further support for the unification of these empirical phenomena as underlyingly similar, from a property that is strikingly different from other properties of SLIs (namely polarity and QUD sensitivity).

The blocking of SLIs by actuality entailments can be explained using Fox's (2007) EXH operator (but not Bar-Lev and Fox's (2020)). If the modal licenses an actuality entailment (AE), the innocent excludability status of the alternatives changes. In particular, all alternatives of an AE-licensing modal utterance will license the same AE. This will mean that excluding any alternative with respect to the utterance will yield a contradiction, there the alternatives cannot be excluded, and any instance of exhaustification will be trivial. Therefore, no SLI can be derived.

6.1.4 The modal-negation interaction

In Chapter 5, I argued against alternative syntax-based explanations for the neg-raising behavior of modals.

I first provided empirical and theoretical arguments for the claim that root modals originate below sentential negation in the syntax, a claim which is not so controversial, but has not received much attention either.

I then argued in work with Gary Thoms against the existence of interpretable movement of modals above negation, an account for neg-raising modals which was previously not so much up to debate (and represented most notably in work by Homer (2011, 2015) and Iatridou and Zeijlstra (2013)). We showed that the availability of neg-raising readings does not correlate with a language's clausal structure, nor with variation in the height of the negative operator or the finiteness of the modal verb, all of which would be expected to affect the availability of head movement. Furthermore, movement of modal verbs and auxiliaries rests on theoretically controversial assumptions, namely the existence of interpretable head movement, which goes against the more common observation that movement of heads does not affect interpretation. When one takes into account the whole range of configurations where neg-raising is observed with modals, the theory is further strained by the assumption in some cases *covert* interpretable syntactic movement, and Head Movement Constraint violations, and a movement that differs in its properties from overt head movement and QR.

In this dissertation, this unique claim is retracted, along with its problematic consequences, and one of the central pieces of evidence for interpretable head movement.

Finally, removing movement as part of the explanation for modals' neg-raising behavior, and replacing it with SLI triggering, addresses the asymmetry observed between necessity and possibility modals, in which only necessity modals could take apparent scope above negation.

6.2 Extensions: neg-raising more generally

In this section, I propose that scaleless implicatures can be used to explain neg-raising phenomena more generally, showing where the analysis can be extended, and where it shouldn't.

In 6.2.1, I discuss how certain classical neg-raisings predicates may receive SLI analyses. In particular, a preliminary investigation into the behavior of English *think* suggests it could be analyzed as a universal SLI trigger.

In 6.2.2, I show that there is a subclass of neg-raising modals, namely weak necessity modals, that appear to not fit a SLI pattern, therefore calling for a different analysis of them.

6.2.1 Classical neg-raisers can be SLI triggers

In this section I lay out arguments for English neg-raising *think* to receive an analysis as a universal obligatory SLI trigger. A SLI analysis of *think* is comparable in many ways to the account proposed by Romoli (2013), where neg-raisers trigger scal*ar* implicature analysis for neg-raisers, because they have a non-lexical 'excluded middle' alternative. Romoli's (2013) account better captures the distribution of neg-raising than previous accounts (particularly the presuppositional account; Gajewski (2005, 2007)), but must make the ad hoc stipulation of the existence of an 'excluded middle' alternative. A SLI analysis inherits the benefits of Romoli's (2013) account in maintaining NR as an implicature and explaining the distribution of its licensing, while avoiding the undesirable assumption of the existence of an excluded middle alternative.

There is precedence for classical neg-raisers to receive a SLI analysis: Staniszewski (2019) analyzes English *want* as an existential SLI trigger, by showing that existential readings of *want*

arise in certain downward-entailing contexts. I leave an evaluation of this analysis for further work. However, I support the possibility of giving a heterogenous account of classical neg-raisers: some may be universal SLI triggers, some existential, and some may not be at all (and may receive an analysis of a homogeneous plurality of worlds, as presented in the following section 6.2.2).

6.2.1.1 The universal SLI pattern of English *think*

Attitude predicates are generally treated as universal quantifiers over possible worlds, e.g. doxastically accessible ones for *think*. Furthermore, English *think* is neg-raising, as shown in the basic example below. In other words, in this example, *not think* is equivalent to *think not*.

(545) I don't think it is raining.
$\rightsquigarrow$ *I think it is not raining.*

The basic facts, in which we have an apparent universal quantifier over possible worlds which takes apparent wide scope above negation, is, so far, identical to all the examples of neg-raising modals presented in this dissertation. This similarity therefore calls for checking the SLI pattern established in Chapters 2 and 3.

6.2.1.1.1 Unembedded. The second observation is that *think* is "obligatorily" neg-raising, in the sense proposed in this dissertation. In other words, if there is no contextually supplied QUD of the sort {think p, not think p}, neg-raising must follow.

(546) *Contexts: discourse initial, with no previous mention of the relevant topics.*

a. I don't think it's raining. #I'm just not sure.

b. I just heard that Sue doesn't think John is smart. #She just has no opinion.

c. I don't think God exists. ... #So you're agnostic?

In contrast, we can show that with the appropriate QUD, neg-raising can be suspended. In (547a), the QUD is explicitly stated; in (547b), the prosody indicates an answer to the QUD {think p, not think p}.

(547) a. A: Do you think it's raining?
B: No, I don't think that, I'm not sure.
b. John DOESN't think it's raining, he isn't sure.

Suspension of neg-raising inferences as QUD dependent has previously been observed, namely by Romoli (2013). He cites this as an argument that they are scalar implicatures. This observation runs in parallel with the unembedded weak readings observed with obligatory SLIs.

6.2.1.1.2 Non-upward-entailing contexts. In non-upward-entailing contexts, I argue that preliminary evidence points to an optional neg-raising inference.

For example, under a negative subject, a non-neg-raising reading appears. In fact, it is the most salient reading in this case.

(548) Nobody doesn't think John is smart.

a. Non NR reading.
– Nobody doesn't think John is smart.
– That's not true, I don't even know John.
b. NR reading.
Context: John is sensitive and cries if he finds out someone thinks he's stupid.
– Will John cry?
– No, no-one here has an opinion about John, so nobody doesn't think he's smart.

In a conditional antecedent, a neg-raising reading is optional.

(549) As long as Sue doesn't think John is cheating on her, she's happy.

a. Non NR reading.

... So she prefers to stay ignorant and not to ask about his suspicious behavior.

b. NR reading.

... So she can only relax once she looks into his phone to make sure he is not texting someone.

We can contrast this with unembedded out-of-the-blue contexts, where the neg-raising inference is obligatory.

(550) #Sue doesn't think John is cheating on her. And she prefers to stay ignorant and not to ask about his suspicious behavior.

We can also contrast the conditional antecedent example with non-negated *think*, to check that the 'ignorant' reading is not a property of the behavior *think* itself in conditional antecedents. It is not.

(551) As long as Sue thinks that John is faithful to her, she's happy. #So she prefers to be ignorant and not ask about his suspicious behavior.

We also see that under a non-monotonic operator like 'exactly 2', there are two salient readings.

(552) Exactly two people don't think John is smart.

a. Non NR reading (all but two people think John is smart):

... And that's simply because those two people don't know who John is.

b. NR reading (two people think John is not smart):

... But how could anyone think he's stupid?

6.2.1.1.3 Eventivity blocks the SLI. Neg-raising with *think* has been shown to be blocked in eventive contexts (Prince, 1976; Horn, 1978; Özyıldız, 2021). This can be seen in English with *think* in the progressive, as in (553), or in French with the perfective, as in (554).

(553) Max is not thinking that it's raining.

$\not\rightsquigarrow$ Max is thinking that it's not raining.

In French, the same happens in the perfective aspect.

(554) Max n'a pas pensé qu'il a plu.
Mac neg.have neg think.pf that.it had rain.part
Max didn't think$_{perf}$ that it rained.

$\not\rightsquigarrow$ Max thought it didn't rain.

This patterns is reminiscent of the SLI blocking by perfective aspect observed in Chapter 3. Interestingly, however, the examples above do not license actuality entailments. Nevertheless, it seems like they do license an inference of actuality for a particular event other than the stative modality event. This resembles data with French *avoir (à)*, which does not obligatorily license an entailment of the prejacent's actuality, but does entail a particular event, as discussed in Chapter 4. Therefore, if the analysis is extended to such cases, it can also explain the blocking of *think*'s neg-raising.

6.2.1.1.4 No appropriate scalemate in the lexicon. In English, there is no existential attitude predicate that could act as an appropriate scalemate, which would be neg-raising optional with *think*. A paraphrase of such an attitude predicate would be "allow for the possibility", as Močnik (2019) uses in to translate Slovenian epistemic attitude predicate *dopuščati*. Based on the evidence uncovered in Chapter 3 on what a lexical scalar alternative must be, this periphrastic construction cannot work, because of it lacks the status of a lexical item and is low frequency.

6.2.1.2 Advantages of a SLI analysis for *think*

In this section, I give a non-exhaustive list of desirable predictions made by the SLI analysis.

6.2.1.2.1 Partial cyclicity Certain neg-raisers engage in what has been described as 'cyclic neg-raising', as first noted by Fillmore (1963).

(555) a. I don't think Zoe wants Anna to go.

$\rightsquigarrow$ *I think Zoe wants Anna not to go.*

b. I don't think Zoe thinks it's raining.

$\rightsquigarrow$ *I think Zoe thinks it's not raining.*

This is one argument Fillmore (1963) uses for the syntactic account, since syntactic movement can be cyclic. However, as observed by Horn (1972), not all orders of neg-raisers allow cyclic neg-raising, which is not predicted by the syntactic account.

(556) I don't want Zoe to think Anna will go.

$\not\rightsquigarrow$ *I want Zoe to think Anna will not go.*

This can be checked with a strict NPI like *until Tuesday*, and indeed, Horn says negated *think*>*want* licenses the NPI in the lower clause, but not negated *want*>*think*.

(557) a. I don't think Zoe wants Anna to go until Tuesday.

b. ??I don't want Zoe to think Anna will go until Tuesday.

This partial cyclicity pattern is explained if eventivity blocks SLIs. The complement of *want* has to be eventive, by virtue of its presuppositions: $\text{want}_x(p)$ presupposes $\Diamond_x(\neg p_{t_0})$ and $\Diamond_x(p_{t>t_0})$ (where $\Diamond_x$ is epistemic possibility according to x). This means that p cannot be stative, and any stative description like 'think q' will be coerced into an eventive predicate (e.g. a change of state from not thinking q to thinking q). Therefore no neg-raising with *think* is expected in the complement of *want*. *Think* has no such presuppositions, can embed a stative, and therefore can have cyclic neg-raising in its complement.

6.2.1.2.2 Predictions of behavior in DE contexts In this paragraph, I discuss the predictions of the SLI analysis in downward-entailing contexts, and in particular, contrast them against those made by Romoli (2013), and discussed by him. I do not present Romoli's (2013) scalar implicature analysis of *think* in full, and direct the reader to the paper for details. Instead, I focus on a particular inference that Romoli claims his proposal his system makes in downward-entailing environments such as the restrictor of a universal quantifier. I will argue against the existence of this inference, and present the prediction of the SLI analysis, arguing for its existence.

Below is the inference Romoli's analysis predicts.

(558) Every student who believed that she was accepted came to the party.
$\rightsquigarrow$ *Some student who believed that she wasn't accepted didn't come to the party.*

It is unclear whether this inference arises in the first place. For this reason, Romoli argues for the existence of this inference using a test based on Hurford disjunctions. Hurford disjunctions are known to be infelicitous if one of the disjuncts entais the other. For example, the following disjunction is infelicitous.

(559) a. #I will go to Abidjan or Ivory Coast.
b. #She ate zucchini or vegetables.

However, an embedded exhaustification (in the first disjunct especially) can save Hurford disjunctions. Indeed, a disjunction of a scalar implicature triggers and its stronger scalemate is felicitous, as shown below.

(560) He ate some or all of the vegetables.

Romoli uses this this fact to check whether the implicature in (558) indeed holds. The following disjunction without exhaustification is predicted to be infelicitous according to Hurford's constraint.

(561) Either every student who thinks I am right will support me or every student who has an opinion on the matter will.

If it is judged felicitous, however, it constitutes a test for exhaustification in the first disjunct yielding an inference corresponding to the negation of the second disjunct. Romoli leaves the judgment on (561) open. Its complexity and lack of contextual support make it difficult to process. I will attempt to replicate the construction by removing some of its complexity and adding contextual support. In addition, I argue that we have to be careful about using 'have an opinion on the matter' to represent the excluded middle statement. It is useful as linguistic jargon, but doesn't always translate in the actual usage of the expression. In fact, it is conceivable to have a belief about p without having an opinion about p, as in example (562a) below, in which *think* is uttered in a context in which there is a salient belief to be had, and a separate opinion to be had about the belief. In (562b), the belief is based on opinion itself, and the sentence is bad.

(562) a. Context: Alex heard a rumor that Biden won, but doesn't care about the outcome of the election.
'Alex thinks Biden won, but has no opinion on the matter.'

b. Context: The subject of who won is up to debate.
#'Alex thinks Biden won, but has no opinion on the matter.'

However, there are some prejacents that can unambiguously be treated as opinions, as the following example.

(563) Alex thinks the president is great, #but has no opinion on the matter.

Romoli's example seems to be borderline, as the prejacent 'I am right' could refer to either a factual belief or an opinion. Therefore, depending on what this prejacent refers to, the continuation 'has no opinion on the matter' is felicitous.

(564) Alex thinks I am right, but has no opinion on the matter.

This is a confound that Romoli did not take into account, and might have made his example in (561) sound better for that reason. Therefore, while I will keep using this expression, I will make sure that *think* embeds a proposition that unambiguously refers to an opinion, as in (563). Now, for the target example. With more contextual support, and slightly reduced complexity. This sentence is now pretty clearly infelicitous.[1]

(565) – So many people in your country seem to be emotional these days. Who would you say is feeling most emotional?

– #Well, either everyone who thinks the president is great, or everyone who has an opinion about him.

I therefore conclude that the Hurford disjunction in (561) is infelicitous, and consequently the scalar implicature in the first disjunct predicted by Romoli is absent.

We can contrast the lack of this inference with the inference predicted by a universal SLI trigger in the same environment. Recall from Chapter 2 that in non-negative non-UE environments, a universal SLI trigger will trigger an implicature that its existential counterpart is false (through exclusion of subdomain alternatives in the first round of exhaustification). The following inference is predicted.

(566) Everyone who thinks the world will end is scared.

$\rightsquigarrow$ Not everyone who allows for the possibility the world will end is scared.

[1]Note that this sentence improves adding 'at all'.

(i) – Well, either everyone who thinks the president is great, or everyone who has an opinion about him at all.

However, this NPI seems to rescue Hurford disjunctions in general, crucially including those predicted to be false.

(ii) – Who is happy?

a. – #Either everyone who loves zucchini, or everyone who loves vegetables.
b. – Either everyone who loves zucchini, or everyone who loves vegetables at all.

I show below the derivation that predicts it. Note that the set of subdomain alternatives of a doxastic set of worlds bound by a universal quantifier over individuals holding that state must be defined as a conjunction of claims for every individual in the domain.

(567) a. $S = \forall x.\forall w \in \text{DOX}(x).end(w) \rightarrow scared(x)$

b. $Alt(S) = \{\bigwedge_{x \in D} a_x | a_{x \in D} \in \{\forall w \in W.end(w) \rightarrow scared(x) | W \subseteq \text{DOX}(x)\}\}$

c. Assume $D_e = \{x_1, x_2\}$, $\text{Dox}(x_1) = \{w_1, w_2\}$, $\text{Dox}(x_2) = \{w_3, w_4\}$

$Alt(S) = \{end(w_1) \rightarrow scared(x_1) \wedge end(w_3) \rightarrow scared(x_2),$
$end(w_2) \rightarrow scared(x_1) \wedge end(w_3) \rightarrow scared(x_2),$
$end(w_1) \rightarrow scared(x_1) \wedge end(w_4) \rightarrow scared(x_2),$
$end(w_2) \rightarrow scared(x_1) \wedge end(w_4) \rightarrow scared(x_2)\}$

d. $\text{EXH}\ (S)(Alt(S)) = \forall x.[\forall w \in \text{DOX}(x).end(w)] \rightarrow scared(x)$
$\wedge\neg(end(w_1) \rightarrow scared(x_1) \wedge end(w_3) \rightarrow scared(x_2))$
$\wedge\neg(end(w_2) \rightarrow scared(x_1) \wedge end(w_3) \rightarrow scared(x_2))$
$\wedge\neg(end(w_1) \rightarrow scared(x_1) \wedge end(w_4) \rightarrow scared(x_2))$
$\wedge\neg(end(w_2) \rightarrow scared(x_1) \wedge end(w_4) \rightarrow scared(x_2))$
$\equiv \forall x.\forall w \in \text{DOX}(x).end(w) \rightarrow scared(x)$
$\wedge\neg\forall x.\exists w \in \text{DOX}(x).end(w) \rightarrow scared(x)$

Based on intuition, the inference in (566) seems available. Inspired by Romoli (2013), I will run the same Hurford disjunction test for this inference. First, we have to check that "allow for the possibility" and "think" cannot appear together in a Hurford disjunction, to check that there is indeed an entailment relation between them, and that no exhaustification of the weak reading is possible. This seems to hold (contrast with an equivalent weak reading expressed by embedding *might* under *think* – in this case, it seems like *might* triggers a scalar implicature).

(568) a. #Either you allow for the possibility that the world will end, or you think the world will end.

b. Either you think the world might end, or you think the world will end.

Now we go back to embedding *think* in the restrictor of *everyone*, and embedding it in a disjunction with its existential counterpart *allow for the possibility*.

(569) – Who is scared?
– Either everyone who thinks the world will end, or everyone who allows for that possibility.

This sentence appears to be felicitous; it can only be if there is embedded exhaustification in the first disjunct to license an inference corresponding to the negation of the second disjunct, which breaks the entailment relation between the two, avoiding Hurford's constraint. This provides support for the SLI analysis, contra Romoli's account.

6.2.1.3 Conclusion

To conclude, I have argued for a SLI analysis of English *think*, where *think* is a universal SLI trigger. *Think* matches the distribution of a modal SLI trigger, where neg-raising is QUD and polarity sensitive. This analysis is advantageous in that it captures partial cyclicity, and makes specific predictions that are observed in the data, which Romoli (2013) does not make. Furthermore, it avoids the problem central to Romoli's (2013) account of positing a fully stipulative non-lexical scalar alternative.

6.2.2 Some neg-raisers are not SLI triggers

In this section I look into neg-raising phenomena which, I argue, cannot receive a SLI analysis. In particular, I will show that modals of a particular type, namely weak necessity modals,[2] e.g. English *should*, French *devrait*, have a neg-raising behavior that cannot explained in the same way as the modals studied in Chapter 3. Furthermore, I will argue that definite plurals, which have long been observed to have a neg-raising behavior, cannot receive a SLI analysis either, in line with Križ (2015), and contra Bar-Lev (2020); Magri (2014). Finally, I use a number of

[2]Note that the notion of 'weakness' in the widely used term 'weak necessity modals' should not be confused with the term 'weak' often used in this dissertation to refer to expressions equivalent to existential quantification.

tests characterizing homogeneity-inducing behavior and observe that weak necessity modals and definite plurals pattern in a parallel way. The similarities in behavior suggest a unified analysis of definite plurals and weak necessity modals, which I sketch following Križ's (2015) account of plural predication.

This section therefore offers a glimpse into the broader typology of neg-raisers. Neg-raising operators do not form a homogeneous class, and may fall into one of three types (at least): existential SLI triggers, universal SLI triggers, and non-quantificational definite pluralities.

The content of this section is in large part a result of an ongoing collaboration with Omar Agha, whose previous work (Agha, 2020, 2021) inspired and guided the development of the current proposal.

6.2.2.1 What is a weak necessity modal?

6.2.2.1.1 Linguistically I define a weak necessity modal, in its root sense, as a modal that is used for recommendation or advice, when unembedded. We can show that *should* but not *have to* is compatible with guidelines. This is similar for counterparts in French.

(570) a. This is my recommendation: you should stay at home.
b. ??This is my recommendation: you have to stay at home.

(571) a. Voici ma recommandation: tu devrais rester à la maison.
b. ??Voici ma recommandation: tu dois rester à la maison.

(572) a. According to the new guidelines, clients should wash their hands.
b. ??According to the new guidelines, clients have to wash their hands.

In contrast, *have to* but not *should* is compatible with rules.

(573) a. ??According to the new rules, clients should wash their hands.
b. According to the new rules, clients have to wash their hands.

In the literature (Silk, 2018; Von Fintel and Iatridou, 2008; Horn, 1972 and the many references therein), weak necessity modals have been generally diagnosed with tests juxtaposing them with strong necessity modals. In particular, there are two tests that have been used. I cite the examples used in Von Fintel and Iatridou (2008). The first one has to do with the compatibility of a weak necessity modal with the negation of a strong one. This test is said not to be available with another strong necessity modal.

(574) a. You ought to do the dishes, but you don't have to.

b. ??You must do the dishes, but you don't have to.

The second is the reinforcement of a weak necessity modal with a strong one – said to be available only in the one direction.

(575) a. You ought to wash your hands – in fact, you have to.

b. ??You have to wash your hands – in fact, you ought to.

I will shortly express my skepticism of these tests as diagnosing weakness per se, but rather a difference in flavors (which correlates with a feeling of weakness).

6.2.2.1.2 Typologically Weak necessity can be expressed by dedicated lexical items, such as English *ought*, *should*, Swedish *bör*, Russian *sledovat'* and *stoit*. In many other cases, weak necessity is derived from strong necessity modals and a marking that often is used elsewhere in the language to express some notion of counterfactuality (Von Fintel and Iatridou, 2008). However, because of the difficult of pinning down the meaning of this marking, I will call it 'X'-marking, following von Fintel and Iatridou (2020). For example, weak necessity modals can be formed using French 'conditional' mood on typically strong necessity modals *devoir* and *falloir*.

(576) a. Tu dois y aller.
you must there go
You must go.

b. Tu devrais y aller.
you must.X there go
You should go.

(577) a. Il faut y aller.
it must there go
We must go.

b. Il faudrait y aller.
it must.X there go
We should go.

While this morphological strategy is not available for all modals in one languages, or for all languages, it is very common cross-linguistically, as described in Von Fintel and Iatridou (2008). Ideally, an analysis of weak necessity modals should be able to explain this fact. I will not attempt to do so in this dissertation.

6.2.2.2 Weak necessity modals are not SLI triggers

In this section I show that weak necessity modals do not follow a SLI pattern. I mainly use data from English *should* and French *devrait* (*devoir*+X).

6.2.2.2.1 Weak necessity modals are all obligatorily neg-raising The first observation is that they are obligatorily neg-raising modals. In fact, this seems to be a cross-linguistic fact that has not been explicitly noted in the literature, and holds for all weak necessity modals I have checked, listed here: English *should*, French *falloir/devoir*+X, Spanish *deber/tener que/haber que*+X, Russian *sledovat'/stoit'*, Swedish *bör*, Hungarian *kell*+X, Portuguese *dever/haver de*+X, Italian *occorrerre, bisognare, dovere*+X, Dutch *moeten*+X, Greek *prepi*+X.

I give examples from English and French below, which show that neither a weak necessity modal nor its negation expresses existential quantification.

(578) Context: There are two doors that lead to the next room, but there is no advantage to take one or the other – they are fully equivalent options.

a. English *should*

(i) #You should take the right door to go to the next room.

(ii) #You shouldn't take the right door to go to the next room.

b. French *falloir*+X

(i) #Il faudrait prendre la porte de droite pour aller à la chambre d'à côté.

(ii) #Il ne faudrait pas prendre la porte de droite pour aller à la chambre d'à côté.

c. French *devoir*+X

(i) #Tu devrais prendre la porte de droite pour aller à la chambre d'à côté.

(ii) #Tu ne devrais pas prendre la porte de droite pour aller à la chambre d'à côté.

What is interesting about the fact that all weak necessity modals are neg-raising is that many of them are formed from modals that otherwise have different profiles with respect to negation. For example, French weak necessities *falloir*+X and *devoir*+X are formed from an obligatory necessity trigger on one hand, and an optional one on the other.[3] It is therefore clear that whatever makes these modals weak necessity makes them obligatorily neg-raising.

6.2.2.2.2 No SLI pattern In this section, I argue against the analysis of weak necessity modals as SLI triggers, by showing that they do not pattern in the way expected by SLI triggers.

Testing for possibility SLI triggers Staniszewski (2020) has argued for English *should* as an underlyingly possibility modal. However, it does not seem to pattern like SLIs. I check this below for English *should* and French *devoir*+X. For example in the antecedent of a conditional, a possibility reading is expected to be available. However, it is not.

(579) a. ??If I should go, I will.

b. ??Si je devrais y aller, j'y vais.

$\not\approx$ 'If I can go, I will.'

[3] I have found that for the most part they are formed from SLI triggers, either obligatory and optional. However, in two cases from the list above, they are formed from a non-SLI trigger (i.e. a modal that takes unambiguous narrow scope): Hungarian *kell* and Flemish *moeten* (a dialect of Dutch, which otherwise lexicalized *moeten* as a SLI trigger).

(580) a. Few people should go.

b. Peu de gens devraient y aller.

$\not\approx$ 'Few people can go.'

Similarly, in questions, *should* can never have a possibility reading. To make sure that flavor is not an issue, I check four different root flavors. None of them are compatible with a possibility reading.

(581) a. (ability)

(i) #Should you climb this tree?

(ii) #Est-ce que je devrais monter cet arbre?

$\not\approx$ 'Can you climb this tree?'

b. (pure circumstantial)

(i) #Should these flowers grow here?

(ii) #Est-ce que ces fleurs devraient pousser ici?

$\not\approx$ 'Can these flowers grow here?'

c. (teleological)

(i) #To get to the top of this hill, should one take this path? And this path?

(ii) #Pour arriver en haut de cette colline, on devrait prendre ce chemin? Et ce chemin?

$\not\approx$ 'To get to the top of this hill, can one take this path? And this path?'

d. (deontic)

(i) #Should I have a cookie?

(ii) #Est-ce que je devrais avoir un gâteau?

$\not\approx$ 'Can I have a cookie?'

We can also test the perfective aspect in French, which has been used to diagnose SLI blocking. However, only a weak necessity meaning is available. Note that in addition, there is a anti-AE that arises, that, under the analysis in Chapter 4, should block the SLI just as well.

(582) J'aurais dû y aller. → *I didn't go.*
I.have.X must.pf there go
'I should have gone.'

int. I could.pf go.

We can also use the 'no longer' test used by Staniszewski (2019) for *want*, and show that it does not hold for *should*.

(583) a. #If he wants to stay healthy, John no longer should smoke.

Presupposition: It used to be the case that John should smoke.

b. If he wants to stay healthy, John should no longer smoke.

Presupposition: It used to be the case that John smokes.

In his work arguing for an underlying possibility meaning of *should*, Staniszewski (2020) argues that a possibility meaning is available in questions in particular contexts.

(584) Should we (even) be here?

However, this reading is very limited, and it seems only to be licensed by the presence of an overt or covert *even*. Furthermore, it does not seem to be as readily available in French.

(585) ??Est-ce qu'on devrait (même) être là?

This reading is of course intriguing, and calls for an explanation.[4] However, this very limited availability of a possibility reading does not look like the more general availability of weak readings with SLI triggers in non-upward-entailing contexts. Therefore, I conclude that weak necessity modals, at least English *should* and French *devoir*+X cannot be existential SLI triggers.

[4]The analysis sketched in 6.2.2.5 of weak necessity modals as definite pluralities offers a direction to look at for such an explanation.

Testing for necessity SLI triggers Similarly, we should test for *should* and *devoir*+X as necessity SLI triggers. In antecedents of conditionals and in the scope of 'few', the weak $\neg\Box$ reading is not available.

(586) a. If I shouldn't go, I won't go.

b. Si je ne devrais pas y aller, je ne vais pas y aller.

$\not\approx$ 'If I don't have to go, I won't go.'

(587) a. Few people shouldn't go.

b. Peu de gens ne devraient pas y aller.

$\not\approx$ 'Few people don't have to go.'

We can again check for the effect of French perfective aspect on this modal. This does not recover a weak 'not have to' reading.

(588) Je n'aurais pas dû y aller. $\rightarrow$ *I went.*
I neg.have.X neg must.pf there go
'I shouldn't have gone.'

int. $\approx$ I didn't have to go.

We can also check a specific prediction that is associated with necessity modals that project subdomain alternatives or scalar alternatives (see Chapter 2). In non-UE environments, the subdomain alternatives of *must* are exhaustified to yield the following inference.

(589) Few people must go.

$\rightsquigarrow$ Many people can go.

While the inference holds for *must*, it does not seem to hold for *should*. At least, there is a clear contrast between the two.

(590) Few people should go.

$\not\rightsquigarrow$ Many people can go.

6.2.2.2.3 No obvious correlation with lack of a scalemate Finally, if these modals were indeed SLI triggers, it would have to be as a consequence of the lack of a scalemate. As necessity triggers, they should lack a possibility scalemate. However, it seems like *should* should be able to associate with *could*, and *devoir*+X should have *pouvoir*+X as a scalemate. This should in fact be in principle possible for any optional SLI trigger whose scalemate can also combine with X.

As possibility triggers, they should lack a necessity scalemate. It is unclear whether *should* would have an appropriate necessity scalemate in the lexicon: among auxiliary modals, we have *must*, which is very similar except in the perfect, where *should have* has past temporal perspective, but *must have* doesn't, as noted by Rullmann and Matthewson (2018). In French, *devoir*+X could in principle associate with plain *devoir*. This feels a little strange, and perhaps it is possible that morphologically complex modals simply cannot associate with a scalemate. Therefore, as possibility triggers, there is still typological work to be done to see if they can have necessity scalemates, perhaps especially among lexically encoded weak necessities.

6.2.2.3 Definite plurals

I now turn to another empirical domain that exhibits neg-raising: definite plurals. I give several characteristics of definite plurals, as they have been described in the literature. I then show that, like weak necessity modals, they do not have a SLI pattern.

6.2.2.3.1 The empirical profile of definite plural semantics The meaning of definite plural DPs can be described in basic cases as truth-conditionally equivalent to universal quantification.

(591) I talked with the girls.

$\approx$ *I talked to all of the girls.*

However, when the sentence is negated, the universal quantification is interpreted obligatorily above negation.

(592) I didn't talk with the girls.

≈ *Every girl is such that I didn't talk with her.*

Therefore, definite pluralities of individuals can be described as neg-raising. Besides neg-raising, definite plurals exhibit a number of defining characteristics: trivalent truth conditions, obligatory cyclic neg-raising, and exception tolerance. I show these below.

Trivalent truth conditions Plural predication exhibits a trivalent truth conditions, or a truth value gap. The trivalent truth conditions are seen in example (593); the truth value gap is represented by the indeterminate condition,[5] i.e. where the sentence is neither true nor false.

(593) ⟦I talked with the girls.⟧

True iff I talked with all of the girls.

False iff I talked with none of the girls.

Indeterminate otherwise (e.g. if I talked with some but not all of the girls)

In an indeterminate scenario, the sentence is not felicitous, but neither is its overt denial. In contrast, a 'well' response can be used instead, as in (594c).

(594) Context: Mary talked to only some of the girls.

a. A: #Mary talked to the girls.

b. B: #No / That's not true, only to some.

c. B: Well, only to some.

[5] I adopt Agha's terminology, that differs from Križ's 'undefined' truth value. This is to differentiate this truth value gap from that encoutered in presupposition failures.

The overt denial as in (594b) cannot be used to deny the universal quantification of the definite plural, but can be used to convey the false truth value, i.e. a meaning in which Mary talked to none of the girls (corresponding to the neg-raising meaning).

Obligatory cyclic neg-raising Cyclic neg-raising is obligatory with definite plurals.

(595) I don't think that the boys arrived.

a. $\approx$ *I think that for every boy, he didn't arrive.*

b. $\not\approx$ *I think that not every boy arrived.*

Polarity mismatch configurations The meaning of certain expressions is split between an at-issue and non-at-issue meaning, which differ in their polarity. Definite pluralities display the expected homogeneity effect in these split meaning situations: they are interpreted universally in the positive component of the meaning, and as neg-raising in the negative component. For example, the assertion of *only* corresponds to the negation of the alternatives of the prejacent of *only*, and its presupposition corresponds to the prejacent itself, non-negated.

(596) Only Cath saw the girls.

Presupposition: $\approx$ Cath saw all the girls.

Assertion: $\approx$ Everyone else saw no girls.

Not: Everyone else didn't see all the girls.

Exception tolerance Definite plurals are known to tolerate exceptions. Non-maximal (existential) readings are allowed in particular contexts.

(597) *Context: I feel a gust of cold air.*

a. The windows must be open.

b. Are the windows open?

However, these exceptions are also not easily utterable.

(598) I talked with the girls, ??but {not Mary, not all of them}.

In both utterances (597a) and (597b), 'the windows' can be understood as 'some of the windows', because the context makes it possible for any number of windows to be open to answer the QUD 'Why is it cold?'.

6.2.2.3.2 No SLI pattern with definite plurals Several analyses have been put forward in the literature analyzing definite plurals as underlying existential operators triggering scaleless implicatures, in particular by Magri (2014) and Bar-Lev (2020). However, I will argue that definite plurals are not existential SLI triggers, as they do not match a SLI pattern as established in this dissertation. I will furthermore show that the empirical characteristics of definite plurals cited above are not expected for SLIs, including arguments from Križ (2015).

No weak readings in non-UE contexts. There is no systematic appearance of existential readings in non-UE contexts.

(599) Few people saw the girls.

$\not\approx$ Few people saw some of the girls.

(600) Did you see the girls?

$\not\approx$ Did you see some of the girls?

No trivalent truth conditions for SLI triggers. As argued by Križ (2015), trivalent truth conditions are not predicted with implicatures. We can compare (594b) with a response to a sentence with *some*, known to trigger the scalar implicature *not all*. The felicity of the responses in the case are reversed, where 'no' can felicitously deny the implicature, but 'well' cannot.

(601) Mary talked to some of the girls.

a. No, she talked to all of them.

b. #Well, she talked to all of them.

This difference between implicatures and homogeneity has been observed experimentally by Križ and Chemla (2015). I direct the reader to Križ (2015) for further discussion. Furthermore, this means that scaleless implicatures are fine with denials targetting the universal quantification. And indeed, as I will show in the case studies in Chapter 3, this is the case.

No obligatory cyclic neg-raising for SLI triggers. Cyclic neg-raising is not expected to be obligatory under a SLI analysis. In a cyclic neg-raising context, SLIs optionally strengthen, whereas definite plurals nearly obligatorily strengthen.

6.2.2.4 Weak necessity modals as homogeneity-inducing definite pluralities

In this section, I propose that weak necessity modals show the same properties outline above for definite plurals.

6.2.2.4.1 Obligatory neg-raising First, weak necessity modals are obligatorily neg-raising, as observed in 6.2.2.2.1.

6.2.2.4.2 Trivalent truth values The denial test points to trivalent truth conditions.

(602) Same context.

A: How do I get to the next room?

B: You should take the right door.

C: # –{No, That's not true}, you don't have to, but you can.

C: – Well, you don't have to, but you can.

(602) B: – Il faudrait prendre la porte de droite.

C: #– {Non, C'est pas vrai}, on est pas obligé, mais on peut.

C: – Ben on est pas obligé, mais on peut.

There is no direct counterpart to 'well' in French, as far as I can tell.

We can compare these facts to other necessity modals, and more strikingly, with other neg-raising modals that are not weak necessity modals. Denials targetting universal quantification are no problem.

(603) A: How do I get to the next room?

B: You must take the right door.

C: –{No, That's not true}, you don't have to, but you can.

C: – #Well, you don't have to, but you can.

(604) B: – Il faut prendre la porte de droite.

C: – {Non, C'est pas vrai}, on est pas obligé, mais on peut.

6.2.2.4.3 Obligatory cyclic neg-raising Like definite plurals, weak necessity modals also show obligatory cyclic neg-raising.

(605) #I don't think you should take the right door.

$\approx$ *I think you have to not take the right door.*

$\not\approx$ *I think you don't have to take the right door.*

Again, other neg-raisers don't exhibit the same pattern.

(606) #I don't think you must take the right door.

$\not\approx$ *I think you have to not take the right door.*

$\approx$ *I think you don't have to take the right door.*

6.2.2.4.4 Polarity mismatch configurations Weak necessity modals display homogeneity effects in these split meaning situations: they are interpreted universally in the positive component of the meaning, and as neg-raising in the negative component.

(607) Only Cath should go.

Presupposition: $\approx$ Cath has to go.

Assertion: ≈ Everyone else has to not go.

Not: Everyone else doesn't have to go.

6.2.2.4.5 Exception tolerance Weak necessity modals are known to tolerate exceptions. Consider the following example.

(608) If you want to run the marathon... (Homer, 2015)

a. You should train every day.

b. You have to train every day.

In (608a), exceptions can be tolerated in order to meet the goal, in contrast with (608b). More generally, non-epistemic weak necessity modals are defined as expressions for guidelines and recommendations, which are conceptually exception tolerant, in contrast with rules or laws. This fact might be the reason why weak necessity modals are grammaticalized as plural predicates.

6.2.2.4.6 Addressing a potential concern: inutterability of exceptions A homogeneity analysis of plurals is generally associated with the inutterability of exceptions (at least in basic contexts):

(609) #The girls talked, but not all of them.

At first glance, this seems problematic for the analysis of weak necessity modals as pluralities of worlds, because the prototypical diagnostic test for weak necessity modals involves their compatibility with denials of strong necessity modals.

(610) You should take a shower, but you don't have to.

However, despite the wide use of this diagnostic test in the literature, I do not believe it is appropriate. This is because the flavor of the modals does not stay constant. If the flavor switches between the modals, then the domain of quantification is different, and therefore the denial of one

is compatible with the assertion of the other. We can test this by switching the order of the modals, and using an unambiguously deontic strong necessity modal.

(611) a. We should leave, but we're required to stay.

b. You are required to take your shoes off here, but really you should keep them on.

When attempting to fix a common conversational background to the two modals, the sentence is degraded. A conversational background that could be common to both is the content of someone's (e.g. the speaker's) opinion.[6]

(612) a. ??My opinion is that you should take a shower but you don't have to.

b. ??My opinion is that you don't have to take a shower but you should.

These facts question the semantic weakness of weak necessity modals like 'should' relative to strong necessity modals like 'must'. This means that it seems weak necessity modals do pattern like definite plurals after all on this point. Switching conversational background amounts to switching the domain of individuals that the plurality is formed by. And therefore the felicity of the sentence in (610) cannot be compared with the infelicity of sentence (609), but rather the felicity of sentence (613).

(613) I saw the students, but not the professor.

6.2.2.5 Towards an analysis of weak necessity modals

Observing the similarities between weak necessity modals and definite plurals, I propose that these two types of behavior can receive a similar analysis. In this section, I consider Križ's (2015) anal-

[6]One must still be careful with this way of fixing the conversational background, since one's opinion can incorporate different modal flavors in it: e.g. one can still think that something is required by the law (but not, e.g., morally correct). For this reason, very close examples come out better:

(i) As far as I'm concerned, you don't have to take a shower, but you should.

Other than the speaker's opinion, it is difficult to find a common conversational background to *should* and *have to*. Therefore, finding examples in which *should* and *have to* match in flavor is ultimately difficult.

ysis of definite plurals, which involve homogeneous predication, and sketch a parallel analysis of weak necessity modals as definite pluralities of worlds. A desired consequence of analyzing certain modals as pluralities involving homogeneous predication concerns their neg-raising property. Homogeneity guarantees neg-raising, and therefore constitutes an important alternative analysis to that of scaleless implicatures.

The analysis of a modal as a definite plurality of worlds is novel, but has been pointed to a number of times in the literature. For instance, Klinedinst (2007b,a) proposes that possibility modals should be analyzed as existential distributive pluralities; Rullmann et al. (2008) analyze St'át'imcets variable force modals as specific indefinite pluralities of worlds; similar analyses of variable force modals can be found in Peterson (2010); Bochnak (2015). Another piece of work that involves world pluralities is Schlenker (2004); Agha (2021) for analyzing conditionals as definite descriptions. All these proposals are highly suggestive that some modal items can be analyzed as definite pluralities. After all, if we admit there exists quantification over individuals and worlds, as is widely accepted, and there also exists as a separate phenomenon (in)definite pluralities of individuals, it suggests the existence of (in)definite pluralities of worlds. Therefore, looking for items that would fit such an analysis is worthwhile.

6.2.2.5.1 Analyzing definite plurals (Križ, 2015) There is much work on definite plurals and analyses of the truth value gap that I will not do justice to here. Several authors, namely Fodor (1970); Löbner (1985); Gajewski (2005) have sought to explain the truth value gap associated with definite plurals as an excluded middle presupposition, or 'homogeneity' presupposition, similarly to classical neg-raisers. More recently, some authors have departed from the presuppositional approach, including SLI-based analyses, as mentioned earlier (Magri, 2014; Bar-Lev, 2020), and approaches based on pragmatic processes associated with plural predication, as in Malamud (2012) and Križ (2015). I focus on Križ's (2015) analysis, which is particularly successful in capturing the link between homogeneity and non-maximality. I cite below the homegeneity property shared by any predicate of pluralities.

(614) Generalized homogeneity (Križ, 2015)

No individual in the positive extension of a predicate must overlap with an individual in its negative extension.

If there are three individuals a, b, c, and the predicate is true of $a \oplus b$, it cannot be false of any individual or sum of individuals that overlap with it ($a, b, a \oplus c, b \oplus c, a \oplus b \oplus c$): it is either true or indeterminate of those individuals. If it is false of c, then the expression is indeterminate of $a \oplus b \oplus c$. This scenario can be found in the example below.

(615) Scenario: Only a subgroup of the boys is staging the performance.

a. The boys are(n't) performing Hamlet.

b. Well/ #Yes / #No, some of them are.

Therefore, for a homogeneous predication to be true or false, all the individuals must be found either in the positive extension or the negative extension. This property captures the truth value gap and therefore neg-raising.

Another aspect of Križ's (2015) analysis is the link between this homogeneity property and the exception tolerance observed in definite plurals. This is because sentences with an indeterminate truth value can, in certain contexts, be "true enough". A sentence is judged to be true enough in w as long as the QUD does not distinguish w from the worlds where the sentence is true. Therefore, a homogeneous predication which has an indeterminate truth value can be judged to be true enough, in case it is indistinguishable from the universal reading for the purposes of the discourse. This explains the windows example, replicated below.

(616) *Context: I feel a gust of cold air.*

'The windows must be open.'

In this particular example, the implicit QUD could be paraphrased as 'Why is it colder than expected?'. Under this QUD, having some of the windows open and all of the windows open

answers the QUD just as well, i.e. those two situations are indistinguishable for the purposes of answering the QUD. Therefore, this sentence, which is technically indeterminate, can be judged true (enough) in a scenario where only one window is open.

6.2.2.5.2 Weak necessity modals as pluralities of worlds Since Križ (2015) assumes that homogeneity is true of any plural predication, we can extend the theory to plurality of worlds.[7]

Instead of what is standardly assumed for weak necessity modals, *should* is not a universal quantifier, but a definite plurality of worlds. And instead of selecting a proposition as its argument, it itself saturates the world argument of the proposition. Assuming an appropriate modal base R_{w_0} given by the accessibility relation R from a world of evaluation w_0, we can define a predicate of worlds $\lambda w.R_{w_0}(w)$ that is true of all the worlds accessible from w_0. We can then appeal to the pluralization operator * (Link 1983), in which $\lambda w.R^*_{w_0}(w)$ is now a predicate of a plurality of worlds. Finally, the summation operator σ applies to yield the maximal plurality of worlds satisfying the predicate $\lambda w.R^*_{w_0}(w)$, which I propose is the meaning of a weak necessity modal.

(617) $\llbracket \text{should} \rrbracket^{w_0} = \sigma w.R^*_{w_0}(w)$

Then, a sentence of the form 'should p' is formed by predicating the definite plurality *should* of the proposition $\lambda w.p(w)$.

(618) $\llbracket \text{should p} \rrbracket^{w_0} = p^*(\sigma w.R^*_{w_0}(w))$

This analysis captures the obligatory cyclic neg-raising pattern of weak necessity modals, since neg-raising is a property of homogeneous predication itself, and not from an external operation such as exhaustification.

6.2.2.5.3 A few concerns With a definite plural analysis of weak necessity modals, we could be tempted to say that the source of the weak feeling relative to strong necessity modals comes

[7]This proposal is reminiscent of the one offered in Križ (2015) on classical neg-raising predicates like *believe*, as definite pluralities of worlds (which I do not adopt, based on the observations made in section 6.2.1.1).

from exception tolerance, just as 'the girls' feels weaker than 'all the girls' for that very reason. However, 'the girls' can naturally be used to describe 'all the girls', but it is unclear whether *should* can be used to denote strong necessity.

(619) a. ??One should not kill.

b. ??In order to survive, humans should drink water.

Moreover, as mentioned earlier, weak necessity appears correlates with a particular flavor of the modal. One could argue that weak necessity modals are grammaticalized as definite plurals for the very reason that they can tolerate exceptions. And therefore the particular flavor of the modal could be the source of the unavailable of strong necessity readings. Another possibility is that there is a pragmatic competition between the weak necessity modal and strong ones available in the lexicon, blocking weak necessity modals from arising in strong necessity situations. The same competition would not be available for definite plurals for complexity reasons: 'all the girls' is more complex than 'the girls', and therefore cannot act as a competitor to it.

Another concern is the cross-linguistic generalization established in Von Fintel and Iatridou 2008, in which weak necessity modals are very often derived from strong necessity modals and X-marking. We could say that the plural semantics comes from the X marking, but how to derive a plurality of worlds from a quantifier is unclear. Moreover, it must generalize to other uses of X marking, found in subjunctive conditionals, on desire predicates, and possibility modals.

6.2.2.6 Conclusion

In conclusion to this section, it appears that weak necessity modals do not pattern like SLIs, and therefore should not receive the same analysis as the items seen in Chapter 2. Similarly, definite plurals do not pattern like SLIs, but seem to exhibit a pattern close to that of weak necessity modals.

This means that there should exist another mechanism for neg-raising in language, that could explain the behavior of both definite plurals and weak necessity modals. One direction is to adopt the analysis of definite pluralities proposed by Križ (2015), that can naturally be extended

to different domains. This analysis can capture obligatory cyclic neg-raising, trivalent truth values and exception tolerance observed for both definite plural individuals and weak necessity modals.

In table 6.6, I summarize the ways we can distinguish three types of neg-raising operators I propose exist in language.

	scaleless $\exists$	scaleless $\forall$	plurality
unembedded	$\forall$	$\forall$	$\forall$
clausemate negation	$\neg\exists$	$\forall\neg$	$\forall\neg$
O^* [ ]	$O^*(\exists)/O^*(\forall)$	$O^*(\forall)$	$O^*(\forall)$[+EM presupp]
$O^*\neg$[ ]	$O^*(\neg\exists)$	$O^*(\neg\forall)/O^*(\forall\neg)$	$O^*(\forall\neg)$[+EM presupp]
extra-clausal negation	$\neg\forall/\forall\neg$	$\neg\forall$	$\forall\neg$
NR in polarity split	no	no	yes
truth value gap	no	no	yes
denials	$\neg\forall$	$\neg\forall$	$\forall\neg$
exception tolerance	no	no	yes

O^* is a non-UE operator separated from the item by a TP boundary.

Table 6.6: Three types of neg-raisers

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