A QUANTIFIER-BASED APPROACH TO NPI-LICENSING TYPOLOGY:
EMPIRICAL AND COMPUTATIONAL INVESTIGATIONS

by

Mai Ha Vu

A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Linguistics

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Mai Ha Vu

Approved: ______________________________

Benjamin Bruening, Ph.D.
Chair of the Department of Linguistics and Cognitive Science

Approved: ______________________________

John Pelesko, Ph.D.
Dean of the College of Arts and Sciences

Approved: ______________________________

Douglas J. Doren, Ph.D.
Interim Vice Provost for Graduate and Professional Education and
Dean of the Graduate College

I certify that I have read this dissertation and that in my opinion it meets the academic and professional standard required by the University as a dissertation for the degree of Doctor of Philosophy.

Signed: ______________________________

Benjamin Bruening, Ph.D.
Professor in charge of dissertation

I certify that I have read this dissertation and that in my opinion it meets the academic and professional standard required by the University as a dissertation for the degree of Doctor of Philosophy.

Signed: ______________________________

Jeffrey Heinz, Ph.D.
Member of dissertation committee

I certify that I have read this dissertation and that in my opinion it meets the academic and professional standard required by the University as a dissertation for the degree of Doctor of Philosophy.

Signed: ______________________________

Satoshi Tomioka, Ph.D.
Member of dissertation committee

I certify that I have read this dissertation and that in my opinion it meets the academic and professional standard required by the University as a dissertation for the degree of Doctor of Philosophy.

Signed: ______________________________

Thomas Graf, Ph.D.
Member of dissertation committee

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ABSTRACT

This thesis examines the quantifier-based approach to NPI-licensing (as proposed in (Giannakidou, 2000)) from empirical and computational perspectives. This approach argues that all NPIs can be categorized as either existentially or universally quantified items, and that this difference drives cross-linguistically divergent NPI-behaviors. After providing the necessary background and assumptions, in the first half of the thesis I show that English *any*-NPIs are existentially quantified, whereas Hungarian *se*-NPIs are universally quantified. I also demonstrate how this approach can help understand the behavior of NPIs in other languages and language families such as Slavic, Mandarin Chinese, Turkish, and Romance languages. In the second half of the thesis, I analyze the quantifier-based NPI-licensing constraints for computational complexity. I find that except for the constraints that rely on derived c-command, all other constraints can be described with Input-local Tier-based Strictly Local (I-TSL) or Multiple Input-local Tier-based Strictly Local (MITSL) restrictions, which means that tree-languages that satisfy NPI-licensing constraints for the most part fit into a fairly restrictive subregular class of tree-languages. Taken together, this thesis argues that a theoretically informed approach to linguistic phenomena can significantly affect results on their computational complexity.

Chapter 1

INTRODUCTION

This thesis investigates Negative Polarity Item (NPI)-typology, from both empirical and computational perspectives. NPIs are subject to much theoretical interest because of their prevalence in natural language, despite functionally being superfluous (Hoeksema, 2000). They do not exist in artificial languages, for instance programming languages, as their meaning can be expressed by an existential quantifier or adverb that scopes below negation. For example, the meaning of 'anything' and 'yet' can be equally expressed with 'something' and 'already' by explicitly scoping them under negation:

(1) Anything

a. John doesn't see anything.

b. It is not the case that John saw something.

(2) Yet

a. John hasn't eaten breakfast yet.

b. It is not the case that John has already eaten breakfast.

Not only do NPIs exist, to my knowledge in every language, they also display cross-linguistic variation in their syntactic and semantic behaviors. They are thus a core feature of natural language, and should have a prominent place in any comprehensive account of language.

In this thesis I focus on one particular theory of NPI-licensing typology, which I call a quantifier-based approach, first fully described in Giannakidou (2000). In a nutshell, this theory proposes that NPIs diverge in behavior typologically because they can be either universally quantified or existentially quantified. There are two main questions that I address regarding this approach:

1. How well does the quantifier-based approach explain cross-linguistic differences in NPI-behavior?
2. What is the computational complexity of the quantifier-based approach?

To address the first question, I survey NPI-behavior in English and Hungarian in-depth. I present and reanalyze data from the literature, as well as introduce novel data collected from native speakers. As a result, I show that English *any*-pronouns are a prototypical example of existentially quantified NPIs, and that Hungarian *se*-pronouns are universally quantified NPIs. Through a series of syntactic and semantic tests, I show that NPIs in the two languages systematically differ in a way that is predictable from the quantifier-based approach. I also present data collected from both published sources and language informants of other languages and language families, such as Slavic, Mandarin Chinese, Turkish, and Romance languages. I show that the quantifier-based framework is applicable to NPI-behavior in these languages as well.

The second question ties into the overarching pursuit of the computational complexity of natural language, and particularly, the complexity of syntactic structures. We know that the *string* yield of syntactic structures fit in a fairly complex class, Mildly Context Sensitive languages (Joshi, 1985). However, more recent advances in the study of syntactic *trees* have found that depending on the proposed tree structure, many syntactic dependencies can be described with *subregular* constraints, which would place them in a very restrictive class of languages (Graf and Heinz, 2015; Graf, 2018; Graf et al., 2018; Vu et al., 2019). In particular, Graf and Heinz (2015) have shown that well-formed `Merge` and `Move` operations can be described with Input-local Tier-based Strictly Local (I-TSL) constraints on MGs derivation trees. Vu et al. (2019) examine c-command relations as they apply to case licensing, and find that they too can be described with I-TSL constraints. In other words, syntactic patterns can be described with similar computationally restrictive tools to the ones that were used for phonology if we represent syntactic data on trees rather than on strings. In fact, the

Strong Cognitive Parallelism Hypothesis proposed by Graf et al. (2018) states that phonology, morphology, and syntax all have the same subregular complexity over their respective structural representations.

The class of Tier-based Strictly Local (TSL) languages and its extensions, I-TSL and MITSL, have been argued to be this subregular class (Graf and Heinz, 2015; Graf et al., 2018). This is because in these classes, we can use projection functions that select only the relevant nodes to turn long-distance dependencies into local ones. Then for example NPI-licensing in English, which is typically described as a c-command restriction without any locality constraints, becomes a local constraint with the help of the appropriate projection function. By being able to describe long-distance dependencies as local, we have further restricted the computational power required to generate, process, and learn well-formed natural language patterns.

In this thesis, I add several results to the computational study of syntax. For one, I use a derivation tree model that allows clustering, which is a special kind of movement, and I also differentiate between LF and PF operations. I show that even with these additions, the well-formed derivation remain MSO-definable, and thus are regular tree languages. Second, I provide a formal definition for the class of I-TSL tree languages, as the only formal definition for this class has been previously done for string-languages only in De Santo and Graf (2019). Third, I demonstrate that quantifier-based NPI-licensing constraints are also MSO-definable, and thus regular-tree languages can satisfy NPI-licensing. Finally, I show that most of these constraints are also subregular; with the exception of derived c-command (where c-command relations depend on movement), all other constraints could be described with I-TSL or MITSL constraints. These results thus mostly confirm the hypothesis that syntactic constraints are MITSL, however, it also points out that mixing two types of long-distance dependencies, movement and c-command in this case, that can feed or bleed one another is not MITSL.

An important take-away of these results is the insight that the particular theory we adopt significantly affects the computational results. The constraint for universally quantified NPIs could be stated in two ways: either as a c-command requirement, where the NPI has to c-command negation, or a `Move` requirement, where the NPI always has to move to NegP to take scope over negation at LF. These two are not empirically or computationally equivalent. Empirically, I find evidence for the movement based account, and computationally I find that while the c-command requirement is not I-TSL or even MITSL, the movement requirement is MITSL. Taken together, assuming that all universally quantified NPIs move at LF helped *reduce* the complexity of the NPI-licensing requirements for these types of NPIs. This thesis thus argues that empirically-based theoretical analysis should serve as a strong foundation for the computational study of linguistic phenomena.

The thesis is organized in three parts. In Part I, I establish the fundamental assumptions I make throughout this thesis. In Chapter 2 I introduce the syntactic model I use, Minimalist Grammars (MGs) derivation trees and my assumptions for quantifier scope interpretation on the syntax-semantics interface. In Chapter 3, I introduce the object of study, NPIs, and describe the quantifier-based approach to NPI-typology.

In Part II, I provide empirical tests that show the validity of the quantifier-based approach. For the most part, I show English and Hungarian data and argue that English *any*-NPIs are best understood as existentially quantified, while Hungarian *se*-NPIs are most likely universally quantified. I do this in two chapters, where Chapter 4 lists evidence regarding syntactic behavior, and Chapter 5 shows semantic data in support of the theory. Then in Chapter 6 I examine how this approach works for other typologically distinct languages and language families, such as Slavic, Mandarin Chinese, Turkish, and Romance languages.

In Part III I examine the quantifier-based approach with mathematical tools, particularly by using a model-theoretic approach. In Chapter 7 I formally define the tree-models used in the thesis, and also show that the quantifier-based NPI-licensing constraints can be stated with MSO-constraints. Then in Chapter 8, I formally define the class of I-TSL tree languages, and show that for the most part tree-languages of this complexity can satisfy quantifier-based NPI-constraints.

Finally, I summarize the findings and conclude in Chapter 9.

Part I

FOUNDATIONS

Chapter 2

THE SYNTACTIC MODEL

In this chapter, I lay out the details of the syntactic model that I adopt for the thesis. In particular, I describe two things: 1) Minimalist Grammars MGs as a formal framework of syntax, and 2) the theory I adopt for computing quantifier scope on the syntax-semantics interface.

At this point, I give an informal introduction to MGs, which is a formalization of the Minimalist framework. I also expand it in certain aspects, which will aid me in discussing NPI-licensing later. I provide a formal definition for it in Chapter 7.

As for quantifier scope, the notion of semantic scope is central to my proposal of NPI-licensing. Consequently, it is important to state the assumptions that I adopt about the mechanism of scope in the syntax.

2.1 Minimalist Grammars: an informal description

The approach I take is a Chomskian generative one, in particular, I adopt the Minimalist framework (Chomsky, 1993). A rigorous formalization of this framework are Minimalist Grammars MGs (Stabler, 1997). Rigorous formalizations are useful, because they makes it possible to give a precise computational analysis and mathematical proof concerning syntactic phenomena by explicitly spelling out the necessary theoretical machinery. In what follows, I describe the components of MGs informally, and defer the more formal definitions to Chapter 7.

The basic building blocks in MGs, similarly to Minimalism, are Lexical Items LIs. LIs have two parts to them: a phonological form, which is the pronunciation of the given LI, and a list of ordered features (see examples in Table 2.2). The features indicate the type of operations each particular LI participates in. The two basic operations in MGs, just like in Minimalism, are `Merge` and `Move`. While `Move` can have many different subtypes, such as raising, lowering, and side-ward movement among others (Graf, 2012a), for the purposes of the current discussion I will assume that `Move` corresponds to phrasal raising, where an LI (or the phrase headed by the LI) raises to the specifier of the head that has attracted the movement. In other words, all instances of `Move` here are Ā-movement or A-movement; for discussions of head-movement in MGs, see Kobele (2006).

Features drive operations in the following way. Each feature has three variables: the name of the feature, the operation the feature calls for (`Merge` or `Move`), and the polarity of the feature (+ or -). Positive features correspond to selectors in the case of the `Merge` operation, and movement licensors in the case of `Move`. Negative features correspond to category features in case of `Merge`, and movement licensees in the case of `Move`. Table 2.1 gives a summary of the feature system, complete with shorthands for each type of feature.

type of feature	shorthand	name	operation	polarity
category	f	f	`Merge`	−
selector	=f	f	`Merge`	+
movement licensee	−f	f	`Move`	−
movement licensor	+f	f	`Move`	+

Table 2.1: Basic feature calculus of MGs

Two LIs can undergo the `Merge` operation if their first features match each other: they have the same name, opposite polarity, and both call for the `Merge` operation. Matching two LIs this way results in their first features canceling out each other, and now their next feature is going to be active for calling an operation. The head of the newly created tree would be the LI that had the selector feature on it. Figure 2.1 demonstrates how this operation works on the LIs ‘the’ and ‘car’; here *the* becomes the head of the new tree.[1]

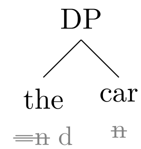
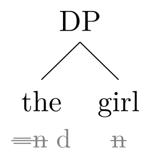
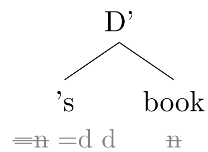


Figure 2.1: Merging *the* and *car*

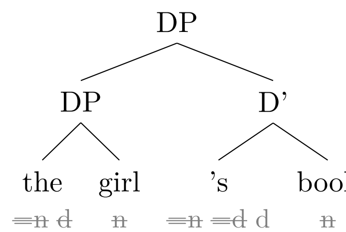
Two trees can also undergo `Merge`, if their heads match. An example of such a case would be a possessive construction, where the full DP can merge with the possessive marker *'s* D head. Figure 2.2 illustrates the steps of such a derivation.



(a) Merging of *the* and *girl*



(b) Merging of *'s* and *book*



(c) Merging *the girl* and *'s book*

Figure 2.2: Deriving the possessive construction

The `Move` operation works similarly to `Merge`, with the difference that one of the LIs comes from the existing derivation rather than from the outside pool of LIs.[2]

Now consider the following toy example, a simplified syntactic derivation of sentence (1). In this example, I assume that the subject is generated within the VP,

---

1 In this thesis, I implicitly adopt the DP-hypothesis for how phrases involving nouns are built. However, nothing important hinges on this; everything I describe here could work with NPs instead of DPs.

2 Hence the alternative name for `Move` being Internal Merge.

and moves to the specifier of TP, motivated by the +nom feature.[3] To derive this sentence, I assume that the grammar consists of the LIs listed in Table 2.2. On the left of :: is the phonological form of the given LI, and on the right is the list of ordered features it has. The phonological form indicated with ε is an empty string. In this particular case, it is an empty string, whose category is t(ense).

(1) Mary likes the car.

the :: =n d	Mary :: d −nom
car :: n	ε:: =v +nom t
likes :: =d =d v	

Table 2.2: Lexical Items to derive (1)

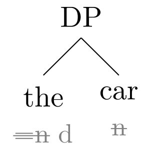
Figure 2.3 shows the steps to derive (1).

Movement, like `Merge` can also affect trees rather than just LIs. For example, a whole phrase can be moved, if the head of the phrase has a movement licensee. In the example in (2), the phrase *which student* is moved multiple times, because the head *which* has two movement licensee features on it. To derive the tree, I assume the following additional LIs to the ones listed in Table 2.2: which :: =n d −nom −wh, student :: n, and ε :: =t +wh c. Figure 2.4 shows the derived tree for (2). To keep the derivation simple, I omit modeling head movement on the tree.

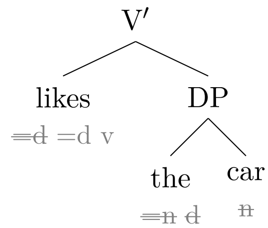
(2) Which student likes the car?

The advantage of a fully ordered feature string is that the derivation is entirely deterministic; there is never a question about which operation to execute next. The only case where the derivation would not be fully deterministic despite the strictly ordered features is when there is more than one LI in the tree that have the same active `Move` licensee feature. A linguistic example of such a case would be multiple wh movement, where two or more LIs would have their −wh features active at the same

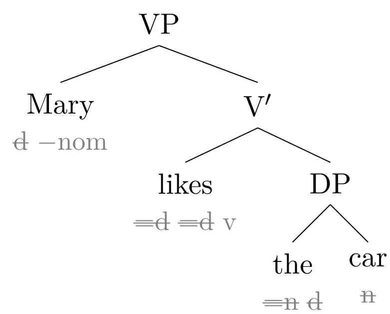
[3] Throughout this section, I omit vPs, but will add them in later discussions.



(a) The determiner *the* merges with the noun *car* by selecting for the n feature



(b) The V merges with the DP *the car* by selecting for the d feature

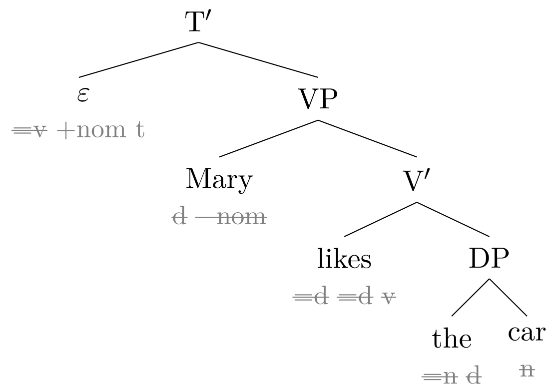


(c) The V merges with the DP *Mary* by selecting for the d feature

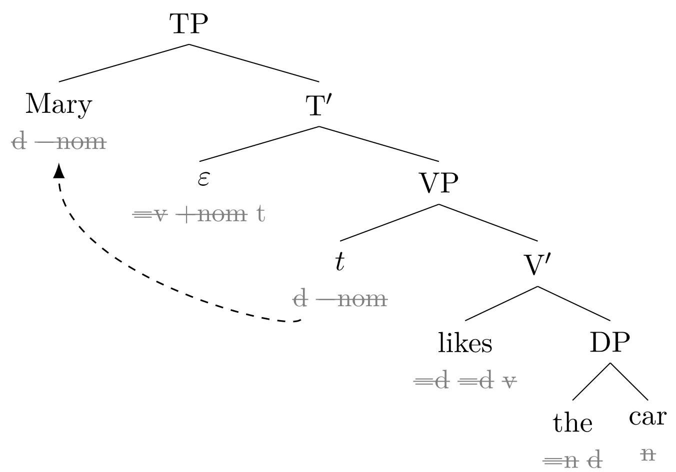
time. To avoid ambiguous cases like this, Stabler (1997) simply bans all configurations where two or more LIs have the same licensee feature active. He names this constraint Shortest Move Constraint (SMC).[4] I describe a potential treatment of multiple wh-movement that circumvents the SMC in the next section.

So far I have shown examples of how MGs work using derived trees as the data structure, which is traditional for theoretical syntax; they show the end result of a series of derivation. For the computational analysis of this thesis, I will use an alternative data structure, called *derivation trees*. Derivation trees, simply put, show the process of the derivation, instead of the output of it. This means, for example, that instead of labeling the outcome of a `Merge` operation with a category (e.g. DP, V′, VP), we now label it with the operation itself, `Merge`. The operation `Move` is indicated by

[4] This is not to be confused with the constraint of the same name in the syntactic literature, which stipulates that whichever LI is closer moves.



(d) The T head merges with VP by selecting for the v feature



(e) The T head attracts *Mary* through the nom feature

Figure 2.3: Step-by-step derivation of (1)

labeling the tree as such where movement is triggered by a `Move` licensor; the identity of the moving element can be deduced from the particular `Move` feature, as the moving element must have a licensee feature that matches. Figure 2.5 shows the derivation tree corresponding to sentence (1). For easier reading, I indicate the correspondence between the moving element and the `Move` node with a dotted line – note that this line is not part of the derivation tree.

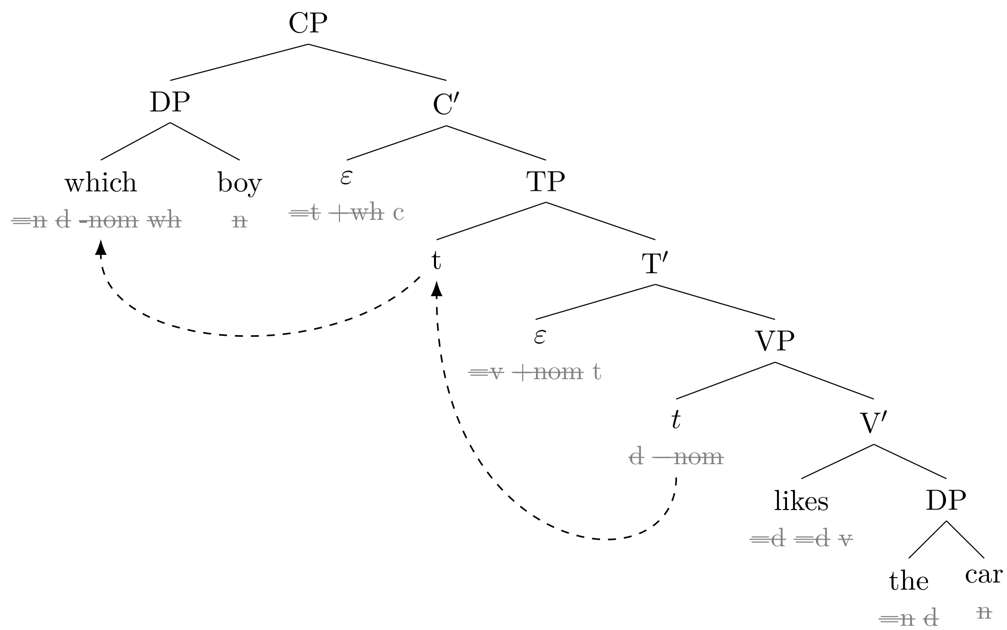


Figure 2.4: Derived tree of (2)

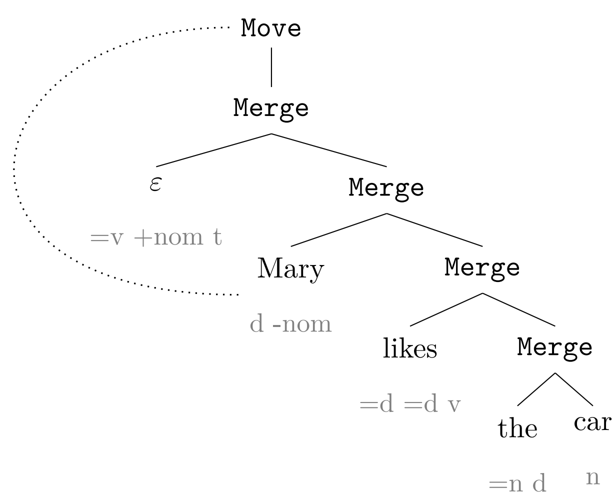


Figure 2.5: Derivation tree of (1)

The reason to use derivation trees is that they do not introduce significantly new data structure that differ from trees that are commonly used in Minimalism. They are essentially Bare Phrase Structure trees, as described in Chomsky (1995). Similarly to bare phrase structure trees, derivation trees build the structure from the bottom up, have unlabeled interior nodes, and are unordered. Furthermore, derivation trees can be easily converted to derived phrase structure trees (Graf, 2013).

Computationally, we can model this idea by defining various syntactic rules with a derivation tree, and then define various transductions that map the derivation to the desired PF or LF output. This two-step computational approach to syntax is taken in Morawietz (2003). The advantage of separating different components this way is that each part is fairly simple computationally. Derived phrase-structure trees that can model complex syntactic phenomena, such as Swiss-German cross-dependency, necessarily have to belong to a class more computationally complex than regular tree languages, a fairly restrictive class (Thatcher, 1973; Joshi, 1985). On the other hand, derivation trees that can be mapped to an identically complex syntactic string, are still only regular (Michaelis, 2001; Kobele, 2006). The mapping from derivation trees to derived trees is only a regular function (Graf, 2012a). Thus describing constraints on derivation trees can help us push down the necessary computational power required for syntactic derivations, without any loss of information. In fact, the most recent results suggest that well-formed derivation trees can be defined with *subregular* constraints (Graf and Heinz, 2015; Graf et al., 2018), which are less complex than regular constraints. I will expand on these findings further in the computational results of this thesis, in Chapters 7 and 8.

In this section, I have described the basics of MGs. Next, I add two things to the current model. One is a different type of movement operation, `Cluster`, which was formalized by Gärtner and Michaelis (2010) to deal with multiple wh-movement in MGs. The second thing I add is the concept of covert and overt movement, first mentioned in Stabler (1997). My addition is to propose explicit labeling of the derivation tree to indicate whether an operation is covert or overt in nature. Graf (2012a) shows that adding new types of movements still keeps derivation trees regular, and 'translating' derivation trees into derived trees can still be done with Monadic Second Order (MSO)-level logic, which is fairly restrictive. The only way my model veers from what is described in Graf (2012a) is that I explicitly label the trees based on movement types, rather than just implying them via the type of different features that are involved in triggering them. In the following section, I explain these additions in detail.

2.1.1 Additions to MGs

As previously described, I am adding two things to the MGs model: a new type of movement operation called `Cluster` and the concept of covert and overt movement and clustering. I first discuss covert and overt movement, then I move on to clustering. The discussion will result in a new expanded feature calculus depicted in Table 2.4, and illustrations of each new type of movement follow in Figure 2.8-2.12.

Distinguishing overt and covert movement is necessitated by the concepts of Phonological Form (PF) and Logical Form (LF) in generative linguistics. Previously, I have left the nature of derived trees vague. Normally, derived trees correspond to the notion of PF: their string yield is directly observable from data.[5] However, at least since May (1977), LF has been studied and generally accepted to exist as the structure corresponding to *semantic interpretation*. Evidence for LF comes, for example, from observed mismatches between the surface position and interpretation site of quantifiers. Thus, there are actually two different possible surface trees: a PF tree and an LF tree. The additional types of operations to MGs make it possible to define functions that would 'translate' a derivation tree to a corresponding PF derived tree and a corresponding LF derived tree, where the two trees do not necessarily look the same.

Accordingly, `Move` can come in three flavors: `Move`, `P(honological)-move`, and `S(emantic)-move`.[6] `P-move` results in movement in the PF-tree only, but not the LF-tree. Note that `P-move` essentially corresponds to *reconstruction* in the linguistic literature: the reconstructed phrase is pronounced high, but interpreted low (Figure 2.6).

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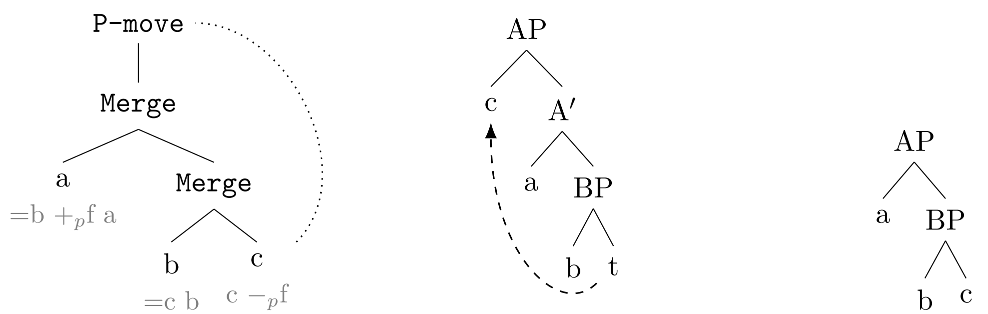
[5] This is a simplified version of PF-trees, and does not take into account prosodic and phonological hierarchies that are usually considered to be part of PF.

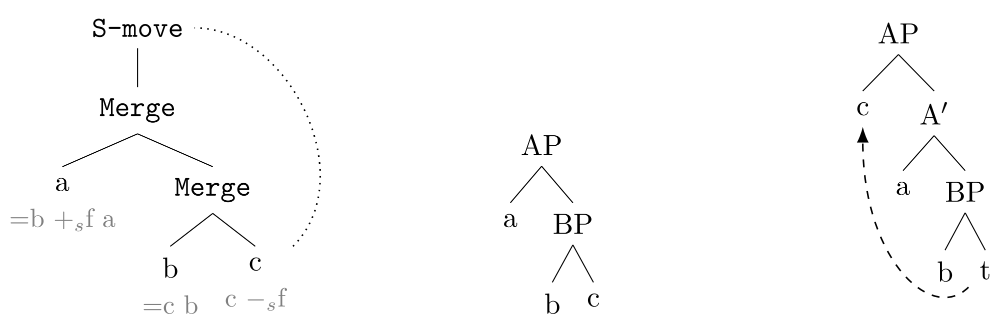
[6] It is possible that there is a fourth type, where `Move` is neither semantic nor phonological. This would be equivalent to formal feature checking in Minimalism. It will not



(a) Derivation tree (b) PF tree (c) LF tree

Figure 2.6: Derivation tree and derived PF and LF trees for `P-move`

`S-move` is the opposite of `P-move`: it translates to movement in the LF-tree, but not the PF-tree. `S-move` then corresponds to covert movement, such as Quantifier Raising or covert wh-movement (Figure 2.7).



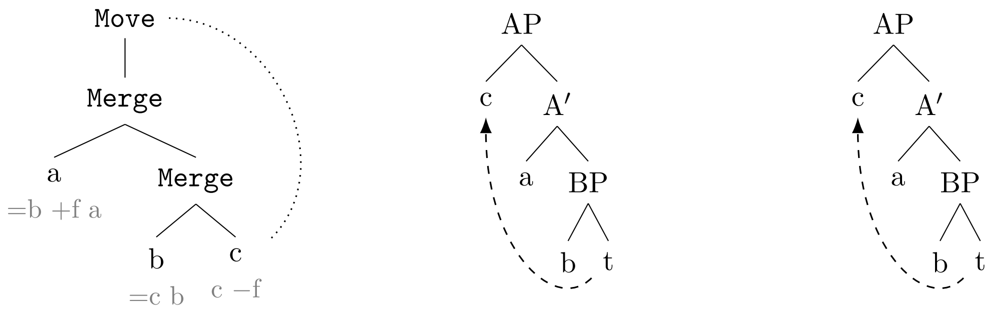
(a) Derivation tree (b) PF tree (c) LF tree

Figure 2.7: Derivation tree and derived PF and LF trees for `S-move`

Finally, `Move` translates to movement at both PF and LF – this is what most types of linguistic movements correspond to (Figure 2.8).

The second addition to MGs is clustering, which is a new type of operation. Gärtner and Michaelis (2010) were the first to implement it in the MGs framework to account for multiple wh-movement, based on the Cluster-hypothesis discussed in Sabel (2001); Grewendorf (2001). Multiple wh-movements are problematic for MGs for two reasons. One is that multiple wh-movement requires that multiple −wh licensee features are active at the same time. This is especially obvious in the case of languages

be used in the current discussion.



(a) Derivation tree (b) PF tree (c) LF tree

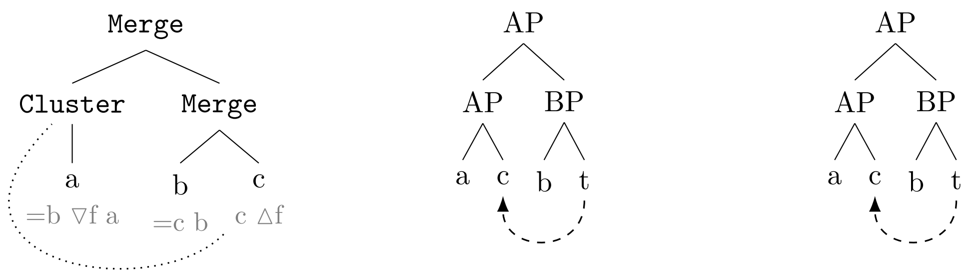
Figure 2.8: Derivation tree and derived PF and LF trees for `Move`

that allow multiple wh-fronting. The presumption there is that each wh-item moves to the specifier of CP to check its − licensee feature. In MGs, such configurations violate the Shortest Move Constraint (SMC), and render the derivation non-deterministic.

Second, in MGs each movement licensor feature can only be checked once – but in the case of multiple wh-movement, there has to be multiple, unknown number of movement licensors on the C^0 which triggers movement. This would result in multiple different LIs that are all C^0 that only differ from each other in terms of the number of wh-movement licensors they have – a rather inelegant solution that would miss a lot of the generalization about wh-movement licensing C^0.

In order to circumvent having to break the SMC or having multiple C^0 of that sort, Gärtner and Michaelis (2010) implement clustering. Clustering lets multiple wh-words adjoin to each other and form a complex phrase, and then it is enough if only the last wh-word checks the +wh feature on C. Clustering is triggered by a new type of feature-pair, a cluster licensee (△f) and cluster licensor (▽f). Figure 2.9 shows an example of clustering on a derivation tree and how that would translate to a PF- and LF-tree.

To give a real linguistic example of clustering, take multiple wh-fronting in Hungarian (3). To derive this sentence through clustering, I assume the LI entries listed in Table 2.3. Figure 2.10 shows the derivation tree of (3).



(a) Derivation tree (b) PF tree (c) LF tree

Figure 2.9: Derivation tree and derived PF and LF trees for `Cluster`

(3) *Ki* *mi-t* *ki-nek* *ad-ott?*
who-NOM what-ACC who-DAT give-PST.3SG
'Who gave what to whom?'

who-DAT :: d △wh	give :: =d =d =d v
what-ACC :: ▽wh d △wh	ε:: =v +nom t
who-NOM :: ▽wh d −nom −wh	ε:: =t +wh c

Table 2.3: Lexical Items to derive (3)

As can be seen from the examples, clustering differs from phrasal movement in three important ways. One is that that in the derived tree, the LI with the cluster licensee feature moves to the LI with the cluster licensor feature, and attaches to its right, forming a complex phrase, instead of moving to its specifier (see Figure 2.9). Second, the `Cluster` node does not dominate the LI that moves. And finally, it is possible for an LI to be both a cluster licensor and a cluster licensee; for example, in (3) the wh-word *mit* 'what-ACC' has both the ▽wh and △wh features. These differences will have consequences to defining well-formedness constraints on clustering computationally.

As with `Move`, `Cluster` can be covert or overt. In fact, Gärtner and Michaelis (2010) argue that multiple wh-movement in *all* languages involve clustering, but differ cross-linguistically in whether it is covert or overt. To make a parallel to my treatment of covert and overt `Move` here, `Cluster` also has a `P-cluster` (Figure 2.11) and an `S-cluster` variety (Figure 2.12).

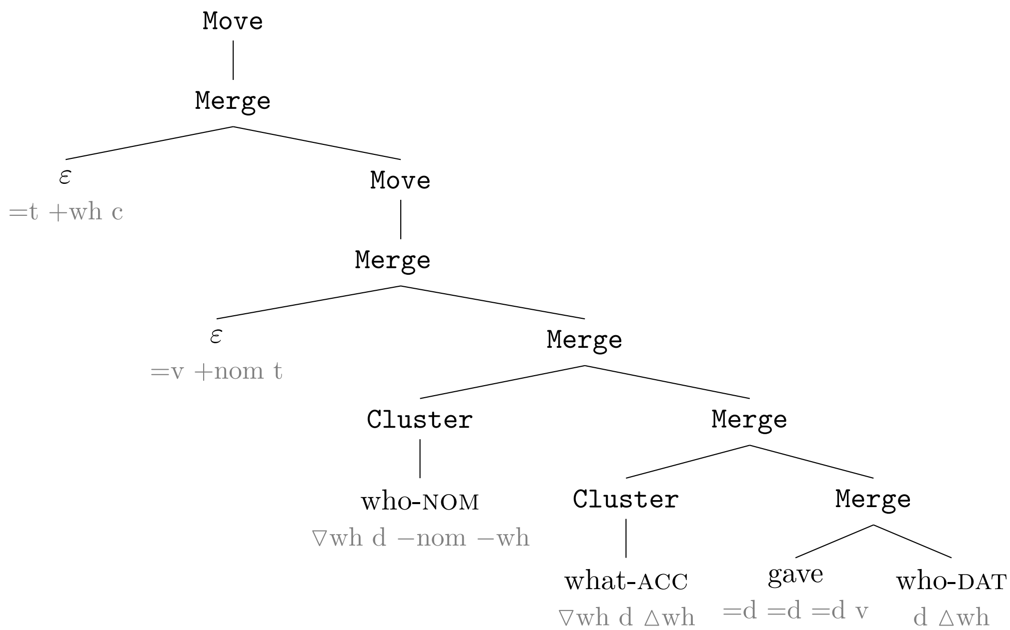


Figure 2.10: Derivation tree of (3) to demonstrate clustering

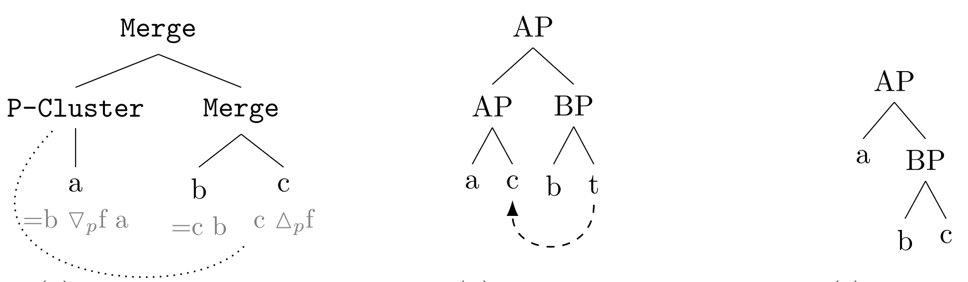
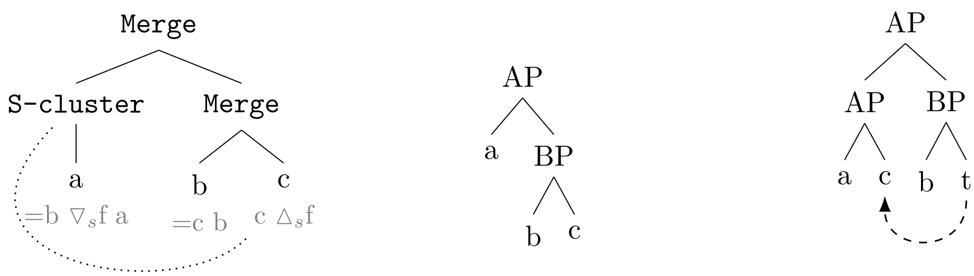


Figure 2.11: Derivation tree and derived PF and LF trees for `P-cluster`

As a result of these additions to the current model of MGs, the feature calculus is considerably expanded to contain features that trigger `Cluster` and features that distinguish between operations that are phonological, semantic, or both. The new expanded feature calculus is shown in Table 2.4.

At first glance, the explosion in number of features might seem implausible. However, we should keep in mind that all new additional operation still is a type of one basic minimalist operation, movement. In all syntactic theories, it has proven necessary to distinguish between various types of movements, such as phrasal movement, head movement, sideways movement, and rightward movement. For a general framework for



(a) Derivation tree (b) PF tree (c) LF tree

Figure 2.12: Derivation tree and derived PF and LF trees for `S-cluster`

type of feature	shorthand	name	operation	polarity
category	f	f	`Merge`	$-$
selector	=f	f	`Merge`	$+$
movement licensee	$-$f	f	`Move`	$-$
movement licensor	+f	f	`Move`	$+$
p-movement licensee	$-_p$f	f	`P-move`	$-$
p-movement licensor	$+_p$f	f	`P-move`	$+$
s-movement licensee	$-_s$f	f	`S-move`	$-$
s-movement licensor	$+_s$f	f	`S-move`	$+$
clustering licensee	$\triangle$f	f	`Cluster`	$-$
clustering licensor	∇f	f	`Cluster`	$+$
p-clustering licensee	$\triangle_p$f	f	`P-cluster`	$-$
p-clustering licensor	∇_pf	f	`P-cluster`	$+$
s-clustering licensee	$\triangle_s$f	f	`S-cluster`	$-$
s-clustering licensor	∇_sf	f	`S-cluster`	$+$

Table 2.4: Enhanced feature calculus of MGs

including these different types of movements, see Graf (2012b). The addition of these features thus merely helps spell out and specify the different types of movements that I found necessary to include in order to account for NPI-licensing.

2.1.2 Pause for breath

So far I have informally described the syntactic framework that I will work with in this thesis, Minimalist Grammars, and the data structure to model the framework, derivation trees. This system is useful in order to give a computational analysis of NPI-licensing constraints, as it enables a more precise and explicit description of syntactic structures. Furthermore, derivation trees are a more restrictive structure than derived trees in terms of computational complexity.

In discussion of syntactic phenomena itself, I will often revert back to using the more familiar framework with derived trees, with occasional discussion of how they would work on MGs derivation trees when relevant. I will give a formal characterization of MGs in Chapter 7, and build on these discussions in the computational analysis of NPI-licensing in Chapters 7 and 8.

2.2 Calculating and deriving scope

I adopt a fairly traditional, syntactic view on quantifier scope, following the ideas dating back to May (1977), and reiterations of these ideas in Aoun and Li (1993), Fox (1995), and Bruening (2001), among others. While all discussion here relies on English, similar assumptions about scope relations for Hungarian have been adopted as well.[7]

In this treatment of quantifiers, scope interpretations are derived from the structure at LF, where the quantifier's scope domain simply is the subtree that it has adjoined to. Structurally, this subtree contains the quantifier's sibling and its sibling's children in the LF tree.

This relation ends up being the same as some versions of c-command: "α c-commands β iff the first branching node dominating α also dominates β and α does not dominate β" (Reinhart, 1976), resulting in the c-command based definition of scope requirements in many studies on quantification (Reinhart, 1976; May, 1977; Aoun and Li, 1993).[8]

Quantification is calculated at LF, as it is often the case that possible scope interpretations do not match the quantifer's position at PF. There are two possibilities:

---

[7] In fact, data in Hungarian has been argued to be the overt manifestation of covert quantifier movement in English (Szabolcsi, 1997; É. Kiss, 2006).

[8] Note that there are also plenty of work that has argued against a syntactic treatment of quantification, and are skeptical of a c-command based calculation of scope domain. See Barker (2012) for some alternative possibilities.

that the quantifier is interpreted higher than it appears, or that it is interpreted lower than it appears. I follow May's (1977) suggestion that these interpretations are achieved by Quantifier Raising (QR) and reconstruction.[9] In the following sections, I discuss these two syntactic operations, and then illustrate how they would be modeled on a derivation tree.

2.2.1 Quantifier raising and Reconstruction

Quantifier raising and reconstruction are syntactic movement operations proposed in May (1977) and May (1985) to account for the ambiguous interpretation of sentences such as (4). The two possible interpretations arise from the different relative scopes of the two Quantified Noun Phrases (QNPs), *some doctor* and *every patient* (4a and 4b). I call (4a) surface scope, and (4b) inverse scope.

(4) Some doctor saw every patient.

a. Surface: There is a doctor who saw every patient. $\exists \gg \forall$

b. Inverse: Each patient was seen by a doctor. $\forall \gg \exists$

There are a few possible options as to how these interpretations can be derived using QR and reconstruction. In May's (1977) original proposal, both QNPs, *some doctor* and *every patient* raise at LF and attach to S (or IP in today's terminology). The different interpretations are derived based on the order of these two quantifiers at LF: (5) and (6) corresponds to (4a) and (4b), respectively.

(5) $[_{\text{S}}$ [some doctor $]_{\text{i}}$ $[_{\text{S}}$ [every patient$]_{\text{j}}$ $[_{\text{S}}$ t_i saw t_j]]]

(6) $[_{\text{S}}$ [every patient$]_{\text{j}}$ $[_{\text{S}}$ [some doctor$]_{\text{i}}$ $[_{\text{S}}$ t_i saw t_j]]]

May (1985) discusses sentences where the quantified element can be interpreted at a lower position than where it appears on the surface. This is particularly apparent in raising constructions, such as in (7), where both interpretations indicated in (7a)

[9] May (1977) and some subsequent work also calls it Quantifier Lowering (QL).

and (7b) are possible. To account for the inverse interpretation in (7b), May proposes that such LF structures are achieved through Quantifier Lowering (QL). QL is different from QR in that it applies to elements that have already raised; the lowering merely puts these elements back to a trace position where they previously have been during the derivation. In more modern terminology, QL has been referred to as reconstruction (since a moved element *reconstructs* to a previous position), and that is what I am calling it.

(7) Some politician is likely to address John's constituency. (May, 1977)

a. There exists a certain politician for whom it is likely that they will address John's constituency. $\exists \gg$ likely

b. It is likely that a politician would address John's constituency. likely $\gg \exists$

Due to later proposals to restrict movement, free movement of quantifiers like in (5) and (6) were not attractive proposals to maintain anymore,[10] and QR itself needed further tweaking (See É. Kiss (2006) for the full history and variations of QR). Consequently, recent versions of quantification suggest to derive inverse scope through *both* QR and reconstruction (Fox, 1995; Johnson and Tomioka, 1997; Bruening, 2001), essentially by putting together the discussions in May (1977) and May (1985). In these newer versions, the object QNP undergoes QR, while the subject QNP reconstructs, ending in a lower position than the QR-ed object at LF (8).

(8) $[_{\text{IP}}\ [_{\text{DP}}$ some doctor$]_{\text{i}}\ [_{\text{vP}}\ [_{\text{DP}}$ every patient$]_{\text{j}}\ [_{\text{vP}}\ t_i\ [_{\text{VP}}$ saw t_j]]]] .

I adopt this view as well, given that there are many compelling and independent pieces of evidence that have shown that subjects reconstruct, not only in the case of raising constructions, but even in clauses with one simple predicate. For example, Johnson and Tomioka (1997) provide evidence that English objects cannot raise beyond the subjects, which necessitates subject reconstruction to derive the inverse

[10] In an MGs framework, this would violate the SMC.

scope interpretation. Diesing (1992) independently argues that in some cases subjects reconstruct to a vP-internal position to achieve an existential interpretation.

Though so far I have only mentioned subject reconstruction, reconstruction also applies to Ā-movement, as noted in Sportiche (2006). The claim is that (9) can receive inverse scope interpretation ('John said that for each doctor, that doctor sees some patient'). To do so, the topic *see some patient* must have reconstructed. The alternative, that *every doctor* raises to get inverse scope is untenable here, because it would violate clause boundedness restriction on QR; for example, (10) cannot have the interpretation where for each patient, there is a doctor who says that the nurse sees them.

(9) See some patient, John said every doctor does. $\forall \gg \exists$

(10) Some doctor said the nurse sees every patient.

A remaining question that I must address regarding reconstruction is the mechanism through which it happens. For May (1985), reconstruction was a type of movement, where the item lowered instead of raising within the structure. In the copy theory of movement, reconstruction effects were achieved through pronouncing the higher copy, but interpreting the lower copy (Chomsky, 1993; Hornstein, 1995). I follow neither of these frameworks. Instead, I adopt the proposal put forth in Sauerland and Elbourne (2002), that reconstruction effects are the result of PF-movement. In other words, some items undergo movement in the PF only, which results in them being pronounced high, and interpreted low. Notice that this theory of reconstruction can be very easily modeled with my current framework of MGs; PF-movement is the equivalent of what I call `P-move`.

The treatment of QR itself also underwent substantial modifications. Recall that for May (1977), the QNP attached to S (or IP) at LF. More recently, the possible landing sites for QR have expanded beyond IP. Following the widely accepted semantic treatment of quantification found in Heim and Kratzer (1998), a QNP must adjoin to a node of type $< t >$ to be interpretable. It follows then that possible landing sites for

QR need to be a node of type $< t >$, and accordingly, in various works discussing QR, landing sites have been assumed to be IP and vP.[11] In addition, I will assume NegP to be a possible landing site for QR, since it also has a type denotation $< t >$. Landing in NegP will be especially relevant for universally quantified NPIs.

2.2.2 Quantifier scope in MGs derivation trees

Following the current discussion about QR and reconstruction, the scope domain is then calculated the following way in a derivation tree. If the QNP does not undergo `Move` or `S-move`, then its scope domain is the subtree it is merged to (Figure 2.13a). Note that this applies also if it only undergoes `P-move`, since `P-move` does not change the site of its interpretation. If the QNP undergoes `Move` or `S-move`, then its scope domain is the subtree dominated by the highest occurrence of the QNP (Figure 2.13b).

(a) Scope domain of unmoved quantifier (b) Scope domain of moved quantifier

Figure 2.13: Scope domains in derivation trees

2.2.3 Summary

In summary, this section laid out the system of quantification that I adopt. I follow a standard syntactic view in that quantifier scope is represented at LF, where the scope domain of the quantifier is the subtree that it adjoins to. I also maintain the standard assumption that quantifiers can have different scope domains by adjoining to different subtrees via QR. My approach to reconstruction is less mainstream: instead of lowering, I follow Sauerland and Elbourne's (2002) proposal in assuming that quantifiers only moved at PF, but not at LF.

[11] There is also additional hypotheses as to whether NP, PP, or DP are possible landing sites, which is outside the scope of the current thesis.

Chapter 3

QUANTIFIER-BASED TYPOLOGY

In this thesis, I adopt a quantifier-based typology for Negative Polarity Item (NPI)-licensing, inspired by Giannakidou (2000). According to this view, the cross-linguistic differences in the syntactic and semantic behavior of NPIs stem from them being different types of quantifiers, either existentials or universals. Existentials must be in the scope of a licensor, whereas universal quantifiers must take scope over negation. In this chapter, I define what I mean by NPIs, describe the quantifier-based theory in detail, and show how the theory can be described within the framework of MGs with derivation trees. My proposal is based on data primarily in English and Hungarian – much of which I discuss in detail in Part II.

3.1 What are Negative Polarity Items?

Before introducing the current approach to NPIs-licensing typology, a clarification as to what counts as an NPI is in order. The definition I adopt is a descriptive one, based on Giannakidou and Zeijlstra's (2017) and Hoeksema's (2000) discussion of negative polarity.

Definition 1 (Negative Polarity Item)**.** *A negative polarity item α is an expression whose distribution is limited by sensitivity to some semantic property β. β must include negation at the least.*

Simply put, an expression is an NPI if a minimal pair similar to (1) exists. In (1) *anything* would be an NPI because the sentence containing it is acceptable with negation, and unacceptable without it.

(1) a. Nancy does not want anything.

b. * Nancy wants anything.

Note that this definition does not exclude non-negative licensors, such as in (2) where the licensor is a conditional. Thus, while negation is always an NPI-licensor, other types of expressions can be licensors too.

(2) If you break anything, you pay for it!

Even though many in the literature define NPIs the same way I do, they do not apply it the same way I do. In discussing the nature of NPIs, there is an implicit added assumption that NPIs are items that behave the same as the likes of English *any*-pronouns: they can be licensed by some non-negative licensors, they can be licensed long-distance, and they cannot be in a subject or topic position. Many use these implicit assumptions to argue that so-called Negative Concord Items (NCIs)[1] are not NPIs (Zanuttini, 1991; Zeijlstra, 2004). However, that the definition does not actually require any of these things to categorize something as an NPI.

In the next section, I discuss the divide between NCIs and NPIs further, and will argue that NCIs are NPIs in most cases.

3.1.1 The status of Negative Concord Items (NCIs)

In this section, I describe the most agreed-upon categorization of NPIs and NCIs, and discuss how my approach does not quite follow along the same lines. Note that the terminology can get confusing; for the first half of this section, I conform to the the general literature in calling only a subset of NPIs as NPIs, even though my definition of NPIs should apply to a broader set of items. Typically, the literature has the following division:

- Negative Polarity Items (NPIs): e.g. English *any*-pronouns
- Negative Concord Items (NCIs):
    - Strict NCIs: e.g. Hungarian *se*-pronouns

[1] Also known as *n-words*.

– Non-strict NCIs: e.g. Romance NCIs

English *any*-pronouns have been implicitly understood to be existential quantifiers or indefinites that are licensed by a variety of different licensors with a certain semantic quality, including negation.[2]

NCIs, on the other hand, have been treated as a completely separate type of items. They are often analyzed as carrying inherent negative meaning similarly to negative quantifiers. This is primarily because they can be negative fragment answers without being licensed, as illustrated in (3). This is not the case for English NPIs (4), but it works with English negative quantifiers, such as *nothing* or *nobody* (5)).

(3) *'Ki-t lát-t-ál?' 'Sen-ki-t.'*
who-ACC see-PST-2SG NPI-who-ACC
Q: 'Who did you see?' A: 'Nobody'.

(4) Q: Who did you see? A: *Anybody.

(5) Q: Who did you see? A: Nobody.

Curiously though, when NCIs co-occur with sentential negation, the sentence still retains a single negative reading (6). This phenomenon is called Negative Concord (NC). Compare this to standard English dialects, where a negative quantifier co-occurring with negation would yield a Double Negation (DN) reading (7). Taking all of this together, NCIs are generally defined as items that yield an NC reading when occurring with negation and can serve as fragment answers (cf. Giannakidou (2000)).

(6) *Se-hol nem lát-t-ott sen-ki sen-ki-t.* Hungarian
NPI-where NEG see-PST-1SG NPI-who NPI-who-ACC
'Nobody saw anybody anywhere.'

[2] This semantic quality has been discussed in the literature to a great extent. Some have identified *downward entailment* to be adequately descriptive (cf. Ladusaw, 1980; Zwarts, 1998; Gajewski, 2011), while others argued that the more proper characteristic would be *antiveridicality* (Giannakidou, 1998). I will not wade into this debate further, but note that a defining characteristic of 'NPIs' in this sense is that they need to be licensed by some non-negative elements in addition to negation.

(7) I didn't see nobody. = I saw somebody.

There is a further division between NCIs that is useful to discuss: strict NCIs and non-strict NCIs. Strict NCIs require licensing in all syntactic positions, including subject positions (8). Non-strict NCIs in subject position, on the other hand, either cannot yield NC with sentential negation (9)[3] or optionally allow NC sentential negation and still yield NC (10.

(8) *Sen-ki* **(nem)* *küld* *nekem* *level-et.* Hungarian
NPI-who NEG send 1SG.DAT letter-ACC
'Nobody send me letters.'

(9) *Nessuno* *non* *ha* *telefonato.* Italian
NPI.body NEG have.3SG called
'*Nobody called.' (Zeijlstra, 2004, Ch. 7, (36b))

(10) *Res* *(no)* *funciona.*
NPI.thing NEG work.3SG
'Nothing works.' (Vallduví, 1994, 26b)

Now that I have given the general characteristics for each group, I address how it measures up to *my* definition of NPIs above. It should be clear that both English-type NPIs and strict NCIs conform to the definition of NPIs without a problem: they both require a licensor to be acceptable in a sentence.[4] Non-strict NCI are trickier. In post-verbal positions, they must be licensed, and thus behave like NPIs; in pre-verbal positions, they do not act like NPIs. Nevertheless, putting non-strict NCIs aside for now, there is a reasonable argument to be made for categorizing strict NCIs and NPIs together based on their shared need for licensing.[5]

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[3] (9) can only have a double negative reading.

[4] I assume that NCIs are licensed by an elided negation in fragment answers, which I expand on in Chapter 4.

[5] This is not a new insight. Typologies built based on potential licensors did just that; Ladusaw (1980), for example, called Hungarian-type items 'strong' NPIs because they had to be licensed by negation only, whereas English-type items were 'weak' NPIs.

As for non-strict NCIs, I adopt an ambiguity-type approach, following ideas in Herburger (2001); Déprez and Martineau (2004); Espinal and Tubau (2016). According to this approach, non-strict NCIs are simply ambiguous between negative quantifiers and NPIs. In post-verbal positions, they are most saliently NPIs that have to be licensed, but in pre-verbal positions they can only be negative quantifiers that do not require licensing. I flesh out this idea in more detail in Chapter 6.

Before I describe approaches that unify NCIs and NPIs, I address the ones that treat them as separate items. The earliest accounts of NCIs assumed that NCIs are a special kind of negative quantifier. One popular account uses the so-called NEG-criterion, proposed first by Haegeman and Zanuttini (1991), and later developed by De Swart and Sag (2002) and Watanabe (2004). The main idea is that NCIs have to be in agreement with a negative head, and reach a negative concord reading through negative absorption. The original proposal by Haegeman and Zanuttini (1991) based it on the idea of wh-absorption, where multiple wh-words amount to one question reading. De Swart and Sag (2002) reanalyzed the negative concord reading as being borne out from composing the semantics of multiple negatives as polyadic quantifcation; using this framework, multiple NCIs can be bound by one single negation. The idea is then that all languages have both a double negative and a negative concord reading available, the question is only which one they prefer to do compositionally. Watanabe (2004) recasted Haegeman and Zanuttini's (1991) NEG-criterion in terms of feature checking movements.

In general, treating NCIs as negative quantifiers explains the inherently negative nature of NCIs (serving as fragment answers, licensing other NCIs in non-strict negative concord languages), but it also creates new puzzles. We basically then need an explanation for the cases where n-words do not behave like negative quantifiers, such as their requirement for licensing and their availability for negative concord reading.

Another approach that only accounts for NCIs to the exclusion of NPIs is Zeijlstra's (2004). He focused on the difference between strict and non-strict NCIs by assigning either uninterpretable ([uNeg]) or interpretable features ([iNeg]) to sentential negation in these languages, respectively, and [uNeg] feature to all NCIs. His proposal fails to address several questions, as detailed in Giannakidou and Zeijlstra (2017). One is the ambiguity of post-verbal NCIs in Romance (detailed in Chapter 6 of this thesis). Second, it is not obvious why preverbal strict NCIs still require a sentential negative licensor. In Zeijlstra's proposal, negative markers in strict NCI languages carry a [uNeg] feature to check against an abstract operator that carries [iNeg] – thus this abstract operator carries semantic negation, not the sentential negation marker. He posits sentential negation as an indicator for the presence of this abstract negative operator; however, when an NCI precedes negation and it presumably already indicates the presence of negation with its own [uNeg] feature, it is unclear why sentential negation is still required to be present.

Approaches that unify NCIs and NPIs are not new either. In these types of work, both NCIs and NPIs are assumed to be NPIs, which implies that negative concord is just a type of negative polarity. The list is far from exhaustive, but some notable ones are Progovac (1994), Giannakidou (2000), and Collins and Postal (2015); in these works, the authors assume an independent mechanism that governs NPI-licensing, and then propose various parameters along which languages differ. With the exception of Giannakidou (2000), all proposals to my knowledge assume that NCIs are just like NPIs in that they have to be in the scope of negation. For example, Progovac (1994) links NPI-licensing to anaphora binding, and accounts for the cross-linguistic differences within this framework. Collins and Postal (2015) derives everything back to NEG-raising, and cross-linguistic differences are accounted for by language-specific constraints on NEG-raising. Giannakidou (2000) argues that the differences are rooted in the quantifier type of the NPIs: some NPIs are existentially quantified while others are universally quantified, and this difference accounts for their behavioral differences.

In this thesis, I adopt Giannakidou's (2000) approach. There are two reasons for doing so. One reason is that a quantifier-based approach naturally follows from the long line of research that treated NPIs and NCIs separately. Historically, NPIs have been assumed to be indefinites, whereas NCIs have been analyzed to be universal quantifiers (cf. Szabolcsi, 1981)). Thus, to translate this divergence into Giannakidou's (2000) framework, NPIs would be indefinite NPIs, and NCIs are universally quantified NPIs. In a sense then, the adopted approach does not differ greatly from those who have treated NPIs and NCIs separately – after all, the two types of items do differ in certain ways –, but it does give an added insight by drawing attention to their shared characteristics, namely, to their shared need for a licensor. Contra to many previous approaches, it also affirms that universally quantified NPIs have more in common with NPIs than negative quantifiers, as they are not semantically negative.

The second reason is that the quantifier-based approach accounts for some semantic behaviors that neither Progovac (1994) nor Collins and Postal (2015) do. For example, Collins and Postal (2015) assume that all NPIs are existentially quantified, even though there are multiple pieces of evidence pointing to the existence of universally quantified NPIs in certain languages, as I will show in Part II. Progovac (1994) has to assume that all NPIs are in the scope of their licensor, but that also does not seem to be true for what I will analyze to be universally quantified NPIs.

3.2 A quantifier-based approach to NPI-licensing

In a nutshell, the quantifier-based approach assumes that an NPI can be either a universal quantifier that must scope over negation at LF (11) or an existential quantifier in the scope of negation at LF (12).[6] These two expressions have the same truth value, but display different syntactic behaviors.

(11) $\forall x[P(x) \rightarrow \neg Q(x)]$

(12) $\neg\exists x[P(x) \wedge Q(x)]$

[6] Giannakidou and Zeijlstra (2017) also refer to existentially quantified NPIs as indefinites that are bound existentially (Heim, 1982) in the scope of negation. In Giannakidou's (2000) proposal it did not make a difference, because the indefinites were never bound by a universal quantifier, and thus never received a universal quantifier interpretation. In this thesis, I will also not make a distinction between these two options, and will continue refer to these types of NPIs as existentially quantified.

Syntactically, these interpretations are accomplished in the following way according to Giannakidou (2000). Universally quantified NPIs undergo covert or overt QR to take scope over negation at LF. To ensure that their negative licensing requirements are checked, they must raise and adjoin to NegP. For existentially quantified NPIs, on the other hand, they simply must be in the scope of the licensor at LF.

Giannakidou (2000) argues that this difference in quantifier types results in the observed differences in NPI-behavior cross-linguistically. For example, universally quantified NPIs can be in a subject position that is a typically higher position than the licensor, simply because it must outscope negation anyways. Similarly, they can act as fragment answers because once they have checked the licensing requirement via QR to NegP, the rest of the sentence can be elided (Merchant, 2004) . Existential NPIs, on the other hand, do not have this option; they cannot raise above negation, and thus cannot be fragment answers. In Part II, I show a number of other diverging behaviors that can be simply accounted for if we assume that NPIs can be different types of quantifiers.

The NPI-licensing requirements as stated in Giannakidou (2000) are not explicit in a way that it would be straightforward to model them with MGs. For example, it is not clear what type of features motivate QR, or how we should calculate scope relationships. Thus, in this section, I essentially implement Giannakidou's (2000) proposal in a a Minimalist system that then can be modeled with MGs. My goal in this chapter is to give an overview and a sense of how the proposal works; for the mathematical formalization of these constraints, see Chapter 7.

Before we begin, I want to clarify that the details of this proposal are primarily based on data from English for existential NPIs and Hungarian for universal NPIs. To my knowledge, data from other languages (e.g. Mandarin Chinese (Lin, 1998), Vietnamese (Tran and Bruening, 2013), Serbo-Crotatian (Progovac, 1994), Russian (Brown, 1999), Greek (Giannakidou, 2000)) suggest that the attributes discussed below apply to them as well. I discuss these other languages in more detail in Chapter 6.

3.2.1 Existential NPIs

As stated previously, in the quantifier-based approach to NPI-licensing, existential NPIs must be in the scope of a licensor at LF. In the syntactic framework adopted here, scope is calculated through c-command relations; consequently, existentially quantified NPIs must be c-commanded by a licensor at LF (13).

(13) ∃ **NPI**: If an NPI is an existential quantifier, it must be c-commanded by a licensor at LF.

This c-command configuration is illustrated in Figure 3.1 on a derived LF tree. This same c-command configuration is more complex to describe on a derivation tree; thus I defer tackling that question to the computational analysis part of this thesis, Chapter 8.

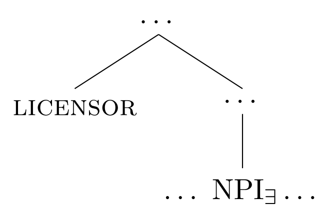

Figure 3.1: LF structure with licensor c-commanding an indefinite NPI

Specifying that the c-command relationship must be checked at LF serves to cover cases where the LF structure is not identical to the PF structure. Such cases occur as a result of covert QR and reconstruction. To my knowledge, there is no linguistic data where a licensor comes to license an NPI through covert raising, but there are a number of cases where reconstruction affects whether the NPI is licensed (14-15).

(14) A doctor who knows anything about acupuncture was not available.
Linebarger (1980)

(15) An admission that the boss fired anyone, we did not expect to hear.

In these examples, the NPI is embedded in a relative clause that is headed by a subject (14) or a topic (15). As long as the head of the subject or topic can reconstruct due to independent reasons, the NPI is licensed despite appearing at a higher position than the licensor on the surface. The licensing is possible because at LF, the NPI is to be interpreted in the scope of the licensor as a result of reconstruction. This is not a completely novel observation: many have used NPI licensing as a diagnostic for reconstruction (Sauerland and Elbourne, 2002; Neeleman and Payne, 2018). I discuss further data regarding reconstruction and NPI licensing in English in Chapter 4.

As mentioned in Chapter 2, I analyze reconstruction as PF move (`P-move`) in MGs – that is, reconstruction effects are the result of movement that only takes part at PF, but not at LF. The consequence of this is that because we calculate c-command relations at LF, any movement due to `P-move` will be invisible. This significantly simplifies the problem of accounting for (14-15). If a phrase is analyzed to reconstruct, we simply do not take its pronounced position into account; instead, we take its base position to determine c-command relations. As an example, Figure 3.2 is my proposed LF-tree for (14), which shows that negation c-commands the NPI *anything*.

3.2.2 Universals

When the NPI is a universal quantifier, then it must scope over negation at LF. This scope configuration is achieved through QR (16). To give a minimalist account, the following questions need to be answered about this proposal: 1) what is the landing site of QR, 2) what feature triggers QR, 3) how can multiple QR be accounted for, and 4) how should covert movement be handled.

(16) $\forall$ **NPI** : If an NPI is a universal quantifier, it must undergo QR, either overt or covert, to take scope over negation at LF.

For the landing site, I assume that an universally quantified NPI must raise to NegP at LF in order to ensure that it takes scope over negation. This is exactly the same mechanism that Giannakidou (2000) proposed in her treatment of universally quantified NPIs.[7]

[7] Another influential, and similar treatment was developed by Haegeman and Zanuttini

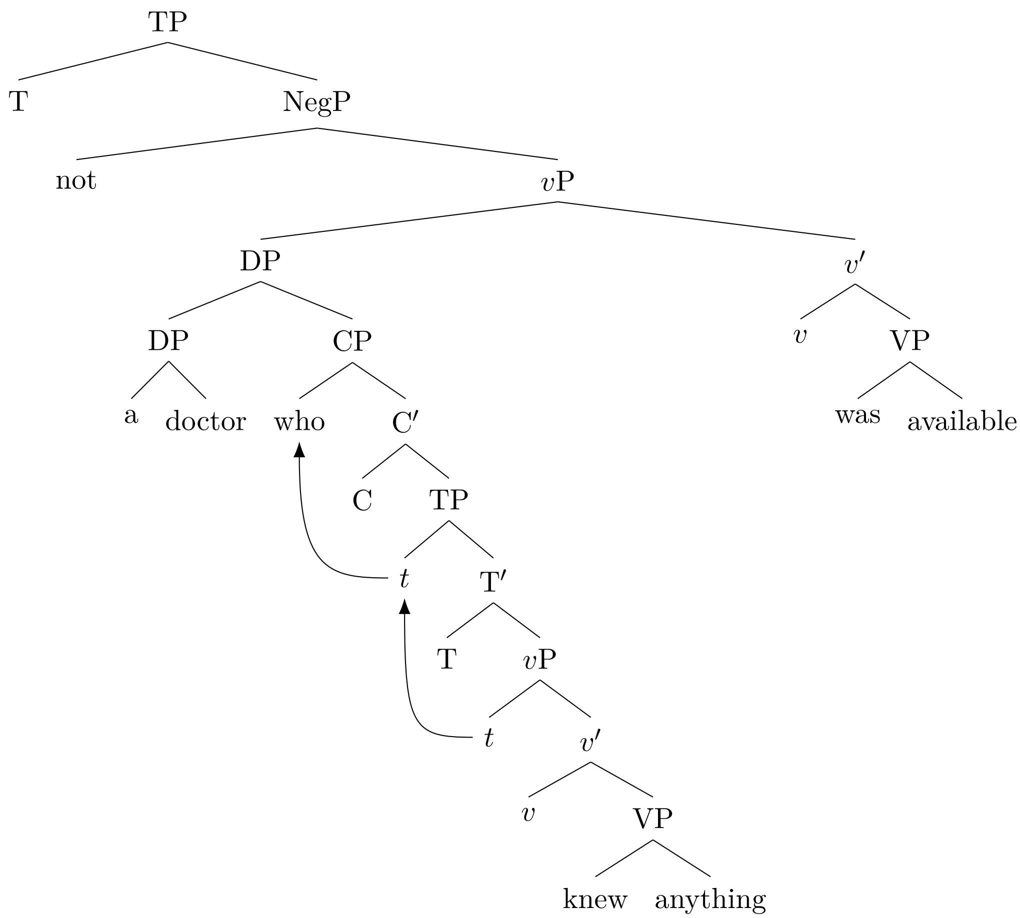

Figure 3.2: LF-tree for (14)

If universal NPIs have to land in NegP to be licensed, then the negative head must have a movement licensor feature on it that attracts a movement licensee feature on NPIs. I stipulate these features to be +npi and −npi, respectively. For example, if the NPI undergoes overt QR, I assume the following feature string for negation: {=v +npi v}, and for an NPIs such as *senki* 'nobody': {d -npi}.

Figure 3.3 shows how the licensing via QR would then look on a simplified derivation tree for a sentence such as (17).

(1991), who argued that NCIs raise to Spec-NegP. Their proposal differs from the current one in that they assume NCIs have a −neg feature, which they must check against NegP, as an analogue to wh-movement.

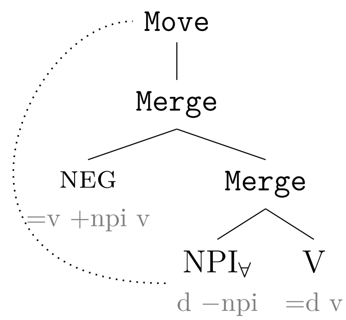

Figure 3.3: Derivation tree showing the licensing of a universally quantified NPI via QR

(17) *Sen-ki nem jö-tt.*
NPI-who NEG come-PST.3SG
'Nobody came.'

The third question regards multiple QR. I adopt Gärtner and Michaelis's (2010) implementation of cluster movement, which they originally applied to multiple wh-movement. Clustering is a new type of movement operation, where LIs can have cluster features represented as △f for cluster-licensees and ▽f for cluster licensors. Clustering then would be translated as essentially right-adjunction on the appropriate PF or LF tree.

For NPIs, the lowest one would have a cluster licensee feature of the form △npi, the highest NPI would have a cluster licensor feature ▽npi and a movement licensee feature −npi. Medial NPIs between the highest and lowest NPIs have both the cluster licensee feature △npi and licensor feature ▽npi. A sentence containing clustering of NPIs such as (18) would then be derived as shown in Figure 3.4. The derived tree version of Figure 3.4 is shown in Figure 3.5.

(18) *Sen-ki sen-ki-nek se-mi-t nem ad-ott.*
NPI-who NPI-who-DAT NPI-what-ACC NEG give-PST.3SG
'Nobody gave anyone anything.'

The third question regards covert movement. This is dealt with by formally distinguishing covert operations from overt operations with features. Covert movement is triggered by covert movement features ($-_s$f), and similarly, covert clustering

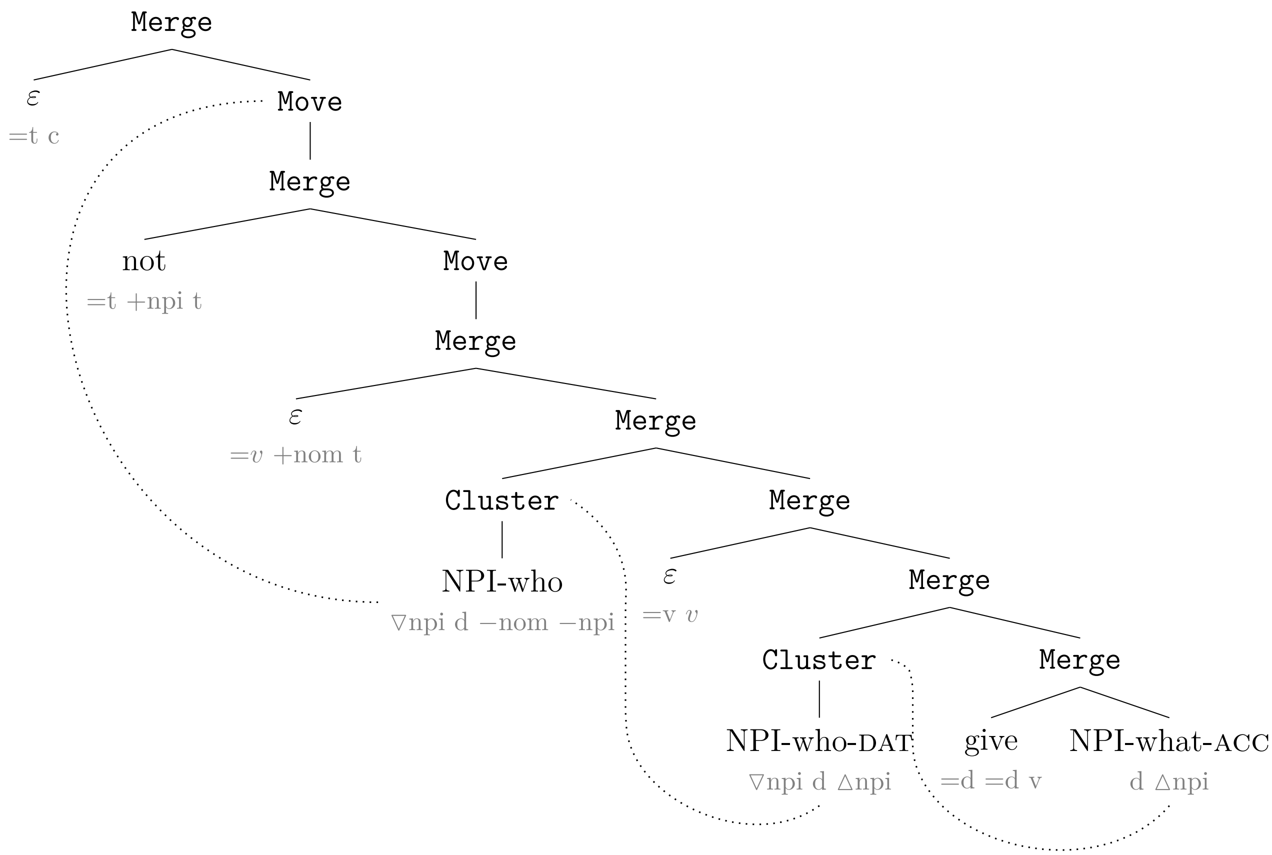

Figure 3.4: Derivation tree showing licensing of multiple universally quantified NPIs via clustering and QR

is triggered by a covert clustering feature ($\triangle_s$f). I explicitly label covert operations as `S-movement` and `S-clustering` in the derivation trees; otherwise they are identical to the trees depicted in Figures 3.3 and 3.4.

Combining all options of various operations that contribute to the licensing of universally quantified NPIs yields four different scenarios, as summarized in Table 3.1. Example sentences depicting each scenario are listed in (19-20). All these sentences are acceptable.

	$\triangle_s$ NPI	$\triangle$ NPI
$-_s$ NPI	(19)	(20)
$-$ NPI	(21)	(22)

Table 3.1: Possible combinations of operations involved in licensing universal NPIs

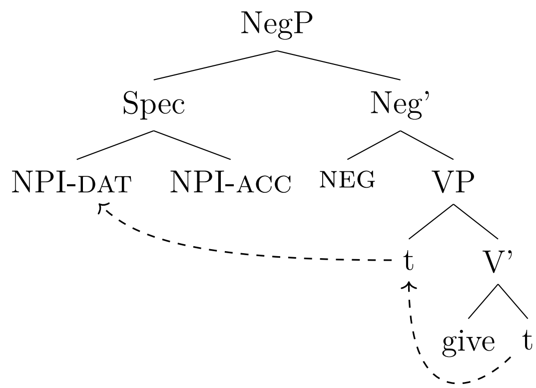

Figure 3.5: Derived tree showing licensing of multiple universally quantified NPIs via clustering and QR

(19) *János nem adott sen-ki-nek karácsony-ra sem-mi-t.*
János NEG give-PST.3SG NPI-who-DAT Christmas-SUBL NPI-what-ACC
'János didn't give anyone anything for Christmas.'

(20) *János nem adott sen-ki-nek sem-mi-t karácsony-ra.*
János NEG give-PST.3SG NPI-who-DAT NPI-what-ACC Christmas-SUBL
'János didn't give anyone anything for Christmas.'

(21) *Sen-ki-nek nem ad-ott János sem-mi-t karácsony-ra.*
NPI-who-DAT NEG give-PST.3SG János NPI-what-ACC Christmas-SUBL
'János didn't give anyone anything for Christmas.'

(22) *Sen-ki-nek sem-mi-t nem ad-ott János karácsony-ra.*
NPI-who-DAT NPI-what-ACC NEG give-PST.3SG János Christmas-SUBL
'János didn't give anyone anything for Christmas.'

The constraint that regulates universal NPI-licensing then can be reduced to movement-constraints: the derivation is well-formed as long as all features are checked. The challenge then is determining the nature of movement constraints in general, which I will do as part of my computational analysis of NPI-licensing constraints in Chapters 7 and 8.

3.3 Summary of the chapter

In this chapter, I defined what I mean by NPIs, and have argued that items that are often called NCIs in the literature should be considered also to be a type of NPI.

Then, I introduced the quantifier-based approach NPI-licensing typology, and sketched the constraints for the two types of NPIs in the framework.

In summary, the proposal is as follows. NPIs in different languages can be put into two groups: they are either existentially or universally quantified. Existentially quantified NPIs have to be in the scope of a licensor by being c-commanded by it at LF. Universally quantified NPIs have to take negation in their scope. They do so by raising to NegP, and thus take negation into their scope.

In the next part, I show empirical evidence that further supports the validity of the quantifier-based proposal. Then, in Chapters 7 and 8 I will give an analysis for the complexity of these constraints on derivation trees.

Part II

EMPIRICAL EVIDENCE

As it was established in Chapter 3, I am pursuing a quantifier-based framework to account for the differing characteristics of NPIs across languages. The goal of this part is to provide empirical evidence for the claim that NPIs in fact can be grouped based on whether they are existential or universal quantifiers, and that this difference systematically predicts their differing syntactic and semantic behaviors in various languages. In this thesis, I will focus primarily on English and Hungarian, with the goal to show that English *any-* NPIs are existential, whereas Hungarian *se-* NPIs are universal quantifiers.

I should note here that throughout this thesis I stick to only discussing pronomial NPIs like English *any-* and Hungarian *se-*pronouns. One group that I do not study in this thesis are *minimizers*, like *a soul* in English (23-24). The reason for doing so is because the semantics of these items seems to be more complex than that of pronomial NPIs; while the lexical semantics of pronomial NPIs like *anybody* could be described as $\exists P \exists x[P(x) \wedge person(x)]$, minimizers are often believed to be composed of a lower endpoint of scale meaning in combination with *even* (Abels, 2003).

(23) I didn't see a soul.

(24) * I saw a soul.

It is possible then that this causes their behavior to be different from that of pronomial NPIs in various ways. For example, as I will show in more detail later, a characteristic of universally quantified NPIs is that they can serve as fragment answers and cannot be licensed long-distance. Minimizers, on the other hand, cannot be fragment answers (25) and also cannot be licensed long-distance in English (26).[1] Further research is needed to determine how the lexical semantics of minimizers might affect their behavior as NPIs.

(25) Who did you see? *A soul.

[1] Minimizers do not behave the same cross-linguistically, either. While Hungarian minimizers behave the same as English ones, Japanese minimizers of the form 'one-classifier-*mo*' can serve as fragment answers.

(26) * Sue didn't say that she saw a soul.

In Chapter 4, I first describe the various syntactic behaviors that support a quantifier-based approach. Since my claim is that universal quantifier NPIs must undergo QR to be interpreted correctly at LF, the syntactic diagnostic tests aim to detect the existence of QR as well as the relative scope to negation with such NPIs, and the lack of QR with existentially quantified NPIs. In Chapter 5, I describe a semantic test I adopted from Shimoyama (2011) that differentiates between the two types of NPIs, and present original data that I collected from native language informants performing this test. Following that, I discuss other semantic tests that have been proposed for the same purpose (Giannakidou, 2000), and argue that many of them are not reliable enough to draw conclusions from. Finally, in Chapter 6, I discuss my hypothesis for how NPIs in Turkish and various Romance languages can also fit into this typology.

All judgments presented here were either confirmed by a number of native speakers, or taken from existing research. The source is always indicated if it is the latter case.

Chapter 4

SYNTACTIC EVIDENCE

The goal of this chapter is to go through the various syntactic evidence that supports the quantifier-based approach to NPI-typology. Throughout the chapter, I present the various diagnostics with data from English and Hungarian, and argue that English *any-* NPIs are existentially quantified, while Hungarian *se-* NPIs are universally quantified. I start with going over my assumptions of the syntactic structure of Hungarian and English sentences in §4.1.

Syntactically, universally quantified NPIs and existentially quantified NPIs differ on two points. The first one is that universally quantified NPIs can outscope negation at LF, while existentially quantified NPIs cannot do that. I expect the relative LF scope to be reflected in possible surface positions, namely that universally quantified NPIs can be in a higher position than negation at the PF as well (through the `Move` operation). On the other hand, existentially quantified NPIs cannot appear higher than negation unless they can reconstruct – in other words, they can only undergo `P-move` if they move at all. I discuss these possibilities in §4.2. In §4.3, I argue that differences in whether an NPI can serve as a fragment answer is the product of it being able to move above negation as a universal quantifier.

The second point of difference between the two types of NPIs is that universally quantified NPIs undergo QR in order to be licensed. The rest of these tests consequently are designed to detect the presence of quantifier movement. In §4.4, I look at NPIs in ACD contexts, which have long been argued to correlate with the availability of QR. In §4.5, I examine the locality requirements on NPI licensing and compare it to the locality restrictions of QR in the same language. Finally, in §4.6, I use island constraints as additional evidence that universally quantified NPIs undergo QR.

4.1 Background on English and Hungarian syntax

Because most of the data presented here is going to be on English and Hungarian, it is useful to first lay out the structures that we assume for these languages, with particular focus on the place of negation in the structure compared to other parts of the sentence.

4.1.1 English

For the structure of English, I adopt Pollock's (1989) proposal that the IP is split in multiple functional projections and one of them is NegP, and the negative particle *not* occupies the specifier of NegP. This idea has been adopted by many subsequent discussions of sentential negation (Laka, 1991; Zanuttini, 1991; Zeijlstra, 2004).

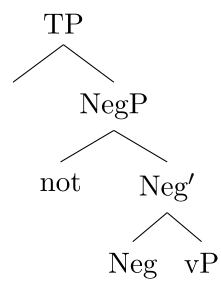

Figure 4.1: General sketch of the English IP structure

Following the more recent theories about the external argument, I assume that the subject is base-generated in Spec,vP (Kratzer, 1996), and raises to Spec,TP. Thus, on the surface, the subject ends up being above negation (1).

(1) $[_{\text{TP}}$ John$_i$ $[_{\text{T}}$ did $[_{\text{NegP}}$ not $[_{\text{vP}}$ t$_i$ arrive.]]]]

4.1.2 Hungarian

There are many ongoing theories about the sentence structure of Hungarian (see É. Kiss (2008) for a review). Here I will lay out the common assumptions, with particular attention on the position of negation in the sentence.

Hungarian is assumed to be a discourse-configurational language (É. Kiss, 1995, 2002) – that is the word order is based on discourse items such as topic and focus. In

Hungarian specifically, the idea is that the sentence has a dedicated topic and focus position followed by the predicate (TP). Figure 4.2 illustrates this structure. Discourse-configurationality is different from subject/object-based word orders in that neither the topic nor the focus position has to be filled. The structure of the predicate is still debated, and its details are unimportant for the current discussion. For a summary of recent accounts, see É. Kiss (2008).

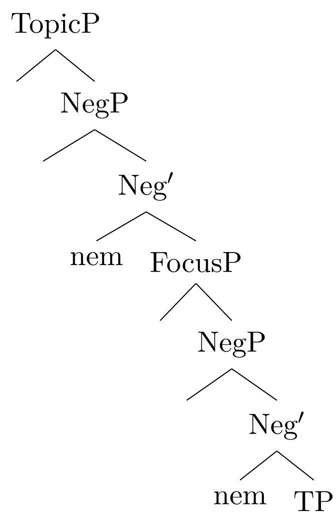

Figure 4.2: General sketch of the Hungarian left periphery

Sentential negation is expressed with the particle *nem* either pre-verbally (2), pre-focus (3), or both (4). Both NegP contributes negative semantics in the sentence, so when both are present, we get a double negative reading.

(2) *Anita nem látogat-ta meg Mari-t.*
Anita NEG visit-PST.3SG PRT Mari-ACC
'Anita didn't visit Mari.'

(3) *Anita nem EZ-T a film-et lát-ta.*
Anita NEG this-ACC the movie-ACC see-PST.3SG
'It wasn't this movie that Anita saw.'

(4) *Anita nem EZ-T a film-et nem lát-ta.*
Anita NEG this-ACC the movie-ACC NEG see-PST.3SG
'It wasn't this movie that Anita didn't see.'

In both cases, I assume that negation occupies the head of a NegP projection. This agrees with proposals by Puskás (2000); Olsvay (2000); É. Kiss (2010).[1] One evidence that supports the head-status of the negative particle is the fact that it blocks verb movement. First consider the sentences in (5). In (5a) there is no focus, and the verb follows the verbal particle. In (5b), on the other hand, the verb moved over the verbal particle to the head of Focus. In (6), however, the verb cannot raise to Focus head like it did in (5b), because negation has blocked it. If the verb was not blocked, we would expect it to surface at the head of Focus, yielding the word order *focus-verb-negation-particle.

(5) Focus triggers verb movement:

a. *Ádám meg látogat-ta János-t.*
Ádám PRT visit-PST János-ACC
'Adam visited János.'

b. *Ádám CSAK JÁNOS-T látogat-ta meg.*
Ádám only János-ACC visit-PST.3SG PRT
'It was only János that Adam visited.'

(6) *Ádám CSAK JÁNOS-T nem látogat-ta meg.*
Ádám only János-ACC NEG visit-PST.3SG PRT
'It was only János that Adam didn't visit.'

As for its possible positions, I adopt the view that NegP in the case of (3) selects for FocusP, whereas in the case of (2), it selects for TP.[2]

[1] See Surányi (2002) for arguments that the Hungarian negative particle is a phrase that occupies Spec,NegP. His objections are resolved in É. Kiss (2010).

[2] There is a lot of variation on what functional projection the lower NegP would select for. I choose TP, but alternatives include NNP (Non-neutral phrase) (Olsvay, 2000) and AspP (Puskás, 2000). Either of these work with the current approach. My proposal, however, disagrees with Surányi's (2002) – he proposed that the negative particle, as a phrase, occupies Spec,FocusP.

4.2 Surface position of the NPI and licensor

As discussed in Chapter 2, I assume that all quantifier scope is expressed at the LF level, through c-commanding dependencies. If NPIs in fact differ from each other in their quantifier types, then existential quantifiers should never be interpreted higher than negation, whereas universal quantifiers should always be interpreted to take higher scope than negation.

It follows then that the only time an existentially quantified NPI can appear on a position higher than its licensor at PF is because it reconstructed. In the current model, reconstruction is achieved through `P-move`, resulting in the reconstructed item being interpreted low at LF, but pronounced high at PF. Universal quantifiers, on the other hand, have to undergo either `Move` (overt move) or `S-move` (covert move), landing at NegP, to be licensed. Thus, if they appear higher than their licensor at PF, they must have undergone `Move`, and not `P-move`.

In what follows, I discuss English and Hungarian NPIs in terms of their surface position compared to their licensor. I argue that English NPIs are existentially quantified, and therefore can only be higher than their licensor in special circumstances that allow reconstruction. Hungarian NPIs, on the other hand, are universally quantified, and cannot reconstruct if they appear higher than their licensor.

4.2.1 English

To reiterate, if English NPIs are existentially quantified, we expect that they cannot be licensed while scoping above their licensor at LF. Therefore, on the surface they can only appear at a higher position than their licensor if they ultimately reconstruct, or, in our current model of syntax, moved there through `P-move`. In what follows, I first discuss subject positions as well as reconstruction from subject positions (A-chain reconstruction), and then move onto topic and reconstruction from topic positions (Ā-reconstruction).

The observable facts regarding English NPI *any*-pronouns in subject position is as follows. Subjects headed by English NPIs are not acceptable if their licensor is in a lower position (7) in the sentence. There does not seem to be a blanket ban on subject NPIs, however; (8) shows that a subject can be headed by an NPI as long as its licensor is at a higher position – in this case, the licensor is matrix negation.

(7) * Anybody did not arrive.

(8) I don't believe that anybody has arrived.

If we assume that English NPIs are existentials that must be licensed in the scope of a viable licensor, then this data suggests that NPIs cannot reconstruct from subject position. In fact, A-chain reconstruction is often absent: sentence (9) shows, for example, that the subject *everyone* cannot be interpreted below negation, presumably because it could not reconstruct.[3]

(9) Everyone seems not to be there yet. (Boeckx, 2001) $\forall \gg \neg, {}^{*}\neg \gg \forall$

However, there is one data point that is a potential problem to the generalization. Sentence (10) shows an NPI embedded in a relative clause that modifies the subject; even though it precedes negation on the surface, it still appears to be licensed. Sentence (11) demonstrates that *anything* is truly an NPI; the sentence becomes unacceptable when negation is missing. In what follows, I argue that (10) is an instance of a subject undergoing reconstruction.

(10) A doctor who knows anything about acupuncture wasn't available. (Linebarger (1980))

(11) * A doctor who knows anything about acupuncture was available.

There are some cases where A-chain reconstruction is attested (May, 1977; Boeckx, 2001). For example, (12) is ambiguous, because the subject *some politician*, can be interpreted either to be at a higher or lower scope than *likely* (May, 1977). Once

[3] Existentially quantified *someone* also cannot reconstruct in the same context, but the fact that *someone* is a Positive Polarity Item (PPI) might restrict reconstruction to begin with.

the relative clause headed by such a subject contains an NPI such as in (13), the only viable interpretation for the subject is a low one, because that is the only way for the embedded NPI to be licensed.

(12) A politician is likely to address John's constituency. (May, 1977)

a. $\exists \gg$ likely

b. likely $\gg \exists$

(13) A politician who has any integrity is not likely to address John's constituency.

a. * $\exists \gg$ likely

b. likely $\gg \exists$

Diesing (1992) makes similar observations about the ambiguous reading of some types of subjects. Sentence (14) can have two possible interpretations, an existential and a generic one. Diesing (1992) proposes that the existential reading is derived from what she calls LF-lowering – where the subject lowers from Spec-IP to Spec-VP, and thus is interpreted low at LF. This is the same type of mechanism that May (1977) used to account for the low interpretation of raised subjects.

(14) Firemen are available. (Diesing, 1992, (4a))

a. There are firemen who are available. (Existential reading)

b. It is a general property of firemen to be available. (Generic reading)

In Diesing's (1992) theory, obtaining the existential (and thus, low) interpretation of the subject has two requirements: 1) the subject must have a *weak* determiner in accordance with Milsark's (1974) classification of determiners, and 2) the predicate must be *stage-level*, in accordance with Carlson's (1977) distinction between *stage-level* and *individual level* predicates.

Milsark's (1974) classification of determiners as *strong* and *weak* works as follows. Semantically, strong determiners can only have a presuppositional reading, meaning that they presuppose the existence of the quantified Noun Phrase (NP) (15). Weak determiners, on the other hand, are ambiguous between a presuppositional (16a) and non-presuppositional interpretation (16b).

(15) Every ghost roasted marshmallows. (Diesing (1992), Chapter 3, (6a))

(16) a. Some ghosts are in the pantry, the others are in the attic. (Diesing (1992), Chapter 3, (5b))

b. There are some ghosts in my house. (Diesing (1992), Chapter 3, (5a))

Syntactically, weak determiners can appear with a subject NP with *there* insertion, and strong determiners cannot (17).

(17) From Diesing (1992), (Chapter 3, (4))

a. There is/are a/some/a few/many/three fly(flies) in my soup.

b. * There is/are the/every/all/most fly(flies) in my soup.

As for Carlson's (1977) distinction between stage-level and individual-level predicates, stage-level predicates are defined as describing a temporary state (for example, *available* is a stage-level predicate), whereas individual level predicates roughly describe something more permanent about the subject (e.g. *is intelligent*). A syntactic test for distinguishing the two types of predicates, again, is *there*-insertion: only stage-level predicates are able to take *there*-insertion (18).

(18) a. There are doctors available.

b. * There are doctors intelligent.

It should be noted that Diesing's (1992) theory is imperfect when it comes to the precise classification of predicates as stage-level and individual-level (for details, see É. Kiss (1998); Dobrovie-Sorin (1997), among others). Identifying the exact predicates that allow subject reconstruction is beyond the scope of this thesis, so I simply hypothesize that whenever subject reconstruction is allowed, an NPI embedded in the subject will also be allowed, and vice versa: NPIs that are licensed while embedded within the subject indicate that the subject reconstructs. In fact, many use NPIs as diagnostics for subject reconstruction (e.g. Sauerland and Elbourne (2002)).

This theory then explains the data in (10). The subject (*a doctor*) has a weak determiner, and the predicate (*is available*) is stage-level. This then allows the entire subject to reconstruct below sentential negation, resulting in the licensing of the embedded NPI.

(10′) A doctor who knows anything about acupuncture wasn't available. (Linebarger (1980))

Furthermore, (10) is ungrammatical when the predicate is an individual-level predicate (19).[4]

(19) * A doctor who knows anything about acupuncture was not intelligent. (Hoeksema, 2000, (61b))

Hoeksema (2000) provides data that seemingly contradicts the adopted generalization so far – but, as it turns out, many of these sentences are not clearly counterexamples. For example, Hoeksema (2000) cites (20) as a sentence where the subject does not reconstruct despite the stage-level predicate (*lying on the floor*). However, a number of native speakers I consulted judge this sentence to be grammatical, albeit odd; and variations of the sentence with the same predicate and subject were judged to be better (21).

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[4] It is hard to test whether subjects with strong determiners similarly block NPI-licensing. All strong determiners seem to independently license *any*-pronouns, either in their NPI or free-choice variety (1), and thus it is impossible to determine whether the lack of reconstruction blocks NPI-licensing by sentential negation.

(1) Every/all/most doctor(s) who knew anything about acupuncture was/were available.

(20) * A fundamentalist yogi who had any interest in philosophy wasn't lying on the floor.
(Hoeksema, 2000, (62))

(21) ? A yogi who has taught any yoga classes wasn't lying on the floor.

Hoeksema (2000) also provides an example of a sentence where despite of the individual-level predicate, the subject still seems to reconstruct (22). It is not convincing, however, that the predicate *exist* is in fact an individual-level predicate. For one, it can take *there*-insertion (23), which identifies it as stage-level predicate.

(22) A good solution to any of these problems doesn't exist.
(Hoeksema, 2000, (63a))

(23) There exists a solution to this problem.

While this reconstruction-based explanation seems to successfully account for the cases where existential NPIs in subject positions are licensed, a new contradiction arises. Now, the ungrammaticality of subjects headed by NPI *any*- NPs is unexplained – namely, it is unclear why they should not be able to reconstruct. Independent tests suggest that *any* is not a strong determiner; for example, it can take a *there* expletive (24).

(24) There isn't any ghost in the pantry.

If *any* determiners are weak, as (24) suggests, *any NPs* should be able to reconstruct from a subject position and licensed by negation – yet, they are not (7). To my knowledge, there is no satisfactory account to this puzzle. In the meantime, I simply stipulate that *any*- cannot have a `P-move` feature. This means that a phrase headed by an *any*- NPI cannot undergo `P-move`, but nevertheless it can occur in a phrase headed by something else that does undergo `P-move`.

(7′) * Anybody did not arrive.

Next, I move on to topics and Ā-reconstruction. Topics reconstruct in all cases.[5] For example, in (25) *some girl* can be interpreted to be in the scope of *every boy*. It must not have been the case that *every boy* raised higher, because QR often cannot cross clause boundaries (26), and topicalization acts as an island to movement.

(25) Visit some girl, Bill said every boy did. (Sportiche, 2006, (11))

(26) Some man said every woman visited him. $\exists \gg \forall$, $*\forall \gg \exists$

It is unexpected then that NPIs heading topics are never licensed (27). This could be due to semantic reasons; topics are expected to be referential, but NPIs are inherently non-referential. For example, *nobody*, which is a non-referential pronoun, cannot raise to topic either (28).

(27) * Any book, Susan did not find.

(28) * Nobody, he said he saw.

As expected, when the NPI is in a relative clause headed by the topic, it is licensed (29-30).

(29) A solution that is any better, we couldn't find. (Hoeksema (2000), (35a))

(30) A fireman who has ever used this equipment, we don't have available right now. (Hoeksema (2000), (35b))

This discussion of English NPIs as subjects or topics has been restricted to cases where the licensor is sentential negation. When the licensor is non-negative, subject NPIs are freely licensed (31-33). In these cases, the NPI is licensed by a c-commanding non-veridical or monotone decreasing operator that takes a higher position, possibly in C (Progovac, 1994). The availability of these sentences further shows that the unavailability of subject NPIs when licensed by negation is not due to a ban on NPIs as subjects in general, but must be due to their failure to be licensed by a lower licensor.

[5] Or more precisely, they always undergo `P-move` in the current framework. I keep the question of how the semantics of topic interpretation is derived from the derivation open.

(31) Was anybody at the party?

(32) If anybody wants to borrow my movies, they are welcome to.

(33) Every car that any police officer stopped that day was following the rules.

The English data on NPIs in subject and topic positions show that in general, English NPIs have to be in the scope of their licensor at LF. For the most part, this is identical to their PF position; the only time they could be at a higher position than their licensor on the surface when they were embedded in a phrase that reconstructs under the licensor at LF. As I have summarized in this section, reconstruction from subject position under certain conditions and from topic positions have been observed and analyzed in May (1977); Diesing (1992); Sportiche (2006). This supports the thesis that English NPIs are existential quantifiers that must be c-commanded by a licensor at LF.

4.2.2 Hungarian

The hypothesis is that Hungarian NPIs are universal quantifiers that must outscope their licensing negation. As outlined in Chapter 3, these types of NPIs undergo QR, either covertly (only at LF) or overtly (at both LF and PF), and their landing site is the specifier of NegP. Consequently, I expect to see two crucial types of data. The first is that on the surface the NPI can appear at a higher position than negation without having to reconstruct. The second is that NPI embedded in another phrase cannot be licensed, unless it can be extracted out of the NP and moved to NegP by itself.

The data in (34) and (35) show evidence for the first point, since in these sentences NPI precedes negation. This corresponds to the NPI being in a higher position than negation, at least in the PF tree. To argue that this surface position is the overt manifestation of the NPI undergoing QR, I also have to show that the NPI does not reconstruct from this high position.

(34) *Sen-ki nem látta a film-et.*
NPI-who NEG see-PST.3SG the movie-ACC
'Nobody saw the movie.'

(35) *Sem-milyen film-et nem lát-tam.*
NPI-what.kind movie-ACC NEG see-PST.3SG
'I didn't see any kind of movie.'

The general consensus about Hungarian quantifiers is that they do not reconstruct – they can undergo overt QR, and thus their high surface position matches their LF scope (Surányi, 2002; É. Kiss, 2010). The only source I am aware of that discusses the possibility of reconstruction in Hungarian is Brody and Szabolcsi (2003). However, even in their framework, there could not possibly be reconstruction in (34) or (35).

According to Brody and Szabolcsi (2003), negation blocks reconstruction. In (36), both scope interpretations are possible, but in (37), only the surface scope is available, because negation has blocked reconstruction.

(36) *Vala-mi-t kölcsönad-ott minden-ki.*
some-what-ACC lend-PST.3SG every-who
(Brody and Szabolcsi, 2003, (51))

a. There was something that was lent by everybody. $\exists \gg \forall$

b. Each person lent a thing. $\forall \gg \exists$

(37) *Vala-mi-t nem ért-ett meg minden-ki.*
some-what-ACC NEG understand-PST.3SG PRT every-who
(Brody and Szabolcsi, 2003, (57))

a. There exists something that not everybody understood. $\exists \gg \neg \gg \forall$

b. * For each person, there was a thing they did not understand. $\forall \gg \exists \gg \neg$

c. * It's not the case that everybody understood something. $\neg \gg \forall \gg \exists$

d. * There is no thing that everybody understood. $\neg \gg \exists \gg \forall$

If negation indeed blocks reconstruction in Hungarian, then NPIs that precede negation can never reconstruct. This is because sentences with NPIs necessarily always contain negation. Then, the NPIs in (34) and (35) must in fact be in their LF position, scoping over negation.

The lack of reconstruction is also apparent in sentences where the NPI is embedded in another phrase that scopes over negation on the surface. If the subject was able to reconstruct and the NPI was existentially quantified, then (38) would be acceptable.[6] Additionally, contrast (38) with sentences (34) and (35), where NPI did c-command and thus scope over negation. Sentence (39) shows that the same sentence without an NPI is fine.

(38) * *Sen-ki elleni küzdelm-et nem akar-unk.*
NPI-who against fight-ACC NEG want-PRS.1PL
'We don't want a fight against anybody.'

(39) *Öt ember elleni küzdelm-et nem akar-unk.*
five person against fight-ACC NEG want-PRS.1PL
'We don't want a fight against five people.'

Furthermore, because the NPI cannot be extracted by itself from these NP structures, (40) is not acceptable. If it were to move, it would move along with the full NP (*senki elleni küzdelmet* 'fight against anybody') – and crucially, in that configuration, it would not c-command negation and have it in its scope at LF. If it does not move, then it does not outscope negation, and hence would not be licensed as a universally quantified NPI. If *senki* was an existentially quantified NPI, it should be licensed in (40).

(40) * *Nem akar-unk sen-ki elleni küzdelm-et.*
NEG want-PRS.1PL NPI-who against fight-ACC
'We don't want a fight against anybody.'

(41) *Nem akar-unk öt ember elleni küzdelm-et.*
NEG want-PRS.1PL five person against fight-ACC
'We don't want a fight against five people.'

---

[6] We cannot test NPIs embedded within a relative clause similar to the English sentence *'The doctor who knows anything about acupuncture wasn't available'*, because Hungarian NPIs have to be licensed locally.

Additionally, NPIs to the right of negation are generally licensed (42), which shows that (40) must be unlicensed because of being embedded within a DP.

(42) *Nem lát-unk sen-ki-t.*
NEG want-PRS.1PL NPI-who-ACC
'We don't see anybody.'

4.3 Fragment answers

In some languages, NPIs can stand alone as fragment answers to a wh-question. This is true, for example, in Hungarian (43a), Turkish (43d), Serbo-Croatian (43b), and Greek (43c). In other languages, on the other hand, this is not possible, such as in English (43e) and Mandarin Chinese (43f).

(43) a. *Ki-t lát-tál? Sen-ki-t.* Hungarian
who-ACC see-PST.2SG NPI-who-ACC
'Who did you see? Nobody.'

b. *Šta si kupio? Ništa.* Serbo-Croatian
what you buy NPI.thing
'What did you buy? Nothing.' (Progovac, 1994)

c. *Ti idhes? TIPOTA.* Greek
what saw.2SG NPI.thing
'What did you see? Nothing.' (Giannakidou, 2000)

d. *Ne gör-dü-n? Hiç-bir-seyin.* Turkish
what see-PST-2SG NPI-a-thing
'What did you see? Nothing.'

e. Who did you see? *Anyone. English

f. *Ni kan-dao shui? *Renhe ren.* Mandarin Chinese
you see-ASP who NPI person
'Who did you see? *Anyone.

In Giannakidou's (2000) view, this behavior corresponds to the quantifier type of these NPIs. She adopts Merchant's (2001) proposal of ellipsis, and proposes that fragment answers form the following way. A universally quantified NPI can raise to a position higher than its licensing sentential negation, then everything but the NPI gets elided, as shown in (44) for Hungarian.

(44) [$_{\text{XP}}$ *Sen-ki-t* [$_{\text{Neg}}$ ~~*nem lát-tam.*~~]] Hungarian fragment answer
NPI-who-ACC NEG see-PST.1SG
'I didn't see anybody.'

This solution also predicts that universal quantifier NPIs can appear seemingly unlicensed in other elliptical contexts, such as in disjunctives. This in fact is true in Hungarian (45). If the NPI is an existential quantifier, like in English, it cannot appear in the same disjunctive elliptical context as its Hungarian counterpart. In (46), *anybody* is only interpretable as an Free-Choice Item (FCI), but not as an NPI.

(45) *Mari-t vesz-em el, vagy senki más-t.* Hungarian
Mari-ACC take-1SG PRT or n-body else-ACC
'I'll marry Mary, or nobody else.'

(46) * I will marry Mary, or anybody else.

In earlier approaches, it was argued that NPIs of the Hungarian type have an inherently negative meaning which allows them to stand on their own (Zanuttini, 1991; Watanabe, 2004). Giannakidou's (2000) ellipsis-based approach is favorable for two reasons. First, these NPIs never contribute their own negative meaning anywhere else. If they did, they would behave more similarly to English negative quantifiers, such as *nothing* or *nobody*. For example, in English, negative quantifiers can contribute negative meaning in declaratives (47a) and questions (47b). Hungarian NPIs, on the other hand, cannot do the same (48), but must always be licensed by negation, a fact unexplained by approaches positing that these items are inherently negative.

(47) English

a. I saw nothing.

b. Did you see nothing?

(48) Hungarian

a. * *Lát-tam sem-mi-t.*
see-PST.1SG NPI-what-ACC
I saw nothing.

b. * *Lát-tál sem-mi-t?*
see-PST.2SG NPI-what-ACC
'Did you see nothing?'

Second, ellipsis requires movement before deletion, assuming Merchant's (2001) theory of ellipsis. There is already independent evidence showing that universal quantifier NPIs must be able to raise to a higher position to take scope over their licensor. Thus, a movement requirement for ellipsis is already part of the course for these types of NPIs.

One argument against the ellipsis account is that the elided part must have contained negation to license the NPI fragment, but there is no antecedent for that negation in the question posed (Watanabe, 2004). One option would be to adopt a Question under Discussion (QUD) condition on fragments (Weir, 2014); that is fragment answers make reference to the semantics of the QUD. The semantic value of the QUD is a set of possible answers, which can contain a null answer; for example, to the QUD 'Who did you see?', possible answers could be {Mary, John, Anna, none of them}. If this is so, fragment answers can recover negation in their elided content, because that is one of the possibilities derived from the semantics of the question they answer to.

Another argument that casts doubt on the movement requirement for ellipsis is the grammaticality of (49), which shows that in the right context, with negative antecedent, English *any-* NPIs are able to serve as fragment answers after all.

(49) *Context: John has returned with the shopping for the party. A and B know that he bought bread, cheese, olives, and juice, but suspect that he has forgotten something.*
A: What didn't John buy? B: Any wine. (den Dikken et al., 2000)

Data like (49), however, seems to be limited. English does not allow NPI fragment answers in other cases where it normally allows non-NPI fragments:

(50) Does Abby speak GREEK fluently? (Merchant, 2004, (84))

a. No, ALBANIAN.

b. No, she speaks ALBANIAN fluently.

(51) Doesn't Abby speak GREEK fluently?

a. * No, ANY foreign language.

b. No, she doesn't speak ANY foreign language fluently.

The same type of data sounds better in Hungarian (52-53).

(52) *ANDRIS-T kér-ted fel a tánc-ra? Nem, sen-ki-t.*
ANRIS-ACC ask-PST.2SG PRT the dance-SUBL no NPI-who-ACC
'Did you ask ANDRIS to the dance?' 'No, (I didn't ask) anybody.'

(53) *Vala-milyen hír csak jö-tt? Nem, sem-milyen.*
some-kind.of news only come-PST.3SG no NPI-kind.of
'Some kind of news must have arrived?' 'No, no kind.

A third potential problem with the ellipsis-based analysis is that it is odd to say the equivalent of the supposed semantic meaning of universal quantifiers, expressed with a positive universal quantifier (54). However, this only shows that universally quantified NPIs are not the complete equivalent of positive universal quantifiers; for one, they always require licensing due to their NPI-nature. It is then possible that they have different semantic-pragmatic behavior from positive universal quantifiers; for example, we will see in §5.2.6 that NPIs are always non-presuppositional whereas positive universal quantifiers are presuppositional.

(54) 'Who did you see?' '#It was everybody I didn't see.'

In summary, I have argued that universally quantified NPIs can serve as fragment answers, while existentially quantified NPIs cannot. The difference is explained by Merchant's (2001) and Weir's (2014) theories of ellipsis. The idea is that universally quantified NPIs raise to a higher position while having negation in their scope, and thus form fragment answers via ellipsis, whereas existentially quantified NPIs cannot do the same. Negation is recovered in the elided content because of the semantics of the QUD the fragment answers to.

4.4 Antecedent-contained Deletion (ACD)

ACD has been used to argue for the necessity of QR (Sag, 1976; May, 1985). In (55), the mystery is the exact makeup of the elided content within the relative clause. According to the principle of Parallelism, the elided VP must be syntactically identical to a pronounced antecedent VP in the discourse. However, if that is applied straight up, the elided VP contains the relative clause itself, which would lead to infinite recursion. In the standard approach, QNPs undergo QR, and thus the elided VP is a remnant after QR has already removed the QNP (Sag, 1976; May, 1985). See (56) for the proposed underlying structure of (55). A further support for this approach to ACD is that it is only possible with NPs that are quantified, and thus undergo QR (57).

(55) John read every book that Kevin did $[_{vP}\Delta]$.

(56) John [every book that Kevin did <read>]$_i$ [read t$_i$]

(57) * John read Mary's book that Kevin did.

Since existentially quantified NPIs do not undergo QR, they should not be licensed in an ACD context that would require them to raise above their licensor. This, however, becomes hard to test. If the licensor is sentential negation, the NPI could still be licensed by not raising higher then negation – just high enough so that it is out of the VP antecedent. In fact, many approaches to QR in English now assume that the first landing site for QR is the vP (Bruening, 2001; Merchant, 2003). To use the ACD test properly, the licensor must be part of the VP antecedent.

The most obvious choice is a double object construction, where the indirect object licenses the NPI (58). In an ACD construction the judgment is unclear (59), as native speakers disagreed about it. If (59) is ungrammatical, that supports the theory that English NPIs must be licensed in the scope of their licensor and here are not because they raised above it due to ACD requirements. However, if it is grammatical, it could be the case that both the direct and indirect objects have raised as argued in Bruening (2001), and thus the NPI is still licensed. In either way, the test is not that meaningful, because a sentence without the NPI indirect object also sounds odd (60), resulting in a lack of contrast that would make the test meaningful. The ungrammaticality of (60) possibly is due to pragmatic effects; the relative clause would be *Kevin did <give nobody every book>*, which does not make much sense.

(58) I gave nobody any book.

(59) ?? I gave nobody any book that Kevin did.

(60) ?? I gave nobody every book that Kevin did.

Another possibility is applying the test to constructions where the NPI is licensed by ‘without’ (61). If ‘any of the tools’ undergoes QR above the VP, then it should not be licensed anymore. This prediction is born out in the ungrammaticality of (62), confirmed by all native English speakers that I consulted.

(61) I can fix this without any of the tools.

(62) * I can fix this without any of the tools you did.

Another possibility is the case where the NPI is licensed by a negative verb, such as *refuse* (63). In this case, we expect that in the ACD construction, the VP antecedent can only be the lower VP *read x*, since if *any book* was to raise higher than *refuse*, it would not be licensed anymore. The prediction is not borne out (64), but as it turns out, *any book* in this case might not be an NPI, but instead is a free-choice item. This is demonstrated by the grammaticality of (65), where there is no NPI-licensor, yet the sentence is grammatical. A few informants said that (65) is not acceptable to them, which indicates that they only get the NPI reading of *any book*. These same informants also could only get the VP antecedent as *read x* only in (64), consistent with our expectations if English NPIs are to be existential.

(63) John refused to read any book.

(64) John refused to read any book that Kevin did.

(65) John wanted to read any book that Kevin did.

In general, initial data points toward the fact that English NPIs are in fact existentials, because they could not undergo QR past their licensor.[7]

In Hungarian, we predict that ACD is possible with NPIs, since the universally quantified NPI has to raise above negation anyways. The results are consistent with the prediction; NPIs in an ACD context are in fact possible (67).

(66) *Nem olvas-ta-m el minden könyv-et, ami-t Mari (sem).*
NEG read-PST-1SG PRT every book-ACC which-ACC Mari either
'I didn't read every book that Mari did (not).'

(67) *Nem olvas-ta-m el se-melyik könyv-et, ami-t Mari (sem).*
NEG read-PST-1SG PRT NPI-which book-ACC which-ACC either
'I read no book that Mari did (not).'

In summary, in this section I have shown that English and Hungarian NPIs diverge in the expected way in ACD contexts. English NPIs by virtue of being existential, are not subject to QR, and thus do not license ACD. Hungarian NPIs, on the other hand, undergo QR and license ACD.

4.5 Locality of licensing

One of the parameters along which NPIs differ cross-linguistically is whether they have to be licensed by a clause-mate licensor or not. In a language such as English, *any-* NPIs can be licensed long-distance. For example, in (68), the embedded NPI *anyone* is licensed by matrix negation. The same sentence is not licit in Hungarian (69), because *senki* has to be licensed by clause-mate negation.

[7] Guerzoni (2006) reports that ACD constructions such as in (64) in fact have an ambiguous reading, in order to argue for a movement-based analysis for English NPI licensing. As discussed in this chapter, there are numerous reasons to be skeptical of such accounts, and evidence based on ACD only is insufficient due to variable responses from native informants that I interviewed.

(68) Sue doesn't think that Joe would meet with anyone.

(69) * *Sue nem gondol-ja, hogy Joe találkoz-na sen-ki-vel.*
Sue NEG think-PRS.3SG that Joe meet-COND.3SG NPI-who-COM
'Sue doesn't think that Joe would meet with anyone.'

In fact, it seems that English *any-* NPIs can be licensed across an arbitrary number of clause boundaries, by any of the possible NPI-licensors (70).[8]

(70) a. Johnny didn't think that Katie saw that Linda ate anything.

b. If Laura thinks that Jim hit anyone, call the police.

c. Did you think that I would say anything?

d. Only Mary said that she wrote anything.

e. At most ten children thought that Santa would eat anything.

f. Hobbes is too tired to claim that he climbed anything.

In a quantifier-based framework, these differences are due to the different quantificational force of these NPIs and the clause-bound characteristics of QR. Universally quantified NPIs must undergo QR to be licensed, whereas existential NPIs do not. Because QR has been long believed to be clause-bound (26,71), universally quantified NPIs in the embedded clause cannot raise to matrix negation in order to be licensed. Thus, this constraint rules out sentences that feature embedded universally quantified NPIs and matrix negation, such as (69).

(26′) Some man said every woman visited him. $\exists \gg \forall$, $^{*}\forall \gg \exists$

(71) Larsson thought that Kollberg questioned every suspect Beck did. (Kennedy (1997), (19))

a. Larsson thought that Kollberg questioned every suspect Beck questioned.

b. # Larsson thought that Kollberg questioned every suspect Beck thought that Kollberg questioned.

[8] For some native speakers grammaticality deteriorates when adding more distance; this might be due to processing factors.

All that said, more recent empirical investigations question the clause-boundedness of QR (Wurmbrand, 2018). Experiments done by Anderson (2004) show two seemingly contradictory tendencies. One is that native speakers preferred no movement even to clause-bounded QR, and at the same time, speakers can access QR interpretations from tensed clauses in certain contexts. Additionally, Syrett (2015) found that QR over tensed clauses is accessible with ACD, further suggesting that QR *can* cross clause-boundaries in the appropriate pragmatic contexts.

Wurmbrand (2018) concludes, based on the new data, that QR is not inherently different from other Ā-movements such as *wh*-movement. Rather, as a covert movement, it is simply a costly operation; the longer the dependency, the more cognitively taxing it becomes. Thus, QR is not beholden to different grammatical restrictions compared to overt Ā-movement. Instead, the perceived difference is simply due to the different processing requirements of covert and overt movements.

In light of these facts, it seems that locality by itself cannot stay relevant for diagnosing the quantifier-type of NPIs as previously believed by Giannakidou (2000). Instead, I take the distinction in processing difficulty between covert and overt Ā-movement as my starting point. Because covert movement is more costly than overt movement, I expect covert QR to still be restricted by locality, and thus be clause-bound, while overt QR to be able to cross multiple phase-boundaries. Hungarian has both covert and overt QR available; and in fact, NPIs seem to be able to cross multiple clauses overtly (compare 69 to 72 and 73).

(69′) * *Sue nem gondol-ta, hogy Joe találkoz-na sen-ki-vel.*
Sue NEG think-PST.3SG that Joe meet-COND.3SG NPI-who-COM
'Sue doesn't think that Joe would meet with anyone.'

(72) *Sue sen-ki-vel*$_i$ *nem gondol-ta, hogy Joe találkoz-na* t_i.
Sue NPI-who-COM NEG think-PST.3SG that Joe meet-COND.3SG
'Sue doesn't think that Joe would meet with anyone.'

(73) *Anna sen-ki-vel*$_i$ *nem hall-otta, hogy Sue meg ígér-te,*
Anna NPI-who-COM NEG hear-PST.3SG that Sue PRT promise-PST.3SG

hogy találkoz-na t_i.
that meet-COND.3SG
'Anna didn't hear that Sue promised that she would meet with anyone.'

The behavior of Hungarian NPIs mirrors the behavior of universal quantifiers in Hungarian (É. Kiss, 1987). The universally quantified *mindenki* 'everybody' in the embedded clause can only be understood in a narrow scope relative to *valamikor* 'sometime' (74), but takes broad scope when it has moved overtly (75).

(74) *János mond-ta vala-mikor, hogy találkoz-ott minden-ki-vel.*
János say-PST.3SG some-when that meet-PST.3SG every-who-COM

a. * For each person, John said at one point that he had met with them. $\forall \gg \exists$

b. John said at some point that he had met with everyone. $\exists \gg \forall$

(75) *János minden-ki-vel mond-ta vala-mikor, hogy találkoz-ott.*
János every-who-COM say-PST.3SG some-when that meet-PST.3SG

a. For each person, John said at one point that he had med with them. $\forall \gg \exists$

b. * John said at some point that he had met with everyone. $\exists \gg \forall$

In this view, the conclusion that English *any-* NPIs must be existential still holds. English *any-* NPIs can be licensed long-distance, even when they did not move overtly like Hungarian NPIs (as demonstrated in (68) and (70)). They crucially do not behave like English universal quantifiers, which cannot undergo long distance QR with the same ease as the effortlessness of long-distance licensing for English NPIs. Moreover, overt QR like the one seen in Hungarian does not exist in English. Since I have assumed that covert movement is costly, and thus would not allow long-distance licensing, English *any-* NPIs could not have undergone covert movement. Then, they can only be licensed long-distance if they are existentially quantified.

4.6 Islands

Islands are typically used as a test to detect movement in a syntactic structure, especially wh-movement (Ross, 1986). QR, as a syntactic movement, is subject to the same constraints, though not all islands used for detecting wh-movement are applicable to QR.

For one, many islands span clause-boundaries. But as shown in §4.5, QR is often restricted to be a clause-internal operation. Such islands are for example complex NP islands (76), adjunct islands (77), and clause-internal topics (78). For NPIs that are licensed across seemingly unbounded number of phase boundaries, like in English, these islands can be used to further exclude the possibility of any movement taking place.

(76) Complex NP islands:

a. * What did John make [the claim that Mary saw t]?

b. A teacher made [the claim that each student passed the class].
$\exists \gg \forall, *\forall \gg \exists$

(77) Adjunct islands :

a. * Who did John call Mary [after he finished speaking to t]?

b. A man called Mary [after she finished speaking to each client].
$\exists \gg \forall, *\forall \gg \exists$

(78) Clause-internal topics:

a. * What$_i$ did John think that [to Irene$_j$, Jim should give t$_i$ t$_j$]]

b. A math teacher believes that [Algebra, each student should master].
$\exists \gg \forall, *\forall \gg \exists$

If an NPI is already known not to be licensed across multiple clause-boundaries, like in the case of covert QR in Hungarian, the islands discussed so far will not work as a test for movement. However, if they are also sensitive to islands that do not span multiple clause boundaries, that counts as further evidence for a QR-based account for such NPIs. Consequently, I will test Hungarian and Turkish NPIs with the islands listed in (79-81), when it is applicable for the target language.

(79) Subject islands:

a. * Which man do you consider [his visiting t] to be shocking?

b. A politician considers [his visiting each man] to be shocking. $\exists \gg \forall, *\forall \gg \exists$

(80) Coordinate structure island:

a. * What did Sam eat beans [and/or t]?

b. A student ate a slice of pizza [and/or every slice of cake]. $\exists \gg \forall, *\forall \gg \exists$

(81) Left branch islands:

a. * Whose does Susan like [t story]?

b. A teacher likes [each student's story]. $\exists \gg \forall, *\forall \gg \exists$

Another problem with using islands as a test for detecting QR in NPIs is that some type of islands might license NPIs themselves. For example, wh-islands and negative operators are such licensors. For this reason, these islands are excluded from the test.

4.6.1 English

For the most part, English *any* NPIs are not sensitive to island effects. In all the sentences below, negation licenses the NPIs.

(82) Complex NP islands

a. I do *(not) buy [pictures that are on sale anywhere].

b. I do *(not) have [the expectation that they will find anyone there]. (Collins and Postal, 2014)

(83) Adjunct islands

a. John did *(not) call Mary [at the same time as anyone else].

b. ? Mary did *(not) go to the library [after calling anybody].

(84) Clause-internal topics

a. Leslie does *(not) believe that [Irene, Jim should call at any time]. Collins and Postal (2014)

(85) Left branch islands

a. Susan does *(not) like [anybody's story].

(86) Subject islands

a. I do *(not) consider [him visiting anyone] to be shocking.

b. That Jim knows any physics is *(not) likely. (Collins and Postal, 2014)

The two types of islands that English NPIs seem to be sensitive to are complex NP islands headed by definites (87), and Coordinate Structure islands with conjunction (89).

Definites might act as an island, because they imply factivity; a definite noun presupposes existence and is referential, and NPIs being headed by definite NPs would then be simply unlicensed. Factive verbs block NPI-licensing for similar reasons as well (88).

(87) * Mary didn't meet the man who gave her any present. (Guerzoni (2006))

(88) * John didn't figure out that anybody left. (Fitzpatrick, 2005, (15))

Coordinate structure islands show mixed results. Only conjunctions, but not disjunctions block NPI-licensing (90), which suggests that the ungrammaticality is not due to the Coordinate Structure island per se, but to some other independent reason that has to do with the semantics of conjuncts. Additionally, they seem fine even in conjunction in a contrastive context (91).

(89) a. * Sam didn't eat [beans and any apple].

b. * Sam didn't eat [any apple and a slice of cake]. (Guerzoni (2006))

(90) Sam didn't eat beans [or anything].

(91) Most people eat beans and rice and beans and toast, but he doesn't eat beans and anything! (p.c. Bruening)

All in all, English *any-* NPs were shown to not be sensitive to island effects, suggesting that they truly do not have to move to be licensed.

4.6.2 Hungarian

As shown in §4.5, Hungarian overt and covert QR are subject to different locality conditions. Covert QR is clause-bound, whereas overt QR is not – so, different island tests are relevant to each type of QR. In any case, island restrictions uniformly show that movement *is* required to ensure NPI-licensing, which is further support for the universal quantifier nature of Hungarian NPIs.

Some of the island phenomena discussed previously do not hold for Hungarian. Hungarian Ā-movement does not have subject island constraint, as shown in É. Kiss (1987). Sentence (92a) and (92b) show that long-distance focus- and *wh*-movement can be extracted from the embedded subject. The same is true with NPIs (92c).

(92) Subject island

a. *János-sal*$_i$ *szeret-né-m, ha a találkozás t*$_i$ *sikerül-ne.*
János-COM like-COND-1SG if the meeting succeed-COND
'I would like it if the meeting with János would succeed.'

b. *Ki-vel*$_i$ *szeret-né-m, ha a találkozás t*$_i$ *sikerül-ne?*
who-COM like-COND-1SG if the meeting succeed-COND
'With whom would I like it if the meeting with would succeed?'

c. *Sen-ki-vel*$_i$ *nem szeret-né-m, ha a találkozś t*$_i$ *sikerül-ne.*
NPI-who-COM NEG like-COND-1SG if the meeting succeed-COND
'I wouldn't like it if the meeting with anyone would succeed.'

Complex NP islands and adjunct islands span clause-boundaries. Because of this, they can only be used to test overt, long-distance QR, and are not applicable for covert QR. Sentence (93a) and (94a) show that Hungarian Ā-movement is in fact subject to these island constraints, and (93b) and (94b) show that long-distance, overt NPI-movement behaves the same way.

(93) Complex NP island

a. * *János ki-t*$_i$ *mond-ta [az-t, hogy lát-ott t*$_i$*]?*
János who-ACC say-PST.3SG that-ACC that see-PST.3SG
'Who did János say the thing that he saw?'

b. * *János sen-ki-t$_i$ nem mond-ta [az-t, hogy lát-ott t$_i$].*
János NPI-who-ACC NEG say-PST.3SG that-ACC that see-PST.3SG
'János didn't say the thing that he saw anybody.'

(94) Adjunct island

a. * *Ki$_i$ indul-unk el, [a-mikor meg érkez-ett t$_i$]?*
who depart-PRS.3PL PRT that-when PRT arrive-PST.3SG
'We depart when who has arrived?'

b. * *Sen-ki$_i$ nem indul-unk el, [amíg meg érkez-ett t$_i$].*
NPI-who NEG PRT until PRT arrive-PST.3SG
'We are not departing until anybody/nobody has arrived.'

I have assumed that when the NPI appears in-situ, it undergoes covert QR to be licensed. Covert QR in Hungarian is clause-bound; because of that, the only island effects that in principle could be tested are left-branch island and the coordinate structure island.

I start with the discussion of left-branch island. Hungarian expresses possessives in two ways. In one case, the Hungarian possessor has a dative case in it, and there is a separate determiner before the possessed object (95). In the second case, the Hungarian possessor has a nominative case, and there is no other determiner before the possessed object (96). These two constructions behave differently when it comes to possessor extraction.

(95) *János-nak a kabát-ja*
János-DAT the coat-POSS
'John's coat'

(96) *János kabát-ja*
János-NOM coat-POSS
'John's coat'

As shown in Szabolcsi (1994, 2006), the first type of possessive construction does not behave like an island (97); extraction is freely possible from it. The second type, however does not allow it (98). The possessed object would have to pied pipe along with the possessor (99) to form a grammatical sentence.

(97) *Ki-nek$_i$ szeret-i Mari [t$_i$ a könyv-é-t]?*
who-DAT love-3SG Mari the book-3SG.POSS-ACC
'Whose book does Mari like?'

(98) * *Ki szeret-i Mari [t$_i$ könyv-ét]?*
who$_i$ love-3SG Mari book-3SG.POSS-ACC?
'Whose book does Mari like ?'

(99) *Ki könyv-ét szeret-i Mari?*
who book-3SG.POSS-ACC love-3SG Mari?
'Whose book does Mari like?'

Hungarian NPIs display the same pattern when the NPI undergoes overt movement (100).

(100) a. *Sen-ki-nek$_i$ nem szeret-i Mari [t$_i$ a könyvé-t].*
NPI-who-DAT NEG love-3SG Mari the book-3SG.POSS
'Mari doesn't love anybody's book.'

b. * *Sen-ki$_i$ nem szeret-i Mari [t$_i$ könyv-é-t].*
NPI-who-NOM NEG love-3SG Mari book-3SG.POSS-ACC
'Mari doesn't love anybody's book.'

When they undergo covert QR, on the other hand, they do not seem to be sensitive to left-branch island in either possessive construction (101). A reason might be that the possessed item always pied pipes along with the NPI when it undergoes covert movement.

(101) a. *Nem szeret-i Mari [sen-ki-nek a könyv-é-t].*
NEG love-3SG Mari NPI-who-DAT the book-3SG.POSS-ACC
'Mari doesn't like anybody's book.'

b. *Nem szeret-i Mari [sen-ki könyv-é-t].*
NEG love-3SG Mari NPI-who-NOM book-3SG.POSS-ACC
'Mari doesn't like anybody's book.'

In the end, this leaves only coordinate structure constraint as a viable island test for covert QR. Hungarian NPIs are sensitive to them, whether the coordinate structure features disjunction or conjunction (102-103), suggesting that Hungarian NPIs undergo movement. This contrasts with the English data on coordinate structure constraints, as English NPIs were not sensitive to either disjunctives or conjunctives in some contexts.

(102) * *Jancsi nem eszik [bab-ot és/vagy sem-mi-t].*
Jancsi NEG eat bean-ACC and/or NPI-what-ACC
'Jancsi doesn't eat beans and/or anything.'

(103) * *Jancsi nem eszik [sem-mi-t és/vagy bab-ot].*
Jancsi NEG eat NPI-what-ACC and/or bean-ACC
'Jancsi doesn't eat anything and/or beans.'

Moreover, in Hungarian NPIs can be in in coordinate structures as long as they are in *both* coordinates (104-105). This mirrors the fact that *wh* extraction is possible from conjuncts as long as they are extracted from both (106). Thus, the grammaticality of (104) and (105), but not of (102) and (103) is then further evidence that NPIs do have to undergo movement in Hungarian to be licensed.

(104) *Jancsi nem eszik [sem-mi zöld-et és/vagy sem-mi kék-et].*
Jancsi NEG eat NPI-what green-ACC and/or NPI-what blue-ACC
'Jancsi doesn't eat anything green or anything blue.'

(105) *Jancsi nem [találkozik sen-ki-vel és/vagy beszél sen-ki-vel].*
Jancsi NEG meet NPI-who-COM and/or talk NPI-who-COM
'Jancsi doesn't meet with anyone and doesn't talk to anyone.

(106) Who$_i$ did you [meet with t$_i$ and talk with t$_i$]?

In summary, I have shown that Hungarian NPIs are sensitive to island constraints. This supports my hypothesis that Hungarian NPIs are universal quantifiers and undergo QR to be licensed.

4.7 Summary of the chapter

In this chapter, I have presented evidence to argue that the variety in the syntactic behavior of NPIs point toward a quantifier-based typology. NPIs that are universally quantified can be in a position that scopes higher than their licensor on the surface, they can be fragment answers to questions, they can participate in ACD structure, they must be licensed locally, and they are sensitive to island effects. Existentially quantified NPIs have the exact opposite distribution.

I have particularly focused on English and Hungarian NPIs. Table 4.1 summarizes my findings regarding how NPIs in these languages fare when applying these tests. As the table indicates, English NPIs were shown to be existentially quantified, whereas Hungarian and Turkish NPIs were shown to be universally quantified.

	English	Hungarian
Pre-negation position	$\exists$	$\forall$
Fragment answers	$\exists$	$\forall$
ACD	$\exists$	$\forall$
Locality requirement	$\exists$	$\forall$
Island sensitivity	$\exists$	$\forall$

Table 4.1: Summary table of how English, Hungarian NPIs fare for each test

Chapter 5

SEMANTIC EVIDENCE

In this chapter, I discuss the different semantics-based diagnostics to determine the quantificational force of NPIs. The overall conclusion of these semantic tests is that their conclusions are not as straightforward as the conclusions of the syntactic tests. One main difficulty is assessing the possible interpretations a native informant can get, and other difficulties involve an incomplete understanding of how these diagnostics actually work.

I first discuss a test designed to detect the relative scope of NPIs and negation by introducing other quantificational elements, to my knowledge first used by Shimoyama (2011) for this purpose. Here, I report data collected from English and Hungarian native speakers. Though there are potential confounds, such as an intervention effects in the licensing relation, after taking these confounds under consideration, the results still suggest that English NPIs are existentials, and Hungarian NPIs are universals.

I then move on to a series of tests used in Giannakidou (2000) for Greek, and in others, such as Surányi (2006) for Hungarian. I argue that many of these tests and their conclusions are not as clear-cut as presented in these previous works. I specifically reinterpret Surányi's (2006) conclusions that Hungarian NPIs are ambiguous between universal and existential readings, by showing that there are a number of conceptual and empirical problems with the diagnostics to begin with.

In the end, I argue that more and better understood semantic diagnostics are needed to investigate the quantificational force of NPIs. Until then, we necessarily have to rely on syntactic behavior and assumptions about how quantification, and specifically QR, is diagnosable in the syntax – which I did in Chapter 4.

5.1 Experiment: quantificational adverbs

To test whether a quantifier-based typology in fact works for NPI-licensing, I adopt a test that was originally used by Shimoyama (2011) for Japanese $-mo$ NPIs. In this section I present a modified version of her test, and apply it to English and Hungarian.

If the quantifier-based approach is correct, then there should be a difference in interpretation when another quantificational element, such as an adverb (Q_{adv}), is introduced in a sentence with negation and NPIs. The differences depend on if the adverb does not induce intervention effects in the NPI-licensing relationship. The requirement against any potential intervention effect is necessary because the crucial data point comes from cases where the adverb can scope between negation and the NPI: while the interpretation of $\forall \gg \neg$ and $\neg \gg \exists$ are indistinguishable, $\forall \gg Q_{adv} \gg \neg$ and $\neg \gg Q_{adv} \gg \exists$ are not. Thus, in discussing the results of this test in the different languages, I will also always discuss the possibility that Q_{adv} is an intervener.

5.1.1 General logic and methods

The logic of the test then works as follows. Depending on the relative scope of negation and Q_{adv}, there are two cases to consider. If Q_{adv} scopes above negation and (1a) is an available reading, then that is support for the NPI being a universal quantifier. On the other hand, if negation scopes over the quantifier and (2a) is an available reading, then it means that the NPI is an existential quantifier. Notice that readings (1b) and (2b) would not give decisive evidence for the quantifier type in either direction, because they can be expressed equivalently using either a universal or existential quantifier.

(1) $Q_{adv} > \neg$

  a. $NPI_{\forall} > Q_{adv} > \neg$

  b. $Q_{adv} > NPI_{\forall} > \neg = Q_{adv} > \neg > NPI_{\exists}$

(2) $\neg > Q_{adv}$

a. $\neg > Q_{adv} > NPI_{\exists}$

b. $\neg \gg NPI_{\exists} \gg Q_{adv} \gg= NPI_{\forall} \gg \neg \gg Q_{adv}$

The next task is to decipher the possible readings of a sentence that contains the operators negation, Q_{adv}, and NPI – the possibilities are the operators' relative scope to each other. Since such sentences can get difficult to interpret for native speakers, I use illustrations, inspired by Shimoyama (2011), that depict possible scenarios of the sentence, and ask participants to choose all scenarios that they could interpret as true given the sentence.

To demonstrate how these situations work, let us look at a more concrete example. Let us assume that the test sentence is (3), and that the Q_{adv} 'usually', scopes over negation. Since the adverb scopes over negation, the two possible readings are (1a) and (1b).

(3) John usually does not go to any of his classes.

Participants were given the tables in Table 5.1 to choose the situations that they accept as true for (3). Assuming that 'usually' denotes a frequency corresponding to 'more than half of the time', Tables 5.1a and 5.1b show situations that might be evaluated as true for (3), depending on whether the NPI is an existential or a universal, and whether the Q_{adv} is an intervener or not. Table 5.1c is added as a filler; no reading should correspond to it. In the world that the tables depict, John has a schedule where he has English, Math, and History classes on Mondays, Wednesday, and Fridays. Moving forward, I will refer to the situations depicted in Tables 5.1a, 5.1b, and 5.1c as Situation A, Situation B, and Situation C.

	Monday	Wednesday	Friday
English	✓		
Math		✓	
History			✓

(a) Situation A: *For each class, John rarely goes to them. (He goes to each class once a week only).*

	Monday	Wednesday	Friday
English	✓		
Math	✓		
History	✓		

(b) Situation B: *It is rare for John to go to classes. (He only goes to classes on Monday, and skips the rest of the week).*

	Monday	Wednesday	Friday
English	✓	✓	✓
Math			
History			

(c) Situation C: *John went to all his English classes during the week, but skipped all the other classes.*

Table 5.1: Tables to interpret sentences where $Q_{\text{adv}} \geq$ half of the time

In Situation A, John goes to English class only on Mondays, Math class only on Wednesday, and History class only on Fridays. He skips his classes on the other days. This table thus corresponds to a reading where "for all of his classes, John usually does not go to them", or in a formal notation, the relative scope of the three operators is

$NPI \gg Q_{adverb} \gg \neg$ (1a). As a reminder, this reading is only possible if the NPI is a universal quantifier. Crucially, this situation is not compatible with the reading $Q_{adverb} \gg \neg \gg NPI$ – or in lay terms, "usually it is the case that there is no class that John attends", making the availability of Situation A to be a unique identifier for a universal quantifier reading (1a).

In Situation B, on the other hand, John attends all his classes on Mondays, but then skips them for the rest of the week. This situation corresponds to the reading where "usually, for all his classes, John does not attend them", or "$Q_{adverb} \gg NPI \gg \neg$" (1b), where the NPI is a universal quantifier. This reading is equivalent to "usually, there does not exist a class that John attends", or $Q_{adverb} \gg \neg \gg NPI$, where the NPI is an existential. Furthermore, this situation also entails the reading in (1a) – if John does not attend any classes most days, then it is necessarily true that for each of his classes, he rarely attends them. Because this situation is compatible with all possible readings, it should always be chosen as true. If it is the only situation chosen (that is, Situation A is not chosen), then there are two possibilities. One is that that NPI is in fact a universal quantifier, but Situation A is not available because Q_{adv} is an intervener. The other possibility is that the NPI is simply an existential, regardless of whether the adverb is an intervener or not.

Table 5.2 summarizes all the above by indicating which readings are possible for each of the two possible situations.

	Situation A	Situation B
$Q_{adv} \gg \neg \gg \mathrm{NPI}_{\exists}$		✓
$Q_{adv} \gg \mathrm{NPI}_{\forall} \gg \neg$		✓
$\mathrm{NPI}_{\forall} \gg Q_{adv} \gg \neg$	✓	✓

Table 5.2: Summary of reading-situation correspondence when $\mathrm{Q}_{\mathrm{adv}} \gg \neg$

What if negation scopes over Q_{adv}? Then now the two possible readings are (2a) and (2b), repeated here:

(2a′) $\neg > Q_{adverb} > NPI_{\exists}$

(2b′) $Q_{adverb} > \neg > NPI_{\exists} = Q_{adverb} > NPI_{\forall} > \neg$

With negation scoping over the adverb, Situation A now corresponds to the reading where "for each of his classes, it is not the case that John attends any of them usually", or $NPI \gg \neg \gg Q_{adv}$ (5.1.1), where the NPI is a universal. This is equivalent to $\neg \gg NPI \gg Q_{adv}$, where the NPI is an existential. Since this reading is compatible with the NPI being either existential or universal, its availability will not be informative in answering our question on the quantification force of the NPI.

Situation B is again true for all possible readings, including the reading that Situation A does not work with: "it is rare (not usual) that there exists a class that John attends", or $\neg \gg Q_{adv} \gg NPI$ (5.1.1). With this reading, the NPI must be existential. Because Situation B is expected to always be chosen regardless of reading, the test is only informative *in the absence* of the possibility of Situation A; that is, when negation outscopes the adverb, we can deduce that the NPI is existential only if Situation A is not chosen to be true. Usually though, if the NPI is existential, we would expect both $\neg \gg NPI_{\exists} \gg Q_{adv}$ and $\neg \gg Q_{adv} \gg NPI_{\exists}$ to be available readings, which would make both Situations be possible. In these cases, it will be important to also consider the word order and possible LF derivations to get a more informative answer.

Table 5.3 summarizes the possible readings for each situation, when negation scopes over the adverb.

	Situation A	Situation B
$\neg \gg \mathrm{NPI}_{\exists} \gg Q_{adv}$	✓	✓
$\mathrm{NPI}_{\forall} \gg \neg \gg Q_{adv}$	✓	✓
$\neg \gg Q_{adv} \gg \mathrm{NPI}_{\exists}$		✓

Table 5.3: Summary of reading-situation correspondence when $\neg \gg \mathrm{Q_{adv}}$

To make the discussion above clear, Figure 5.1 summarizes the ways one could interpret all possible test results. If Q_{adv} outscopes negation, and Situation A is chosen, then the NPI must be a universal. If it is not chosen, then the NPI is either an existential, or the NPI is a universal, but the adverb is an intervener. If negation outscopes

Q_{adv}, and situation A is *not* an available reading, then the NPI is an existential, and the adverb is not an intervener. If Situation A is an available reading, however, then there is no conclusion to be made about the quantifier type of the NPI: it can be either existential or universal.

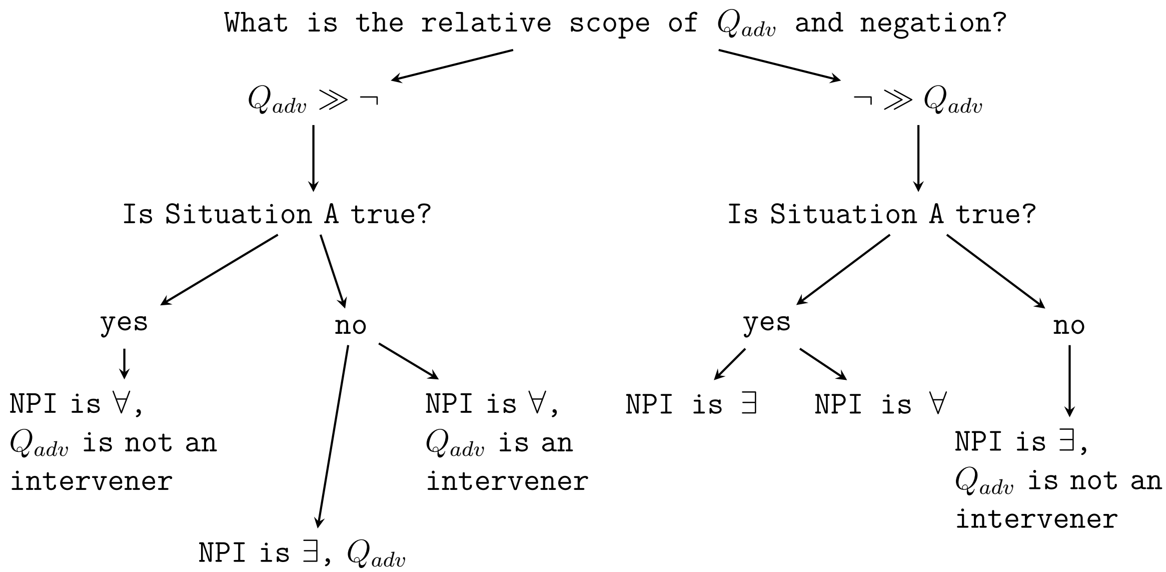


Figure 5.1: Flowchart summarizing the interpretation of potential results in the adverb scope test

I collected data from native informants recruited from LinguistList: for English (n=17) and for Hungarian (n=7). They were first asked a series of questions meant to evaluate the relative scope that certain adverbs take with negation. They were then presented with a series of sentences with the adverbs, negation, and NPI in various positions in the sentence (the possibilities depended on the particular language). Participants then had two tasks: they had to rate the grammaticality of the sentence on the scale of 1 to 5, and then were asked to choose from the situations depicted in Table 5.1, if they rated the sentence least 4.

When the Q_{adv} corresponds to a frequency of less than half of the time, the participants were given tables as in Table 5.4. The readings these situations correspond to are the same as in the above discussion.

	Monday	Wednesday	Friday
English	✓	✓	
Math		✓	✓
History	✓		✓

(a) Situation A: *For each class, John to them most of the time. (He skips each class once a week only).*

	Monday	Wednesday	Friday
English	✓	✓	
Math	✓	✓	
History	✓	✓	

(b) Situation B: *Most days, John attends his classes. (He only skips classes on Friday, and attends the rest of the week).*

	Monday	Wednesday	Friday
English	✓	✓	✓
Math	✓	✓	✓
History			

(c) Situation C: *John goes to all his English and Math classes during the week, but skips all of History.*

Table 5.4: Tables to interpret sentences where $Q_{\text{adv}} \leq$ half of the time

In what follows, I present my findings and interpretation of the results for English and Hungarian.

5.1.2 English

The adverbs tested in English are *usually*, *often*, and *sometimes*. Sauerland (2003) uses the following test to determine the relative scope of adverbs to negation. Consider the sentence in (4). Assuming that *usually* describes a frequency of action that takes place more than half the time, *not usually* might mean the same as 'half of the time'. Then the clarifying follow-up to the first sentence would only be felicitious if the 'not usually' ($\neg >$ *usually*) reading is available. Since the clarification is not felicitous, the implication is that the scope of adverb and negation is fixed as *usually* $> \neg$.

(4) Tom usually doesn't follow. (# In fact, half of the time, he doesn't follow.)
Sauerland (2003), (3b)

The test has the pitfall that the clarifying conjunction *in fact* can be construed as either a strengthening of the first sentence, or as leading into a contradiction to the first sentence. The real question thus is whether the truth value expressed in the follow-up matches the truth-value of the first sentence: if it does, then the scope is $\neg \gg$ *usually*, if it does not, then it is *usually* $\gg \neg$. This type of judgment can become hard to judge for native speakers.

Another diagnostic test is found in Jackendoff (1971). According to him, *often* can refer to specific instances, as demonstrated in (5) by the felicitousness of the follow-up sentence, while *not often* cannot (6). When the adverb scopes over negation, as in (7), the follow-up is felicitous the same way as in (5).

(5) Often, demonstrators are arrested. (On those occasions, the police works overtime.)

(6) Not often are demonstrators arrested. (#On those occasions, the police works overtime/is told to ignore them.)

(7) Often, demonstrators aren't arrested. (On those occasions, the police is told to ignore them.)

I apply both tests to determine the relative scope of the various adverbs and negation in sentences (8-10).[1] Based on the results, the scope of adverbs relative to negation reflects the surface word order.

(8) Usually

a. Usually Jamie doesn't eat breakfast. $Q_{adv} \gg \neg$

[1] I am not including the results for the word order where the adverb is sentence-final. For this word order, as first observed in Lasnik (1972), the scope of adverb relative to negation is largely dependent on intonation. Because of this, the results were mixed, and it would be hard to evaluate when adding an NPI.

i. # In fact, half of the time, she doesn't eat breakfast.

ii. On those occasions, she has a big lunch.

b. Jamie usually doesn't eat breakfast. $Q_{adv} \gg \neg$

i. # In fact, half of the time, she doesn't eat breakfast.

ii. On those occasions, she has a big lunch.

c. Jamie doesn't usually eat breakfast. $\neg \gg Q_{adv}$

i. In fact, half of the time, she doesn't eat breakfast.

ii. # On those occasions, she has a big lunch.

(9) Often

a. Often Jamie doesn't eat breakfast. $Q_{adv} \gg \neg$

i. # In fact, half of the time, she doesn't eat breakfast.

ii. On those occasions, she has a big lunch.

b. Jamie often doesn't eat breakfast. $Q_{adv} \gg \neg$

i. # In fact, half of the time, she doesn't eat breakfast.

ii. On those occasions, she has a big lunch.

c. Jamie doesn't often eat breakfast. $\neg \gg Q_{adv}$

i. In fact, half of the time, she doesn't eat breakfast.

ii. # On those occasions, she has a big lunch.

(10) Sometimes

a. Sometimes Jamie doesn't eat breakfast. $Q_{adv} \gg \neg$

i. # In fact, more than half of the time, she doesn't eat breakfast.

ii. On those occasions, she has a big lunch.

b. Jamie sometimes doesn't eat breakfast. $Q_{adv} \gg \neg$

i. # In fact, more than half of the time, she doesn't eat breakfast.

ii. On those occasions, she has a big lunch.

c. * Jamie doesn't sometimes eat breakfast.

The test sentences were all similar to (11). All variation lay in word order and the chosen adverb (*usually*, *often*, or *sometimes*).

(11) Usually/Often/Sometimes, Oliver doesn't go to any of his classes.

Tables 5.5 and 5.6 summarize the results. The sentences are coded based on their surface word order; for example, *usually Oliver doesn't go to any of his classes* is coded as *usually S* NEG *V NPI*. Data were excluded according to the following criteria: only filled answers were taken into consideration, and I excluded results that contained a choice of Situation C (so when a participant chose all situations, their answer got excluded), and excluded replies where the informant judged the sentence to be less than 4 grammatical. The average grammaticality rating for all of these sentences was greater than 3.5 on the scale of 1 to 5.

sentence	Situation A	Situation B	Situation A and B
usually S NEG V NPI	1	8	0
often S NEG V NPI	0	8	0
sometimes S NEG V NPI	0	11	0
S *usually* NEG V NPI	0	12	0
S *often* NEG V NPI	0	7	0
S *sometimes* NEG V NPI	0	10	1

Table 5.5: English results where $Q_{adv} \gg \neg$

When the adverb scoped over negation, participants tended to choose only Situation B as a valid interpretation of the given sentence. There were only two instances where an informant also chose Situation A, which I take to be insignificant enough to consider it to be simple error. This suggests two possibilities: either that the NPI is existential or that the NPI is a universal and the adverb is an intervener in NPI-licensing.

sentence	Situation A	Situation B	Situation A and B
S NEG *usually* V NPI	1	7	1
S NEG *often* V NPI	0	4	2

Table 5.6: English results where $\neg \gg Q_{adv}$

When negation scoped over the adverb, participants were more mixed about their answers. However, compared to the results for Hungarian (Tables 5.8 and 5.9), these numbers are still more skewed toward only Situation B to the exclusion of Situation A. This suggests that the NPI is existential, and the adverbs do not act as interveners. Notice however that sentences with *often* in general got very few interpretable answers, and thus conclusions based on the data are necessarily limited – they are suggestive rather than definitive. If we are to accept them as informative enough evidence, though, they are pointing toward the conclusion that English NPIs are existential, in line with the syntactic evidence listed earlier.

5.1.3 Hungarian

In Hungarian, two adverbs with similar meanings were determined to bear different scope qualities: *általában* 'usually' scopes above negation regardless of word order, whereas the scope relation of *gyakran* 'often' and negation mirrors the surface order. This contrast is demonstrated in (12) and (13).

(12) Usually

a. *Általában János nem megy be az órá-i-ra.*
usually János NEG go PRT the class-POSS.3SG-onto
'John usually doesn't go to his classes.'

i. # In fact, half the time he doesn't go to class.

ii. Those times, you can find him in the library.

b. *János általában nem megy be az órá-i-ra.*
János usually NEG go PRT the class-POSS.3SG-onto
'John usually doesn't go to his classes.'

i. # In fact, half the time he doesn't go to class.

ii. Those times, you can find him in the library.

c. *János nem megy be általában az órá-i-ra.*
János NEG go PRT usually the class-POSS.3SG-onto
'John usually doesn't go to his classes.'

i. # In fact, half the time he doesn't go to class.

ii. Those times, you can find him in the library.

d. *János nem megy be az órá-i-ra általában.*
János NEG go PRT the class-POSS.3SG-onto usually
'John usually doesn't go to his classes.'

i. # In fact, half the time he doesn't go to class.

ii. Those times, you can find him in the library.

(13) Often

a. *Gyakran János nem megy be az órá-i-ra.*
often János NEG go PRT the class-POSS.3SG-onto
'John often doesn't go to his classes.'

i. # In fact, half the time he doesn't go to class.

ii. Those times, you can find him in the library.

b. *János gyakran nem megy be az órá-i-ra.*
János often NEG go PRT the class-POSS.3SG-onto
'John often doesn't go to his classes.'

i. # In fact, half the time he doesn't go to class.

ii. Those times, you can find him in the library.

c. *János nem megy be gyakran az órá-i-ra.*
János NEG go PRT often the class-POSS.3SG-onto
'John usually doesn't go to his classes.'

i. In fact, half the time he doesn't go to class.

ii. # Those times, you can find him in the library.

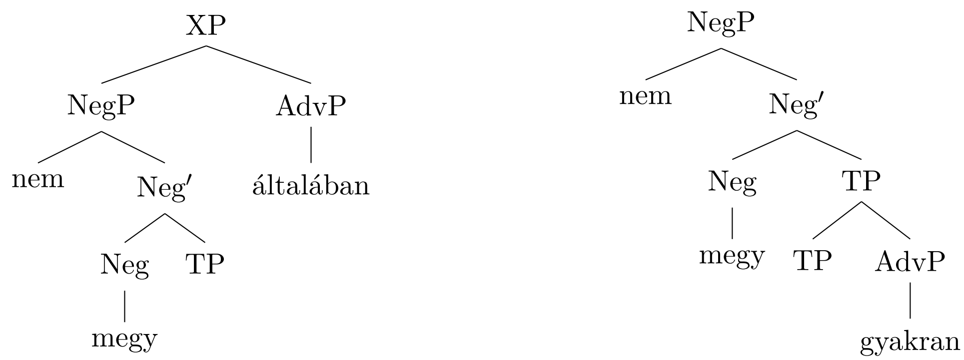
d. *János nem megy be az órá-i-ra gyakran.*
János NEG go PRT the class-POSS.3SG-onto often
'John doesn't go to his classes often.'

i. In fact, half the time he doesn't go to class.

ii. # Those times, you can find him in the library.

For the treatment of adverbs in Hungarian, I adopt an adjunction-based theory proposed by É. Kiss (2010).[2] According to her, post-verbal adverbs take a high scope

[2] Alternatively, we might say that *általában* undergoes obligatory QR above negation.



(a) Tree structure of (12c) and (12d)   (b) Tree structure of (13c) and (13d)

Figure 5.2: Tree structures of sentences with post-verbal adverbs in Hungarian

in a sentence because they right-adjoin at the appropriate height, but then linearize freely with other post-verbal material. Based on this proposal, I assume the rough structure depicted in Figure 5.2a for sentences (12c) and (12d); and the tree in Figure 5.2b for sentences (13c) and (13d).[3] The point is that *általában* 'usually' attaches high, at a functional projection above NegP, whereas *gyakran* 'often' attaches low, below NegP.

For the test, informants were presented with sentences with either subject or object NPIs. These sentences were based on either (14) or (15), with a permutation of different word orders[4].

(14) *Senki nem megy be általában/gyakran az órá-k-ra.*
NPI.BODY NEG go PRT usually/often the class-PL-TO
'Nobody goes to classes usually/often.'

(15) *Laci nem megy be általában/gyakran semelyik órá-ra.*
Laci NEG go PRT usually/often NPI.WHICH class-TO
'Laci doesn't go usually/often to any classes.'

[3] The proposed structure slightly differs from the one in É. Kiss (2010). She includes a number of extra functional projections which are omitted here to keep it simple.

[4] The only word order not represented is 'NPI ≫ *adverb* ≫ NEG', because for many speakers, elements intervening between preverbal NPI and negation are unacceptable.

For a sentence with NPI in the subject position, the situations were the ones presented in Table (5.7). For sentences with object NPIs, the presented situations were the same as for English, as in Table 5.1.

	Monday	Wednesday	Friday
Anna	✓		
Balázs		✓	
Csaba			✓

(a) Situation A

	Monday	Wednesday	Friday
Anna	✓		
Balázs	✓		
Csaba	✓		

(b) Situation B

	Monday	Wednesday	Friday
Anna	✓	✓	✓
Balázs			
Csaba			

(c) Situation C

Table 5.7: Situation for sentences with NPI subjects.

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Tables 5.8 and 5.9 show the results of 7 informants' judgments. Again, the tables do not report answers where informants either left the answer blank or chose Situation C as true.

When the adverb outscoped negation at LF, the most available interpretation was Situation B. This means that participants could access the readings $Q_{adv} \gg$ NEG $\gg$ NPI$_{\exists}$ or $Q_{adv} \gg$ NPI$_{\forall} \gg$ NEG, but not NPI$_{\forall} \gg$ adverb $\gg$ NEG. Such results do not decisively indicate anything regarding the quantifier type of the NPI. It could either mean that the NPI is an existential, or that it is a universal but the adverb is an intervener (cf. Figure 5.1).

When negation outscoped the adverb, most participants chose both Situation A and Situation B, or at least there were equally many people who chose Situation A as those who chose Situation B. In these cases, the two possible LF scope configurations

Surface order	Situation A	Situation B	Situation A and B
S *often* NEG V NPI	0	5	0
S *often* NPI NEG V	0	5	0
S *usually* NEG V NPI	0	3	0
S *usually* NPI NEG V	0	4	0
S NEG V NPI *usually*	0	2	0
S NEG V *usually* NPI	0	3	0
S NPI NEG V *usually*	0	4	0

(a) NPI is an object

Surface order	Situation A	Situation B	Situation A and B
often NEG V NPI O	1	5	0
often NPI NEG V O	0	6	0
usually NEG V NPI O	0	5	0
usually NPI NEG V O	0	4	0
NEG V NPI *usually* O	0	4	0
NEG V *usually* NPI O	1	3	0
NPI NEG V *usually* O	1	4	0

(b) NPI is a subject

Table 5.8: Hungarian results where $Q_{adv} \gg \neg$

Surface order	Situation A	Situation B	Situation A and B
S NEG V NPI *often*	1	0	3
S NEG V *often* NPI	1	1	2
S NPI NEG V *often*	1	2	2

(a) NPI is an object

Surface order	Situation A	Situation B	Situation A and B
NEG V NPI *often* O	1	1	5
NEG V *often* NPI O	1	3	3
NPI NEG V *often* O	2	1	4

(b) NPI is a subject

Table 5.9: Hungarian results where $\neg \gg Q_{adv}$

were NEG $\gg$ $\text{NPI}_{\exists}$ $\gg$ Q_{adv} and $\text{NPI}_{\forall}$ $\gg$ NEG $\gg$ Q_{adv}. Again, with these readings, there is no decisive evidence for either quantifier type, and there is also no indication whether the adverb is an intervener or not.

The results for Hungarian do not give a decisive answer on the quantifier type of its pronomial NPIs. Nevertheless, I argue that they should be classified as universal quantifiers, based on the syntactic evidence laid out in §II and comparing the required derivational steps to get the different readings.

In Table 5.10, I list the ways to derive the appropriate LF readings that would also correspond to the different surface word orders for both existential and universal NPIs. For these derivations, I assume the surface structures depicted previously in Figure 5.2; when the adverbs are post-verbal, they right-adjoin at the appropriate level. Because of the free linearization of post-verbal elements, sentences such as (16a) and (16b) have the same assumed structure, (17). All movement depicted could be a result of multiple consecutive moves, if locality conditions necessitate it. I show them as one operation to keep the derivations simple. As per my proposal, pre-negation NPIs are depicted in Spec,NegP.

(16) a. *Laci nem megy be se-melyik órá-ra általában.*
Laci NEG go PRT NPI-which class-onto usually

b. *Laci nem megy be általában se-melyik órá-ra.*
Laci NEG go PRT usually NPI-which class-onto
'Laci doesn't go to classes usually.'

(17) $[_{\text{XP}}$ $[_{\text{NegP}}$ NEG $[_{\text{TP}}$ V $[_{VP}$ NPI$]]$ *usually*$]$

As seen in the tables in Table 5.10, to get the readings involving a universal quantifier NPI, all sentences uniformly require either `S-move` (covert QR), or `Move` (overt QR) to Spec,NegP. On the other hand, to get any reading assuming an existentially quantified NPI, the NPI has to end up in a very specific spot at LF, sometimes through `S-move` (QR) and more often, through `P-move` (reconstruction).

A reconstruction-based requirement for NPIs is problematic for a number of reasons. One is that English existentially quantified NPIs could never reconstruct as

Surface word order	Possible LF readings	
	$Q_{adv} \gg NPI_{\forall} \gg \neg$	$Q_{adv} \gg \neg \gg NPI_{\exists}$
Q_{adv} NEG V NPI	$[_{XP} Q_{adv}\ [_{NegP}\ NPI_{\forall}\ [_{Neg}\ NEG\ [_{TP}\ [_{T}\ V\ [_{VP}\ t\ ]]]]]]$ S-move	-
Q_{adv} NPI NEG V	$[_{XP} Q_{adv}\ [_{NegP}\ NPI_{\forall}\ [_{Neg}\ NEG\ [_{TP}\ [_{T}\ V\ [_{VP}\ t\ ]]]]]]$ Move	$[_{XP} Q_{adv}\ [_{NegP}\ NPI_{\exists}\ [_{Neg}\ NEG\ [_{TP}\ [_{T}\ V\ [_{VP}\ t\ ]]]]]]$ P-move
NEG V NPI Q_{adv} NEG V Q_{adv} NPI	$[_{XP}\ [_{NegP}\ NPI_{\forall}\ [_{Neg}\ NEG\ [_{TP}\ [_{T}\ V\ [_{VP}\ t\ ]]]]]\ Q_{adv}\ ]$ S-move	-
NPI NEG V Q_{adv}	$[_{XP}\ [_{NegP}\ NPI_{\forall}\ [_{Neg}\ NEG\ [_{TP}\ [_{T}\ V\ [_{VP}\ t\ ]]]]]\ Q_{adv}\ ]$ Move	$[_{XP}\ [_{NegP}\ NPI_{\exists}\ [_{Neg}\ NEG\ [_{TP}\ [_{T}\ V\ [_{VP}\ t\ ]]]]]\ Q_{adv}\ ]$ P-move

(a) For cases where $Q_{adv} \gg \neg$

Surface word order	Possible LF readings	
	$NPI_{\forall} \gg \neg \gg Q_{adv}$	$\neg \gg NPI_{\exists} \gg Q_{adv}$
NEG V NPI Q_{adv} NEG V Q_{adv} NPI	$[_{NegP}\ NPI_{\forall}\ [_{Neg}\ NEG\ [_{TP}\ [_{T}\ V\ [_{VP}\ t\ ]]\ Q_{adv}\ ]]]$ S-move	$[_{NegP}\ [_{Neg}\ NEG\ [_{TP}\ NPI_{\exists}\ [_{TP}\ [_{T}\ V\ [_{VP}\ t\ ]]\ Q_{adv}\ ]]]]$ S-move
NPI NEG V Q_{adv}	$[_{NegP}\ NPI_{\forall}\ [_{Neg}\ NEG\ [_{TP}\ [_{T}\ V\ [_{VP}\ t\ ]]\ Q_{adv}\ ]]]$ Move	$[_{NegP}\ NPI_{\exists}\ [_{Neg}\ NEG\ ]\ [_{TP}\ t\ [_{TP}\ [_{T}\ V\ [_{VP}\ t\ ]]\ Q_{adv}\ ]]]$ P-move, Move

(b) For cases where $\neg \gg Q_{adv}$

Table 5.10: The derivations that get the surface word order and the LF interpretations with $NPI_{\forall}$ and $NPI_{\exists}$

the head of a phrase – only as part of one (see Chapter 4). It would then be unlikely for reconstruction to be allowed in Hungarian, assuming that existential NPIs share syntactic behavior like this cross-linguistically. Second, there is no convincing evidence that Hungarian allows quantifier-related scope reconstruction from an Ā-position at all (Surányi, 2002; É. Kiss, 2008). Then it would be odd if there was an exception in this regard for NPIs.

One might worry at this point that non-decisive results would automatically assume a universal interpretation for the NPI. However, this is not true. The considerations here are based on the unique features of Hungarian syntactic structure, and especially the fact that Hungarian NPIs can be in a pre-verbal, pre-negation position. This position suggests that Hungarian NPIs should be interpreted as universal quantifiers.

In the end, there was no way to get a reading where the adverb was interpreted between the NPI and negation (18-19), and thus there was no direct way to tell the quantificational force of the NPI. However, because the interpretation where the NPI is existentially quantified can only be derived through reconstruction, which is implausible for a number of reasons, I conclude that Hungarian NPIs are universally quantified, but adverbs act as interveners.

(18) *Laci általában nem megy be se-melyik órá-ra.*
Laci usually NEG go PRT NPI-which class-onto

a. $Q_{adv} \gg NPI_{\forall} \gg \neg = Q_{adv} \gg \neg NPI_{\exists}$

b. $* \, NPI_{\forall} \gg Q_{adv} \gg \neg$

(19) *Laci nem megy be se-melyik órá-ra gyakran.*
Laci NEG go PRT NPI-which class-onto usually
'Laci doesn't go to classes often.'

a. $NPI_{\forall} \gg \neg \gg Q_{adv} = \neg NPI_{\exists} \gg Q_{adv}$

b. $* \, \neg \gg Q_{adv} \gg NPI_{\exists}$

This conclusion is not completely unprecedented, as intervention effects in NPI-licensing relations is a known phenomenon (Linebarger, 1987). For Hungarian, further evidence for intervention comes from the fact that informants generally disallow sentences where additional items can go between the pre-verbal NPI and negation (see fn. 4).

5.2 Other types of semantic evidence

In this section, I discuss additional semantic tests used to investigate the quantificational force of NPIs. Specifically, I go through the ones employed in Giannakidou (2000), and carefully examine whether these tests are applicable to English and Hungarian NPIs. For most of these tests, I will show that no definite conclusion can be drawn from them, as there are many independent variables that could contribute to a false positive or a false negative result.

I will pay particularly close attention to Hungarian, because previously Surányi (2006) had relied on these same tests to argue that Hungarian NPIs are ambiguous between universal quantifiers and indefinites. He divides the Hungarian sentence into three parts, Field 1, Field 2, and Field 3 (20). Field 1 corresponds to roughly the topic position, Field 2 to the focus position, and Field 3 is the postverbal position. Surányi (2006) maintains that in Field 2, the NPI is *optionally* focused. So while Hungarian NPIs are ambiguous in this proposal, their distribution is restricted by their quantifier type. In Field 1 and non-focused Field 2, they can only be universal quantifiers. In focused Field 2 they can only be existential quantifiers. In Field 3, either interpretation is available.

(20) [Field 1 [$_{FP}$ Field 2 [$_{F}$ (nem) V] [Field 3]]]

As I disagree with Surányi's (2006) conclusions about the quantificational force of Hungarian NPIs, I will spend time critiquing the results that had lead him to his proposal. Because I want to directly critique the use of his tests rather than his assumptions about Hungarian syntax, I will assume that his views of the Hungarian sentence structure are correct (20), and point out inconsistencies within his own framework. This sentence structure, in any case, can be worked into the proposal I laid out in

Chapter 3; Spec,NegP, the landing site for Hungarian NPIs, corresponds to Field 2 in Surányi's (2006) framework.

In general, all these tests are imperfect for one reason. The overall logic is to correlate the behavior of NPIs with the behavior of either existential or universal quantifiers. A problem with this line of logic is that these tests are sensitive to semantics, and often there is no exact minimal pair available, one featuring the NPI and one featuring a positive version of a universal or existential quantifier in the language. To see whether these tests actually show the quantificational force of an NPI, there needs to be a deep understanding of the semantic properties of quantifiers and the exact properties that allow or disallow their distribution in certain contexts. I attempt to do some of this work in this section, but in many cases, further investigations into the semantics of these tests and the quantifiers would be necessary.

5.2.1 Focusability

Quantifiers can differ in their focusability. Giannakidou (2000), for example, reports that in Greek, universal quantifiers cannot bear focus, whereas existential quantifiers can, and Greek emphatic and non-emphatic NPIs correlate with this behavior. Giannakidou's (2000) evidence is based on whether the focus marker *ke* can modify these items or not; it could not modify universal quantifiers, but it could do so for existential quantifiers.

This test's use is contingent on the given language's focus properties. In English, focus in a declarative sentences is indicated by stress (see Féry (2013) for a review) which already makes it hard to detect without acoustic measurements. Another possible diagnostic of focus could be based on the fact that focus generally indicates new information – the constituent that conveys the answer to a wh-question is focused. It seems that in English, quantifiers do not differ on whether they can be information focus (21). Focusability then is not a good diagnostic for quantificational force in English.

(21) Who did you see?

a. I saw EVERYONE.

b. I saw SOMEONE.

c. I didn't see ANYONE.

For Hungarian, Surányi (2006) uses several focus-based arguments to claim that Hungarian NPIs can behave like existential quantifiers. His first argument, paralleling Giannakidou's (2000), is the fact that Hungarian NPIs also admit a focus marker similar to *ke*. In Hungarian, this is *sem*, which etymologically comes from the combination of *is* 'also' and *nem* 'no', and it means 'either'. Surányi (2006) observes that universal and existential quantifiers differ on whether they can be modified with the additive *is*; universal quantifiers cannot be (22), whereas existential quantifiers can be (23). So, he argues, the fact that *se*-pronouns in Hungarian can co-exist with *sem* supports that they are in some cases existentially quantified (24).

(22) * *El jött mindenki is?*
PRT came everybody ADD
'Did everybody come?'

(23) *El jött valaki is?*
PRT came somebody ADD
'Did even somebody come?'

(24) *Sen-ki sem jö-tt el.*
NPI-who ADD.NEG come-PST PRT
'Nobody came.'

This argument that Hungarian *se*-pronouns are existentially quantified relies on the assumptions that *is* and *sem* are the same semantic particle, and so their behaviors are comparable. This, however, very difficult to verify, as their selectional distributions are complementary. *Sem* does not combine with any quantifier other than *se*- pronouns, while *is* cannot combine with *se*-pronouns.

Moreover, their syntactic distribution is not the same either. DPs modified with *is* are barred from the identificational pre-verbal focus position (25), while the ones modified with *sem* are not (26), according to Surányi (2006). *MARI* must be in a focus position in (26), because the only-phrase *csak Andi* can only be in a post-verbal position if the pre-verbal focus position is filled (27). Since the DPs they modify behave syntactically differently, it is then also doubtful that *is* and *sem* are the exact same particle and would modify items of the same quantificational force.

(25) * *MARI-t is látogat-ta meg csak Andi.*
Mari-ACC ADD visit-PST-1SG PRT only Andi
'I visited Mari also.'

(26) *MARI-t sem látogat-ta meg csak Andi.*
Mari-ACC.NEG ADD visit-PST.3SG PRT only Andi.
'It was Mari that only Andi did not visit either.'

(27) * *Látogat-t-am meg csak Andi-t.*
visit-PST-1SG PRT only Andi-ACC
'I visited only Andi.'

Furthermore, throughout Surányi (2006), on many occasions *se*-pronouns modified with *sem*, pass tests that are meant to show that they have universal force. In fact, bare NPIs and NPIs modified with *sem* seem to have almost always the same behavior when it comes to tests of quantificational force. If *sem* could only attach to an existentially quantified item, we would expect it to fail all tests that would support *senki sem* to have a universal force – this, however, is not born out within Surányi's analysis itself.

The other focus-based argument Surányi (2006) gives is based on the fact that universal quantifiers cannot be in the pre-verbal focus position (28) in Hungarian, whereas NPIs can be.

(28) * *Minden-ki (nem) szavaz-ott vég"ul csak János-ra.*
every-who (NEG) vote-PST.3SG finally only János-SUBL
'Everybody didn't vote in the end for János.'

(29) *Sen-ki nem szavaz-ott vég"ul csak János-ra.*
NPI-who NEG vote-PST.3SG finally only János-SUBL
'Nobody voted for only János in the end.' (Surányi, 2006, (44b))

However, it is not the case that any existentially quantified item can be in the focus position, either. Identificational focus position is believed to only accommodate

DP that are group-denoters (Szabolcsi, 1994), such as *hat fiú* 'six boys', *a fiúk* 'the boys', and *Péter és Mari* 'Peter and Mari'. Thus, other, non-group denoting quantifiers also cannot be in this focus position, even if they are existentially quantified, such as the indefinite *valaki* 'somebody' (30). FCIs, which Halm (2016) argued to be indefinites, also cannot occupy this position (31). Then if NPIs are in the focus position, as Surányi (2006) argues, it does not prove that they are existentially quantified either.

(30) * *Vala-ki olvas-ta el csak a Micimackó-t.*
some-who read-PST.3SG PRT only the Winnie-the-Pooh-ACC
'Someone read only Winnie the Pooh.'

(31) * *Akár/Bár-ki olvas-hat-ta el a Micimackó-t.*
any/any-who read-PST.3SG PRT only the Winnie-the-Pooh-ACC
'Anyone$_{FCI}$ could read only Winnie the Pooh.'

All in all, focusability does not provide a good test for the quantificational force of Hungarian NPIs. I have addressed two separate focus-related arguments: one regarding the focus particle *is/sem*, and the other regarding the pre-verbal focus position. I have pointed out that there is no positive evidence supporting that the focus particles *is* and *sem* behave identically when it comes to what type of quantifiers they can select for. In fact, their syntactic behaviors diverge at points and Surányi (2006) faces a number of internal contradictions within his own proposal, if he assumes that *is* and *sem* are the same. As for the pre-verbal focus position, there is neither reason to think that the difference between universally and existentially quantified items are diagnosable by focusability, nor reason to think that Hungarian NPIs can even be focused.

5.2.2 Modification by *almost*

The general observation is that universally quantified nouns can be modified by *'almost'*, but existentially quantified entities cannot be (Giannakidou, 2000), as demonstrated in (32).

(32) a. Mary has read almost/absolutely every book.

b. * Mary has read almost/absolutely some book.

As it turns out, *almost* can also modify precise values, as in (33), with the requirement that the value is interpreted as high in context (Horn, 2000; Giannakidou, 2001). The contrast in (32) then is the result of universal quantifiers denoting a high value, whereas existential quantifiers not doing so. Then, it would be more precise to say that the availability of *almost*-modification does not necessarily prove universal quantification, but the lack of it suggests the lack of universal quantification.

(33) Mary has read almost five books.

For the most part, *almost* cannot modify English NPIs (34), which is expected by the hypothesis that English NPIs are existentially quantified.[5]

(34) * Katie has not read almost any book. *English*

In Hungarian, as reported by Surányi (2006), *almost* can modify the NPI in all positions, except when the NPI is postverbal and is a complement of a non-presuppositional predicate, such as '*find*' (36). Surányi's (2006) explanation is that presuppositional predicates only select for existential NPIs due to existential import (further discussed in §5.2.6), and thus *almost*-modification, which diagnoses universal quantifiers, would not be allowed with these predicates. His conclusion is then that Hungarian NPIs can have either quantificational force.

(35) *Tegnap majdnem senkivel nem beszél-t Zeta.*
yesterday almost NPI-INST NEG talk-PST Zeta.
'Yesterday Zeta didn't speak with almost anybody.' (Puskás, 2000)

[5] Horn (2000) notes that English *any* NPIs only fail to be modified by *almost* when licensed by negation; with other licensors, *almost* modification is marginally better (1). However, in (1) has more of a free-choice reading rather than an NPI reading. Further research is needed to truly distinguish the two, and for now it is clear that at least when NPIs are licensed by negation in English, they cannot be modified with *almost*.

(1) ? If almost anyone has a cold, I'll catch it. (Horn, 2000, (40b))

(36) * *Nem találtam majdnem semmit a hűtőben*
not find-PST-1SG almost nothing-ACC the fridge-in
'I found almost nothing in the fridge.' (Surányi, 2006)

Surányi's (2006) use of the diagnosis is problematic, however. There is a synonym for *majdnem* in Hungarian, *szinte*. *Szinte* has the same behavior as *majdnem* when it comes to modifying existential and universal quantifiers (37).

(37) a. *Kati táncol-t szinte minden-ki-vel.*
Kati dance-3SG almost every-who-INST
'Kati danced with almost everybody.'

b. * *Kati táncolt szinte vala-ki-vel.*
Kati dance-3SG almost some-who-INST
'Kati danced with almost somebody.'

If instead of *majdnem*, we use the word *szinte* in the sentences in (35-36), these sentences become all acceptable. It is still an open question what contributes to the difference between *szinte* and *majdnem*, see Halm (2019) for some preliminary ideas.

(38) *Tegnap szinte senkivel nem beszél-t Zeta.* Puskás (2000)
yesterday almost NPI-INST NEG talk-PST Zeta.
'Yesterday Zeta didn't speak with almost anybody.'

(39) *Szinte senkivel nem beszélt Zeta.* Surányi (2006)
almost nobody-with SEM talk-PAST-3SG Z.-NOM
'Zeta talked to almost nobody.'

(40) *Nem találtam szinte semmit a hűtőben* Surányi (2006)
not find-PST-1SG almost nothing-ACC the fridge-in
'I found almost nothing in the fridge'

In the end, modifiability by *almost* correlates with the quantificational force of the NPI. In the context of negation, Hungarian NPIs can be modified by almost, as expected from universally quantified items, whereas English NPIs cannot be, suggesting that they are existential.

5.2.3 Licensing donkey-anaphora

Another test used by Giannakidou (2000) regards donkey anaphora. The initial observation is that universal quantifiers and existential quantifiers differ in whether they can license donkey anaphora (41).

(41) a. The students that have something to say should say it now.

b. * The students that have everything to say should say it now.

There are a number of complications to consider, however, before the test can work for our purposes. The first complication is negation. As shown in (42), negation can create an island for anaphora because it references non-existing entities, thus it is important to test with a sentence that makes more sense, like in (43). Alternatively, we can follow Giannakidou's (2000) suggestion to use imperatives as the sentence that houses the NPI (44). As seen below, both options successfully show the contrast between the two types of quantifiers.

(42) * The students that have not finished a/every report should turn it in.

(43) The students that have not finished a/*every report for class today should write it tomorrow.

(44) a. Don't check out a book from that Satanic library. Reading it might warp your mind! (Giannakidou, 2000, (40a))

b. * Don't check out every book from that Satanic library. Reading it might warp your mind!

The second complication, not discussed in either Giannakidou (2000) nor Surányi (2006), is the number on the donkey anaphora. In sentence (45), the universally quantified *every book* licenses donkey anaphora in the plural form *them*. As a further complication the plural *them* can also be licensed by an existential (46). In sum, at least for English, the existential and a universal shows the contrast where licensing a *singular* anaphora, such as *it*, but it does not show the contrast with plural anaphora *them*. The same precautions have to be taken in the other languages too before drawing conclusions about the quantifier-type of NPIs in those languages.

(45) The students who took every book off the shelf should put them on the floor.

(46) The students who took a book off the shelf should put them on the floor.

As evident from the discussion so far, in English, singular donkey anaphora can only be licensed by an existentially quantified antecedent, whereas plural donkey anaphora can be licensed by either existentially or universally quantified antecedents. In light of these facts, English *any*-pronouns behave like existential quantifiers, as they can license singular donkey anaphora (47).

(47) a. The students that have not written any report today should write it tomorrow.

b. Don't check any book out of that Satanic library; reading it might warp your mind. (Giannakidou, 2000, (40a))

For Hungarian, Surányi (2006) shows (48) as evidence to argue that Hungarian NPIs can license donkey anaphora (48), and therefore NPIs can receive existential interpretation. Again, this conclusion is only apt if there is indeed a difference between and existential and universal quantifiers.

(48) *Ne fog-j-ál meg sem-mi-t$_i$ a laboratórium-ban! Még pro$_i$*
NEG tough-IMP-2SG PRT NPI-what-ACC the laboratory-INESS possibly PRO
meg ráz-hat!
PRT shock-POSS-can.3SG
'Don't touch anything in the laboratory! It might shock you!' (Surányi, 2006, (29))

Judgments from native informants were mixed on this matter, however. While informants agreed that universal quantifiers can license donkey anaphora, they were divided on whether the donkey anaphora must be plural or singular (49). Generally, informants rejected donkey anaphora licensed by existential quantifier *valami*, possibly because it is a Positive Polarity Item (PPI) in the scope of negation. In any case, given (49), there is no reason to believe that Hungarian NPIs are not universally quantified in (48).

(49) *Ne fog-j-ál meg minden szerkentyű-t$_i$ a laboratórium-ban! Még*
NEG tough-IMP-2SG PRT every gadget-ACC the laboratory-INESS possibly
pro$_i$ meg ráz-hat-(nak)!
PRO PRT shock-POSS-can-3SG.PL
'Don't touch every gadget in the laboratory! It might shock you!'

(50) *Ne fog-j-ál meg valami fontos szerkentyű-t$_i$ a laboratórium-ban!*
NEG tough-IMP-2SG PRT some important gadget-ACC the laboratory-INESS
Még pro$_i$ meg ráz-hat!
possibly PRO PRT shock-POSS-can.3SG
'Don't touch some important gadget in the laboratory! It might shock you!'

Moreover, according to Surányi (2006), non-focused NPIs in the pre-verbal position are universally quantified. Then it would be unexpected that pre-verbal NPIs can license donkey anaphora (51).[6]

(51) *Sem-mi-t$_i$ ne fog-j-ál meg a laboratórium-ban! Még pro$_i$*
NPI-what-ACC NEG tough-IMP-2SG PRT the laboratory-INESS possibly PRO
meg ráz-hat!
PRT shock-POSS-can.3SG
'Don't touch anything in the laboratory! It might shock you!'

In conclusion, the donkey anaphora facts are consistent with Hungarian NPIs being universally quantified.

5.2.4 Availability of split scope reading with modals

Consider a sentence such as in (52). This sentence can have two different readings: de re and split (De Swart, 2000), all illustrated with the corresponding scopal relationships between negation, modal, and the existential operator, in (52a-52b). The

[6] Surányi (2006) might say here that this NPI is actually focused, and thus it is existentially quantified. I have no good way to prove that it is not focused, but as discussed in §5.2.1, neither does Surányi that it is.

availability of split scope has been used to argue that negative indefinites such as *no* should be lexically decomposed as $\neg$ and $\exists$ (Jacobs, 1980; Rullmann, 1995)

(52) They need to fire no nurses.

a. De re: $\neg > \exists > need$, $\forall > \neg > need$

There is no nurse such that it is necessary to fire her.

b. Split: $\neg > need > \exists$

It is not necessary for them to fire a nurse.

Giannakidou (2000) follows the lexical decomposition approach when she applies this test to NPIs. Her reasoning is that if the split reading is available in a sentence with an NPI (53), then the NPI must be existentially quantified; there is no way to get the $\neg \gg$ modal $\gg \exists$ reading if the NPI was universally quantified.

(53) We need not fire any nurses.

To tell apart the de re reading and the split reading, De Swart (2000) offers the following scenario. Suppose that there is a hospital where budget cuts necessitate the firing of some nurses. However, there is no particular nurse that should be fired. In this scenario, the de re reading would be true, while the split reading would not be.

When we tested this in English (54) and Hungarian (55), informants reported that they can get the split reading in both languages. Following Giannakidou's (2000) logic, this test would indicate that all three languages have existential NPIs. Surányi (2006) argues so based on this data.

(54) It is not necessary to fire any nurses.

(55) *Nem kell semelyik nővér-t ki rúg-ni.*
NEG need NPI nurse-ACC PRT fire-INF
'It is not necessary to fire any nurse.'

However, there are two problems with this test. One is that while there is a situation to unambiguously determine that a sentence can get the de re reading, there is no situation that would be true in the opposite direction: something that is only true in the case of split reading, but not true in the de re reading. If the hospital does not need to fire any nurse, then it is always going to be true that there is no nurse that the hospital needs to fire. That is, the split reading entails the de re reading, but the de re reading does not entail the split reading. Consequently, if the meaning corresponding to the split reading is available, it does not necessitate the existence of the LF structure $\neg \gg$ modal $\gg \exists$, since that meaning could be also represented with $\neg \gg \exists \gg$ modal.

The second problem is that deriving the split reading via the lexical decomposition approach is undesirable for many independent reasons (De Swart, 2000; Abels and Martí, 2010), and there are alternative proposals to derive the same reading without necessitating the split of negation and indefinite. For example, Abels and Martí (2010) propose that the split reading is derived the following way. The quantifier quantifies over choice functions, and when it undergoes QR, it leaves a choice function variable in the trace position, giving an illusion of an existentially bound indefinite in the scope of the modal. If their proposal is right, there is no need for the raised quantifier to be existential; a split scope reading could be derived even if the quantifier was universal. In fact, that is what Abels and Martí (2010) propose; they argue that all quantifiers can give rise to split scope reading, only that sometimes the split scope reading is identical to a de dicto reading.

All in all then, testing the quantificational force of NPIs based on the availability of the split scope reading also turns out to be unreliable for our purposes.

5.2.5 Predicate nominals

Another type of test that Giannakidou (2000), and following her, Surányi (2006) uses regards predicate nominals. The observation is that existentially quantified expressions can be predicate nominals, but not universally quantified expressions (56).

(56) a. Martha has been a doctor.

b. Martha has been somebody important.

c. * Martha (and Anna) have been every doctor. (Mcnally, 1998, (15a))

d. ? Martha (and Anna) have been everybody important.

A similar contrast can be observed in existential *there*-constructions, but only when the quantifier is a determiner and quantifies over an NP, not when it is a pronoun. When the predicate nominal is a universally quantified pronoun *everybody* (57d), the existential construction is acceptable for some speakers. Similar observations have been made in Higginbotham (1987).

(57) a. There was a doctor at the convention.

b. There was somebody at the convention.

c. * There was every doctor at the convention. (Mcnally, 1998, (9a))

d. ? There was everybody at the convention.

Moreover, the contrast between existential and universal quantifiers is superficial, as universally quantified items can be predicate nominals when they range over kinds or sorts (Lumsden, 1983; Williams, 1983), as shown in (58). To address this observation, Mcnally (1998), following Partee (1987), proposes that BE-type predicates select for *properties*, and so quantified NPs are only licit if the quantification ranges over properties.[7] In the end then, the contrast between existential and universal quantifiers only holds in English if the quantification does *not* range over properties, and if it is a quantificational determiner.

(58) Martha has been every kind of doctor. (Mcnally, 1998, (15b))

(59) There was every kind of doctor at the convention. (Mcnally, 1998, (9b))

In English, NPs with the NPI determiner *any* (60) can act as predicate nominals. As expected, English *any* patterns like an existential quantifier: they can be in a determiner form that quantifies over a noun phrase, and do not have to quantify over properties.

---

[7] She follows Heim's (1982) approach in saying that indefinites are not quantified expressions.

(60) a. Martha isn't any doctor.

b. There isn't any doctor.

In Hungarian the contrast also holds (61), and similarly to English, universal quantification in the predicate is allowed if it ranges over properties (62).

(61) a. *István egy orvos.*
István a doctor
'István is a doctor.'

b. *István volt vala-ki.*
István COP.PST.3SG some-who
'István was somebody.'

c. * *István és Károly minden orvos.*
István and Károly every doctor
'István and Károly are every doctor'

d. * *István és Károly volt minden-ki fontos.*
István and Károly COP.PST.3SG COP.PST.3SG every-who important
'István and Károly were everybody important.'

(62) *István minden féle orvos.*
István is every kind doctor
'István is every kind of doctor.'

Surányi (2006) gives three examples where the Hungarian NPI seemingly can serve as a predicate nominal (63).

(63) a. *Nem lesz sem-mi baj.*
NEG COP.FUT NPI-what problem
'There won't be any problem.'

b. *Ez a zaj nem volt sem-mi (sem) a tegnap-i-hoz képest*
this the noise NEG COP.PST.3SG NPI-what SEM the yesterday-ADV-to in.comparison
'This noise was nothing compared to yesterday's.'

c. *Nem volt sem-mi köz-e (sem) hoz-zá.*
NEG COP.PST.3SG NPI-what business SEM to-3SG
'He had nothing to do with it.'

These examples are misleading, however. First, *se-* expressions cannot normally act as determiners for NPs, except for *sem-milyen* 'NPI-kind'. There is no determiner analogous to *no* in English (Surányi, 2002). *Sem-milyen* 'NPI-kind' quantifies over properties, which makes it irrelevant for the test, as all quantificational determiners over properties are licit as predicate nominals (Williams, 1983).

In (63a) and (63c), where *sem-mi* 'NPI-what' seems to be a quantificational determiner, I argue that it is actually a shortened version of *sem-milyen*. The first piece of evidence is based on the morphological make-up of these items: *sem-mi* NPI-what acts as a pronoun in many cases. It makes little sense then, if morphology is compositional, that this same lexical item would be also a determiner modifying an NP. Moreover, substituting *semmi* with *semmilyen* in these sentences does not seem to change the meaning of them in Hungarian. Informants also found *semmi NP* constructions to be marginal with other types of NPs such as in (64a), and usually preferred *semmilyen NP* (see the contrast in (64)). I wager that the reason (63a) or (63c) sound perfectly acceptable is that the expressions in those sentences are commonly used, and became lexicalized as an expression.

(64) a. * *Nem ad-t-ak be sem-mi beadandó-t.*
NEG give-PST-3SG PRT NPI-what assignment-ACC
'They didn't submit any assignment.'

b. *Nem ad-t-ak be sem-milyen beadandó-t.*
NEG give-PST-3SG PRT NPI-what assignment-ACC
'They didn't submit any assignment.'

Sentence (63b) poses a bigger problem for the current view. One thing to point out is that *semmi* has also become lexicalized, taking up the meaning of 'nothing'. For example, (65) is an often used colloquialism. The present tense version of (63b) also must be without negation to get the intended meaning (66). The data below suggests that *semmi* in this predicate nominal position is a different lexical item, one that is not an NPI anymore.

(65) *Ez nem semmi!*
this NEG nothing
'This is not nothing!'

(66) *Ez a zaj semmi a tegnap-i-hoz képest.*
this the noise nothing the yesterday-ADV-to in.comparison
'This noise is nothing compared to yesterday's.' (Surányi, 2002, (60b))

5.2.6 Existential import and presupposition

Universal quantifiers presuppose a non-empty domain, whereas existential quantifiers do not (Strawson, 1950; Geurts, 2007). Consequently, it is infelicitous for universal quantifiers to quantify over non-existing entities. Assuming that unicorns do not exist, the sentences in (68) are infelicitous, because their presuppositions clash with the non-existence of unicorns.

(67) a. Mary didn't see a unicorn.
b. Mary saw a unicorn.

(68) a. # Mary saw every unicorn.
b. # Mary didn't see every unicorn.

English *any*-pronouns, as expected, license existential import and do not presuppose existence (69).

(69) Mary didn't see any unicorn.

Surányi (2006) reports a difference based on the syntactic position of the NPI in Hungarian. He claims that when the NPI is in a non-focus pre-verbal position, which he analyses to be a universal quantifier position, the sentence is rendered infelicitous because the NPI is universally quantified (70). However, when the NPI is in a post-verbal position, it has an existential interpretation, and thus the sentence is acceptable (71). However, the consulted native speakers found both sentences to be fine. This would suggest that Hungarian NPIs are existential, because they allow existential import.

(70) Sem-mi értelmét nem lát-t-am.
NPI-what sense NEG see-PST-1SG

'I didn't see any point to it.'

(71) Nem lát-tam sem-mi értelmé-t.
NEG see-PST-1SG NPI-what sense-ACC

'I don't see any point to it.'

In the end this test would suggest that both Hungarian and English NPIs are existentially quantified because they are non-presuppositional. However, another option would be to propose that universally quantified NPIs *differ* from positive universal quantifiers in this regard; that they are universal quantifiers that have no presuppositional meaning.[8]

5.2.7 Interim summary

I have argued in this section that the tests that Giannakidou (2000) and Surányi (2006) used for diagnosing the quantificational force of NPIs are unreliable. Many of them rely on superficial differences between existential and universal quantifiers which fall apart under further scrutiny. Additional empirical data in Hungarian also casts doubt on Surányi's (2006) claim that Hungarian NPIs sometimes behave as if they have existential force. For all these tests, there needs to be more semantic analysis for the

[8] This requirement needs further work. For one, universally quantified NPIs can be answers to a question that already restricts the domain, which would be unexpected if they are truly pre-suppositional:

(1) *'A diák-ok közül ki jött el?' 'Sen-ki.'*
the student-PL among who came PRT NPI-who
'Among the students, who came?' 'Nobody.'

circumstances where they might work, especially for diagnosing the quantificational force of NPIs. As of now, this work is still missing.

5.3 Summary of the chapter

In this chapter, I presented various semantic diagnostics for the quantificational NPIs as they apply to English and Hungarian specifically. None of the tests proved to be completely definitive, as there are many potential confounds we need to consider when evaluating the results. The test based on adverb scope suggest a direction toward my proposal that English NPIs are existential, and Hungarian NPIs are universal, while I showed that the diagnostics used in previous work that suggested different conclusions were unreliable. In sum, I argue that the data discussed in this chapter must be informed by the syntactic behavior of NPIs that were discussed in Chapter 4. When taking both into consideration, there is strong evidence that NPIs indeed differ based on quantificational force, specifically that English NPIs are existential and Hungarian NPIs are universal.

Chapter 6

OTHER LANGUAGES IN THE TYPOLOGY

In this chapter, I discuss how languages other than English and Hungarian might fit in the quantifier-based typology. By necessity, the discussion is fairly cursory; more in-depth data collection and study are needed to classify the quantifier type of NPIs in these languages with certainty. In any case, the predictions of the quantifier-based typology are straightforward are testable, as I demonstrate in this chapter.

In what follows, I discuss data in various Slavic languages (Russian, Serbo-Croatian, Czech), Mandarin Chinese, Turkish and various Romance languages (Italian, Portuguese, Spanish, Catalan). In these languages, I mainly present data concerning the syntactic behavior of these NPIs (surface position of the NPI relative to negation, NPIs as possible fragment answers, locality requirements on licensing). All languages feature data both from published literature and native speakers. As in previous chapters, I always indicate the source in the case of published data.

Based on the cursory examination of the data, I find that *ni*-NPIs in Slavic languages are universally quantified and NPIs in Mandarin Chinese are existentials. I then discuss the less straightforward case of Turkish NPIs – while previously many have assumed that Turkish NPIs are existentials, I show that they fit better in the typology as universally quantified NPIs. An interesting finding regarding Turkish is that if they are universally quantified, they do not behave like normal universal quantifiers in the language; rather, they behave like the universally quantified NPIs in Hungarian. Lastly, NPIs in Romance languages display unique behavior in pre-verbal positions. For them, I adopt the view that they are ambiguous between being NPIs and negative quantifiers.

English	Russian	Serbo-Croatian	Czech
anybody/nobody	ni-kto	ni(t)-ko	ni-kdo
anything/nothing	ni-čego	ni-što	ni-c
anywhere/nowhere	ni-kuda	ni-gde	ni-kdy
never	ni-kogda	ni-kad	ni-kam

Table 6.1: NPIs in Slavic languages

6.1 Slavic languages

In this section, I aim to present data from representatives of all three branches of the Slavic language family: East (Russian), South (Serbo-Croatian), and West (Czech). All these languages have NPIs formed by combining a negative particle *ni* with *wh*-indefinites (Table 6.1).

All these items show the contrast expected from NPIs of being licensed by negation, and being unlicensed without it (1-3).

(1) Russian

a. *Ja ne videl ni-kogo.*
I NEG saw NPI-who.ACC
'I saw no one.' (Brown, 1999, Ch. 3, (14))

b. * *Ja videl ni-kogo.*
I saw NPI-who.ACC
'I saw no one.' (Brown, 1999, Ch. 3, (14))

(2) Serbo-Croatian

a. *Mario ne vidi ni(t)-ko-ga.* Serbo-Croatian
Mario NEG see NPI-who-ACC
'Mario doesn't see anybody.' (Progovac, 1994, Ch. 1, (98))

b. * *Mario vidi ni(t)-ko-ga.* Serbo-Croatian
Mario see NPI-who-ACC
'Mario doesn't see anybody.' (Progovac, 1994, Ch. 1, (98))

(3) Czech

a. *Milan ne vidím ni-koho.* Czech
Milan NEG see NPI-who.ACC
'Milan doesn't see anybody.' (Zeijlstra, 2004, (77c))

b. * *Milan vidím ni-koho.* Czech
Milan see NPI-who.ACC
'Milan doesn't see anybody.' (Zeijlstra, 2004, (77c))

Based on the data to be presented below, these Slavic NPIs behave similarly to Hungarian *se*-pronouns. Because of this similarity, I conclude that these items are universal quantifiers, just like their counterpart in Hungarian.

As in Hungarian, Slavic NPIs can be in the subject position, higher than negation on the surface (4-6); in all cases, they require clause-mate licensing.

(4) *Ni-kto *(ne) zvonil.* Russian
NPI-who NEG called
'Nobody called.' (Brown, 1999, Ch. 3, (34a))

(5) *Niko *(ne) vidi Milan-a.* Serbo-Croatian
NPI-who NEG see Milan-ACC
'Nobody sees Milan.' (Progovac, 1994, Ch. 1, (108))

(6) *Ni-kdo *(ne) volá.* Czech
NPI-who NEG
'Nobody is calling.' (Zeijlstra, 2004, (52a))

As expected from universally quantified NPIs, Slavic *ni*-pronouns can serve as fragment answers:

(7) *Kogo ty videl? Ni-kogo.* Russian
who you saw NPI-who.ACC
'Who did you see? No one.' (Brown, 1999, Ch. 3, (13))

(43b′) *Šta si kupio? Ni-šta.* Serbo-Croatian
what you buy NPI.thing
'What did you buy? Nothing.' (Bošković, 2009, (19a))

They also cannot be licensed by matrix negation, if they are in a tensed embedded clause:[1]

[1] They can be licensed across long-distance if the matrix verb takes a "subjunctive-like" complements.

(8) * *Peter ne skazal čto Maria vidit ni-ko-go.* Russian
Peter not says that Mary sees NPI-who-ACC
'Peter doesn't say that Mary saw anyone.' (Progovac, 1994, Ch. 4, (69))

(9) * *Ne veruje-m da Marija voli ni-(t)ko-ga.* Serbo-Croatian
not claim-1SG that Mary loves NPI-who-ACC
'I do not claim that Mary loves anyone.' (Progovac, 1994, Ch. 4, (3))

Finally, they can be modified by *almost*, which correlates with being a universal quantifier:

(10) *On počti ni-čego ne delal.* Russian
he almost NPI-what NEG did
'He did almost nothing.' (Brown, 1999, Ch.3, (16b))

(11) *Ivan nije pojeo skoro ni-šta* Czech
Ivan NEG eat almost NPI-thing
'Ivan ate almost nothing.' (Tieu and Kang, 2014, (25))

While this data is nowhere near as complete as the data on Hungarian, what is presented here supports the hypothesis that Slavic *ni*-NPIs are universally quantified: they can be in subject position, they can serve as fragment answers, they cannot be licensed long-distance, and they can be modified with *almost*.

6.2 Mandarin Chinese

Mandarin Chinese has two ways to express NPIs: via *wh*-indefinites or via constructions with *renhe*.[2] The main difference between them seems to be that *renhe* is licensed in contexts that are typically associated with NPIs only (e.g. negation,

(1) *Ne želi-m da vidi-m ni(t)-ko-ga.* Serbo-Croatian
NEG wish-1SG that see-1SG NPI-who-ACC
'I do not wish to see anyone.' (Progovac, 1994, Ch. 1, (176))

[2] I gloss *renhe* as NPI.renhe and *wh*-indefinites as NPI.who.

questions, conditionals), whereas *wh*-indefinites are licensed in some additional environments (Wang and Hsieh, 1996; Lin, 1998).[3] In the literature, the *renhe*-construction is generally regarded to be a "typical" NPI, whereas *wh*-indefinites are not always discussed as such.

The sentences below show that both the *wh-indefinites* (12a-12b) and the *renhe*-constructions (13a-13b) conform to expected NPI-behavior. They are licensed in negative contexts, and are not licensed if negation is missing in the same sentence.

(12) *Wh*-indefinite:

a. *Wo mei you shenme malingshu.*
I NEG have NPI.what potato
'I don't have any potato.' (Wang and Hsieh, 1996, (3))

b. * *Wo you shenme malingshu.*
I have NPI.what potato
'I don't have any potato.' (Wang and Hsieh, 1996, (4))

(13) Renhe construction:

a. *Wo mei you renhe malingshu.*
I NEG have NPI.renhe potato
'I don't have any potato.' (Wang and Hsieh, 1996, (3))

b. * *Wo you renhe malingshu.*
I have NPI.renhe potato
'I don't have any potato.' (Wang and Hsieh, 1996, (4))

When examined for their various syntactic behavior, their distribution indicates that they should be categorized as existentials. For one, they cannot precede negation, and thus outscope negation on the surface. Since Mandarin Chinese generally does not display scope ambiguity (Huang, 1982; Aoun and Li, 1993), I assume that NPIs in this position would outscope negation at LF as well. The fact that such sentences are not acceptable, either when the NPIs are subjects (14-15) or scrambled objects (16-17), supports their indefinite nature.

[3] According to Lin (1998), *wh*-indefinites are licensed in all environments that entail non-existence, and it is a superset of the environments that license English *any*-NPIs or Chinese *renhe* constructions. It is dubbed as a superweak NPI in Lin et al. (2014).

(14) * *Shei mei you lai.*
NPI.who NEG have come
'Nobody came.' (Wang and Hsieh, 1996, (8a))

(15) * *Renhe ren mei you lai.*
NPI.renhe person NEG have come
'Nobody came.' (Wang and Hsieh, 1996, (8a))

(16) * *Zhangsan shenme shuiguo meiyou chi gou.*
Zhangsan NPI.what fruit NEG eat ASP
'Zhangsan has never eaten any fruit.'

(17) * *Zhangsan renhe shuiguo meiyou chi gou.*
Zhangsan NPI.renhe fruit NEG eat ASP
'Zhangsan has never eaten any fruit.'

Furthermore, subjects can be in a position where they follow negation on the surface. Since now they are in the scope of negation, they are licensed (18-19).

(18) *Mei(-you) shenme ren xihuan kaoshi*
NEG NPI.what person like exam
'No one likes exams.' (Wang and Hsieh, 1996, (8b))

(19) *Mei(-you) renhe ren xihuan kaoshi*
NEG NPI.renhe person like exam
'No one likes exams.' (Wang and Hsieh, 1996, (8b))

Chinese NPIs also cannot serve as fragment answers, as expected for indefinites:

(20) *Ni kandao shei? *Renhe ren.*
you see who NPI.renhe person
'Who do you see? Nobody.'

(21) *Ni kandao shei? *Shenme ren.*
you see who NPI.what person
'Who do you see? Nobody.'

Additionally, they can be licensed long-distance, like English *any*-NPIs. In (22) and (23), both *renhe*-NPI and *wh*-indefinites are licensed in a tensed embedded clause by matrix negation. Sentence (24) shows that this licensing relation can cross multiple clause boundaries.[4]

(22) *Wo bu juede [Zhangsan xihuan renhe ren].*
I NEG think Zhangsan like NPI.renhe person
'I don't think Zhangsan likes anyone.' (Wang and Hsieh, 1996, (29))

(23) *Zhangsan bu renwei [ni hui xihuan shei].*
Zhangsan NEG think you will like NPI.who
'Zhangsan didn't think that you will like anyone.' (Huang, 1982, (110))

(24) *Wo bu juede [Lisi yiwei [Zhangsan xihuan renhe ren]].*
I NEG feel Lisi think Zhangsan like NPI.renhe person
'I don't feel that Lisi thinks that Zhangsan likes anybdoy.'
(Wang and Hsieh, 1996, (38a))

Chinese NPIs are licensed across islands (25-26), which is further evidence that they do not move. It should be noted, however, that this might not serve as decisive evidence, if one adopts Huang's (1982) analysis of Ā-movement in Chinese; according to him, *wh*-interrogatives undergo LF-movement, even though they are not subject to island constraints.

(25) Complex NP constraint:

a. *Zhangsan bu xiangxin [you renhe ren xihuan Mali de shuofa].*
Zhangsan NEG believe have NPI.renhe person like Mary DE claim

'Zhangsan does not believe the claim that anyone likes Mary.'
(Wang and Hsieh, 1996, (45))

[4] There are contradictory judgments regarding long-distance licensing, and what is presented here is data confirmed by native informants who speak Taiwan Mandarin. Dialectal differences might contribute to judgment differences. For example, Li (1990) claims that NPIs are only licensed across non-finite clauses but not finite ones, and Wang and Hsieh (1996) gives a question mark for (24).

b. *Zhangsan bu xiangxin [you shenme ren xihuan Mali de shuofa].*
Zhangsan NEG believe have NPI.what person like Mary DE claim

'Zhangsan does not believe the claim that anyone likes Mary.'

(Wang and Hsieh, 1996, (45))

(26) Adjunct island:

a. *Mali mei(-you) [yinwei you renhe ren xihuan Zhangsan] jiu shengqi*
Mary NEG because have NPI.renhe person like Zhangsan then angry
'Mary did not get angry because anyone likes Zhangsan.'

(Wang and Hsieh, 1996, 51)

b. *Mali mei(-you) [yinwei you shenme ren xihuan Zhangsan] jiu shengqi*
Mary NEG because have NPI.what person like Zhangsan then angry
'Mary did not get angry because anyone likes Zhangsan.'

(Wang and Hsieh, 1996, 51)

So far, I have shown data that supports the hypothesis that Chinese *renhe*-constructions and *wh*-indefinites both act like indefinite NPIs. Additional data regarding the *dou* distributive particle in Mandarin Chinese provides further support for the quantifier-based distinction of NPIs. According to Huang (1996), *dou* provides universal quantification semantics to the NPs it modifies; consequently, when *dou* modifies Chinese NPIs, they would be expected to act syntactically as the universal quantifiers.

This is born out for surface position: adding *dou* lets both the *renhe*-construction and the *wh*-indefinites be in the subject position, preceding negation (27-28).

(27) *Renhe ren dou mei you lai.*
NPI.renhe person all NEG have come
'Nobody came.'

(28) *Shei dou mei you lai.*
NPI.who all NEG have come
'Nobody came.'

The same is the case with objects scrambled to a position that precedes negation:

(29) *Zhangsan renhe shuiguo dou meiyou chi gou.*
Zhangsan NPI.renhe fruit all NEG eat ASP
'Zhangsan has never eaten any fruit.'

(30) *Zhangsan shenme shuiguo dou meiyou chi gou.*
Zhangsan NPI.what fruit all NEG eat ASP
'Zhangsan has never eaten any fruit.'

Not all behavior is displayed, however. For example, *dou* still does not let Chinese NPIs serve as fragment answers (31). This, however, could be due to *renhe ren dou* not being a constituent.

(31) *Ni kandao shei? *Renhe ren dou.*
you see who NPI.renhe person all
'Who did you see? Nobody.'

All in all, I have found that Chinese NPIs are pattern with existentially quantified NPIs, as they are not licensed when scoping above negation, they cannot be fragment answers, and they are licensed long-distance. Furthermore, the fact that once they are modified with the distributive particle *dou*, which gives them universal quantification semantics, they behave like universally quantified NPIs when it comes to leftward scrambling and being licensed in subject position.

6.3 Turkish

For Turkish, I focus on NPIs formed by the combination of *hiç* 'ever' and indefinites (in the rest of this chapter, I gloss *hiç* as 'NPI' in these constructions). Such words are for example *hiçkimse* 'anybody' and *hiçbirşey* 'anything'. As other NPIs, these words are licensed with negation (32), and unlicensed without it (33). Unlike English *any*-NPIs, Turkish *hiç*-NPIs are not licensed in questions or conditionals (Kelepir, 2001).

(32) *John hiç-kimse-yi gör-me-di.*
John NPI-person-ACC see-NEG-PST
'John didn't see anybody.'

(33) * *John hiç-kimse-yi gör-dü.*
John NPI-person-ACC see-PST
'John saw anybody.'

Previous accounts of Turkish NPIs, such as Kelepir (2001), have assumed these items to be existentially quantified. I show in this section why this assumption is faulty based on the data, as many tests such as surface position, fragment answerhood, and *almost* modification all suggest that *hiç*-constructions are universally quantified. I also argue that an analysis where *hiç*-constructions are universally quantified can still account for the data in Kelepir (2001), which she presented to support her hypothesis that these constructions are existentially quantified.

One unexpected thing is that Turkish NPIs do not pattern with positive universal quantifiers in the language; while universally quantified NPIs have to scope over negation, positive universal quantifiers must scope under negation in Turkish. Consequently, I conclude that Turkish NPIs are a special case of universal quantifiers in Turkish that pattern differently from positive universal quantifiers in the language.

6.3.1 Surface position of NPIs

Turkish NPIs are allowed to be in subject (34), left-ward scrambled (35), and right-ward scrambled positions (36). While due to the head-final status of Turkish clauses, (34) in itself is not a decisive piece of evidence, the possibility of leftward-scrambling as in (35) suggests that Turkish NPIs are universally quantified. Unfortunately, rightward scrambling is still poorly understood in Turkish, and thus (36) is less straightforward of an evidence.

(34) *Hiç-kimse Ali-yi gör-me-di.*
NPI-person Ali-ACC see-not-PST
'Nobody saw Ali.'

(35) *Hiç-kimse-yi, Ali gör-me-di.*
NPI-person-ACC, Ali see-NEG-PST
'Ali didn't see anybody.'

(36) *Ali gör-me-di hiç-kimse-yi.*
Ali see-NEG-PST NPI-person-ACC
'Ali didn't see anybody.'

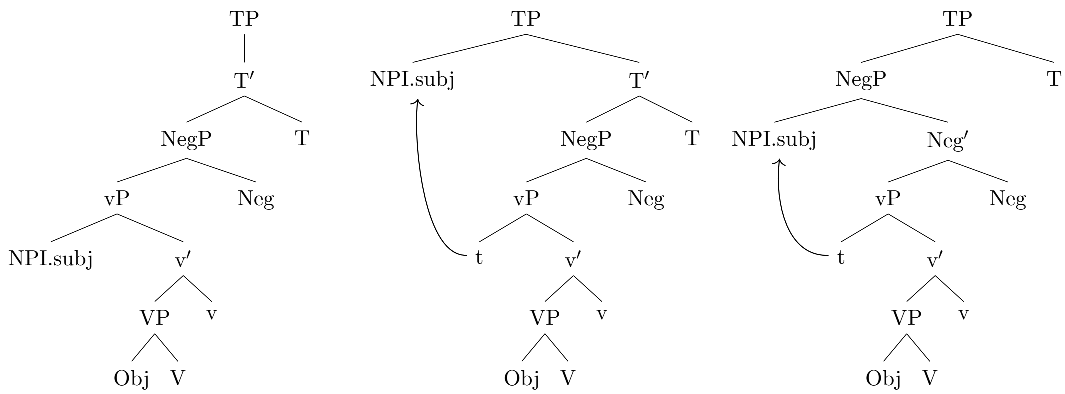
In Hungarian, it was clear that NPIs can surface at a position higher than negation, because Hungarian sentence structure has been analyzed to generally mirror linear order: not counting relative clauses, heads to the left c-command heads to their right. Turkish, on the other hand, is a head-final language, where the basic word order is SOV. Negation is expressed with a verbal suffix on the verb. Because it precedes Tense/Modal/Aspect morphology (Kelepir, 2001), I assume that NegP is at a place lower than TP in the sentence. As for the position of the subject, there are three possibilities, with different implications for the nature NPIs.

If the subject stays in a low position (Figure 6.1a), as argued in Öztürk (2005), then negation c-commands the subject, and thus the availability of subject NPIs by itself does not confirm its universal quantifier nature. It could be existential due to it scoping under negation, or it could be universal if it undergoes covert raising at the LF.

If the subject raises to Spec,TP (Figure 6.1b), then it c-commands negation. Assuming the subject does not reconstruct at LF, that would be evidence that it can it outscope negation as a universal quantifier. The third possibility is what I have proposed for Hungarian, that NPIs occupy Spec,NegP (Figure 6.1c).

One way to tease these options apart might be through looking at other types of quantifiers in subject positions. However, the data is not straightforward. Universally quantified NPs always scope below negation in Turkish, whereas indefinites always scope above negation (Kelepir, 2001). Thus, the scope of the subject position relative to negation is unclear in Turkish. I will return to the differences between positive universal quantifiers and *hiç*-NPIs and discuss them in more detail in §6.3.5.1.

How about the availability of NPIs in scrambled positions, such as (35) and (36)? Both of these positions have been shown to be high in the structure. Kornfilt



(a) Low subject in vP (b) High subject in IP (c) High subject in NegP

Figure 6.1: Possible placements of the subject in Turkish

(2005) shows that the preverbal scrambled position scopes over all other arguments in the pre-verbal positions, including the subject.

Furthermore, Kamali (2008) shows that constituents scrambled to this position and separated by intonation from the rest of the phrase take scope over sentential negation. This is why (37) is ungrammatical: (positive) universal quantifiers must scope under negation (Kelepir, 2001), and that is violated when they are scrambled to a high, preverbal position. Then, the fact that NPIs scrambled to this same position are acceptable, as in (35), might indicate that they in fact can scope over negation, and are universally quantified NPIs. If they were indefinites, we would have to postulate that items in this position can reconstruct to a position lower than negation; and we would also need to explain why *herkes* could not reconstruct in the same environment (37).

(37) * *Herkes, o test-e gir-me-di.*
everybody that test-DAT ener-NEG-PST
Intended: ‘Not everybody took that test.’ (Kamali, 2008, (9))

Post-verbal scrambling occupies a position higher than all other arguments in the sentence (Kural, 1997), but it also displays the ability to reconstruct according to Kornfilt (2005). Kornfilt (2005) reports the following judgment: post-verbally scrambled subjects tend to have wide scope over the pre-verbal parts of the sentence (38), but objects tend to have narrow scope (39). She suggests this is because both subjects and objects can reconstruct and be interpreted at their base position.

(38) *Üç kişi-ye dün akşam yardım et-miş herkes.*
three person-DAT yesterday evening help do-PST everybody
'Everybody helped three people yesterday evening.' (Kornfilt, 2005, (21))

a. $\forall \gg 3$

b. $3 \gg \forall$

(39) *Üç kişi dün akşam yardım et-miş herkes-e.*
three person yesterday evening help do-PST everybody-DAT
'Three people helped everybody yesterday evening.' (Kornfilt, 2005, (23))

a. $\forall \gg 3$

b. $3 \gg \forall$

Native informants judged post-verbally scrambled subject NPIs (40) to be more marginal than object NPIs (6.3.1). At first, this might look like an argument for Turkish NPIs being existentially quantified; subjects are worse because they reconstruct into a position that is still higher than negation, while objects reconstruct to a lower position as internal arguments. However, this contradicts the fact that Turkish NPIs in base subject position are fine, as in (34). If reconstruction into this position would lead them to be unlicensed, one would have to explain the data in (34), where they are licensed just fine. It is thus more convincing to think that NPIs in both (6.3.1) and (40) are universally quantified, do not reconstruct, and are interpreted higher than negation. The mild subject-object asymmetry needs further examination still, but nevertheless both sentences were acceptable to informants.

(36′) *Ali gör-me-di hiç-kimse-yi.*
Ali see-NEG-PST NPI-person-ACC
'Ali didn't see anybody.'

(40) ? *Ali-yi gör-me-di hiç-kimse.*
Ali-ACC see-NEG-PST NPI-person
'Nobody saw Ali.'

So far the evidence suggests that Turkish NPIs are universally quantified. The most unambiguous data in this regard is the fact that Turkish NPIs can be scrambled into a topic position, which sources agree to be in a high scope position relative to other items in the sentence.

6.3.2 Fragment answers

Turkish *hiç*-constructions can serve as fragment answers (43d). As discussed in Chapter 4, I have taken this fact to indicate that the NPI is universally quantified. To form a fragment answer, universally quantified NPIs move to a high position, and the rest of the sentence is erased.

(43d′) *Ne gör-dü-n? Hiç-bir-seyin.*
what see-PST-2SG NPI-a-thing
'What did you see? Nothing.'

6.3.3 Locality of licensing

In Chapter 4, I have argued that locality restrictions on licensing a given NPI can be informative about the quantifier nature of that NPI. This is because covert Ā-movements like QR are often subject to locality conditions. As universally quantified NPIs must undergo QR, they would be expected to display the same locality restrictions. It follows then that locality restrictions on licensing are only meaningful in comparison to the locality restrictions on QR in the same language.

Turkish has been described as a "scope-rigid" language (Kural, 1997), which means that quantifier scope mirrors surface c-command relations.[5] Sentences (41) and (42) illustrate this fact, as the interpretation of these sentences are unambiguous, and

[5] There are two exceptions to scope rigidity that I have found in the literature. One is that accusative-marked indefinites can take wide scope (Kelepir, 2001). These are likely similar to the indefinites discussed in Reinhart (1997), and can be interpreted high with the help of choice functions. The other exception has to do with reconstruction: phrases that scrambled to a post-verbal position can take either high scope or narrow scope (Kornfilt, 2005), where narrow scope is due to reconstruction, as I discussed in §6.3.1.

follows surface order. Because of this, the general consensus is that Turkish quantified phrases do not undergo QR. Due to the the lack of QR to compare it to, locality restrictions on licensing are not directly informative for diagnosing Turkish NPIs as universal quantifiers that undergo QR.

(41) *Öğrenci-ler-in çoğ-u her kitab-ı oku-du.* most ≫ ∀, *∀ ≫ most
student-PL-GEN most-POSS every book-ACC read-PST
'Most students read every book.' (Kelepir, 2001, (74a))

(42) *Her kitab-ı öğrenci-ler-in çoğ-u oku-du.* *most ≫ ∀, ∀ ≫ most
every book-ACC student-PL-GEN most-POSS read-PST
'Most students read every book.' (Kelepir, 2001, (74b))

At the same time, it also seems that Turkish NPIs are *not* existentials based on long-distance licensing data. If they were, like English *any*-NPIs, we would expect unbounded long-distance licensing to be available for them, subject only to processing constraints. However, this is not the case for Turkish, as discussed in Kelepir (2001) and Kayabasi and Özgen (2018).

Turkish NPIs are not licensed across tensed, finite clause boundaries, with nominative-marked embedded subjects:

(43) * *Demet [$_{CP}$ sen-ø kitab-ı kimse-ye ver-di-n diye] bil-mi-yor.*
Demet 2SG-NOM book-ACC NPI-DAT give-PST-3SG that know-NEG-PRS
'Demet doesn't acknowledge that you gave the book to anybody.' (Kayabasi and Özgen, 2018, (7))

(44) * *[$_{CP}$ Kimse-ø geç gel-di] san-m-ıyor-lar.*
NPI-NOM late come-PST think-NEG-PRS-3PL
Intended: 'They don't think anybody came late.' (Kelepir, 2001, (260a))

Sentences with tensed embedded clause are rare. Most often, Turkish expresses embedded clauses with nominalized, non-finite CPs, such as in (45). Note that in these sentences, the verb has a nominalizer on it, such as -*DIK*-, followed by an accusative marker. The embedded subject is in genitive case, instead of nominative case.

(45) *Hasan [Elif-in gül-düg-ün]-ü biliyor.*
Hasan Elif-GEN laugh-DIK-3SG-ACC knows
'Hasan knows that Elif is laughing.' (Kelepir, 2001, (249b))

NPIs are generally licensed across such non-finite, nominalized clauses (46). Because of the prevalence of nominalized clauses, Turkish NPIs are often treated as if they allow long-distance licensing (Kornfilt, 1997; Kelepir, 2001). Note, however, that this is not different from the ability of licensing Slavic or Hungarian NPIs across non-finite clause boundaries. Thus, the data on long-distance licensing in Turkish, if anything, mirrors the behavior of NPIs that I have diagnosed as universally quantified.

(46) a. *Ahmet-in kimse-yi sev-diğ-in-i san-m-ıyor-um.*
Ahmet-GEN NPI-ACC love-DIK-3SG-ACC think-NEG-PRS-1SG
'I don't think Ahmet loves anybody.' (Kelepir, 2001, (252a))

b. *Toplantı-ya kimse-nin gel-eceğ-in-i san-m-ıyor-um.*
meeting-to NPI-GEN come-ECEK-3SG-ACC think-NEG-PRS-1SG
'I don't think anybody will come to the meeting.' (Kelepir, 2001, (252b))

c. *Hasan hiçkimse-nin git-me-sın-ı iste-me-di.*
Hasan NPI.body-GEN go-MA-3SG-ACC want-NEG-PST
'Hasan doesn't want anybody to go.'

Again, notice that Turkish NPIs thus are turning out to be items that pattern the same as NPIs in Hungarian and Slavic languages, but do not pattern the same as universal quantifiers in the same language. They seem to display QR and obligatory scoping above negation, whereas positive universal quantifiers in Turkish do not do either. I discuss this contrast further in §6.3.5.1.

6.3.4 Islands

In Turkish, embedded CPs are often non-finite, and thus a wider range of island tests can be used than in Hungarian. They also are not licensed in wh-questions, making it possible to also test wh-islands on them without fear that they are licensed by the wh-question rather than negation. On the other hand, Turkish is a wh-in-situ language, and wh-phrases do not appear to be sensitive to islands (47). This fact makes direct comparison between Ā-movement and NPIs nearly impossible.

(47) a. Complex NP island, argument wh:

Hasan Fatma-nin ne-yi gör-düg-ü iddiasında bülün-dü?
Hasan Fatma-GEN what-ACC see-DIK-ACC claim find-PST
'What did Hasan make the claim that Fatma saw t?'

b. Complex NP island, adjunct wh:

?Adam-ın neden yaz-dığ-ımektup uzun?
man-GEN why write-DIK-ACC letter long
'Why is the letter the man wrote t long?'

c. Adjunct island:

John kiminle konusmay-i bitirdikten sonra Mary-i ara-di?
John who-GEN-INSTR speak-ACC finished after Mary-ACC call-PST
'Who did John call Mary after he speaking to t?'

d. Coordinate structure island:

Sam fasulye ve ne ye-di?
Sam bean and what eat-PST?
'What did Sam eat beans and t?'

e. Wh-island:

John Eric-in nere-ye ne al-maya git-tig-in-ı merak edi-yor?
John Eric-GEN where what buy-MA go-DIK-3SG-ACC wonder do-PROG
'What does John wonder where Eric went to buy t?'

Interestingly, Turkish NPIs, unlike their wh-question counterparts, are sensitive to island effects (48-52). The only construction where this was not true was complex NP islands, where the NPI is an argument (48). It is unclear why this is an exception, but nevertheless the data seems robust.

(48) Complex NP island, argument NPI:

Hiçkimsey-i üz-ecek sır-lar-ı acik et-me-di-m.
NPI-ACC upset-ECEK secret-PL-ACC open do-NEG-PST-1SG
'I didn't expose secrets that hurt anybody.'

(49) Complex NP island, adjunct NPI:

**Fatma-yi hiçbir sekilde üz-ecek sır-lar-ı acik et-me-di-m.*
Fatma-ACC NPI way upset-ECEK secret-PL-ACC open do-NEG-PST-1SG
'I didn't expose secrets that upset Fatma in any way.'

(50) Adjunct island:

**Hiç-kimşey-le konuşma-yi bitirdikten sonra John Mary-i ara-ma-di.*
NPI-who-DAT talking-ACC finishing after John Mary-ACC call-NEG-PST
'John didn't call Mary after talking to anybody.'

(51) Coordinate structure island:

**John fasulye ile hicbirsey yemez.*
John bean and NPI eat-NEG-PRS
'John doesn't eat beans and anything.'

(52) WH-island:

**Mary-e Kevin-in hickimse-yi nasil öldür-düg-ün-ü sor-ma-di-m.*
Mary-ACC Kevin-GEN NPI-ACC how kill-DIK-3SG-ACC ask-NEG-PST-1SG
'I did not ask Mary how Kevin killed anyone.'

The data suggests that Turkish NPIs undergo movement. The contrast between Turkish NPIs and wh-questions are especially striking when compared to Mandarin Chinese. In Chinese, neither *wh*-questions nor NPIs were sensitive to islands, suggesting that either neither of them moves or that Ā-movement generally is not constrained by islands in the language. In Turkish, the fact that islands do matter in some constructions then means that movement *is* sensitive to islands, and that *wh*-phrases genuinely do not undergo movement whereas NPIs do. The island data thus again suggests that Turkish NPIs are universally quantified.

6.3.5 Semantic evidence

6.3.5.1 Relative scope

In this section, I discuss data regarding the relative scope of NPIs compared to negation and other quantifiers and quantificational adverbs. One unexpected finding is that Turkish NPIs, while patterning like Hungarian universally quantified NPIs, do not pattern like Turkish positive universal quantifiers. In the literature, Kelepir (2001) has argued that Turkish NPIs are existentials and have to be in the scope of negation and are subject to the Immediate Scope Constraint (ISC) – that is, no other quantifying element can intervene the licensing relationship (Linebarger, 1987). In what follows, I dispute some fo the data presented by Kelepir (2001), and show that the remaining data can also be accounted for if Turkish NPIs were universally quantified.

Before I start discussing the data, it is important to establish two generalizations regarding the scope of quantifiers and quantificational adverbs in Turkish. One is that universally quantified NPs always scope under negation (53), and second, NPs modified by *bazı* 'some' always take scope over negation (54).

(53) *Bogün herkes gel-me-di.* $*\forall \gg \neg, \neg \gg \forall$
today everybody come-NEG-PST
'It is not the case that everybody came today.' (Kelepir, 2001, (210))

(54) *Hasan bazı müşteri-ler-i ara-ma-di.* $\exists \gg \neg, *\neg \gg \exists$
Hasan some customer-PL-ACC call-NEG-PST
'It was some customers that Hasan didn't call.' (Kelepir, 2001, (211))

Similarly adverbs like *her zaman* 'always' scopes under negation (55), while *genellikle* 'usually' scopes over negation (56).

(55) *Hasan bu ders-e her zaman git-m-iyor-muş.*
Hasan this class-DAT always go-NEG-PROG-EP
'It is not the case that Hasan always go to this class.' (Kelepir, 2001, (225a))

a. $*$ *always* $\gg \neg$

b. $\neg \gg$ *always*

(56) *Hasan genellikle bu ders-e git-m-iyor-muş.*
Hasan usually this class-DAT go-NEG-PROG-EP
'Usually, Hasan doesn't go to this class.' (Kelepir, 2001, (225b))

a. *usually* $\gg \neg$

b. $*\neg \gg$ *usually*

In light of these facts, Kelepir (2001) accounts for the contrast between (57) and (58) by appealing to the indefinite nature of Turkish NPIs and the ISC. I first go over her analysis for (57), then continue on to (58)

(57) * *Herkes kimse-yi gör-me-di.*
everybod NPI.body-ACC see-NEG-PST
'Everybody didn't see anybody.' (Kelepir, 2001, (207a))

(58) *Hasan bazı insan-lar-a hiçbir resm-i göster-me-di.*
Hasan some person-PL-DA NPI picture-ACC show-NEG-PST
'Hasan didn't show any pictures to some people.' (Kelepir, 2001, (208a))

In Kelepir's view, (57) is unacceptable because *herkes* 'everybody' c-commands the NPI *kimşe*, and thus is either forced to scope high (Figure 6.2a) or intervenes between negation and the NPI-licensing (Figure 6.2b).

(a) *Herkes* scopes above negation, violating scope constraint on *herkes* (Kelepir, 2001, (223b))

(b) *Herkes* scopes below negation, but violates ISC (Kelepir, 2001, (223d))

Figure 6.2: Possible structures for (57) according to Kelepir (2001)

However, the quantificational force of the NPI is not actually crucial to derive the ungrammaticality of (57). If the NPI was universally quantified, instead of being an indefinite, by being higher than negation, it would force *herkes* to be also higher than negation (Figure 6.3), following the common assumption that surface scope mirrors LF scope in Turkish. This results in *herkes* violating the constraint that it must take scope under negation.

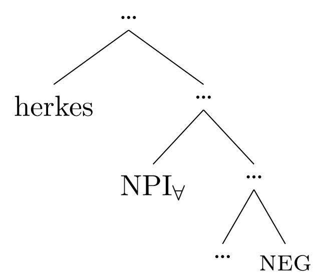


Figure 6.3: Structure for (57) with ∀ NPI, violating scope constraint on *herkes*

Alternatively, if we assume that the NPI undergoes QR above both *herkes* 'everybody' and negation, we have to stipulate a constraint that bans a universally quantified element to raise across another universally quantified element. This at least seems to be true for Hungarian, where object NPIs are bad with universally quantified subjects (59) but object NPIs are acceptable with universally quantified objects (60).

(59) * *Sen-ki-t nem lát-ott minden-ki.*
NPI-who-ACC NEG see-PST.3SG every-who
'Every didn't see anybody.'

(60) *Sen-ki nem lát-ott minden-ki-t.*
NPI-who NEG see-PST.3SG every-who-ACC
'Nobody saw everybody.'

Next, I discuss (58), repeated below. Recall that the scope constraint on *bazı* 'some' is the opposite of the constraint on *her* 'every': *bazi* always has to take scope above negation. In Kelepir's (2001) account then, (58) is grammatical because now *bazı*, or a choice function linked to *bazı*, scopes higher than negation, the NPI scopes lower, and no ISC or scope constraint violation takes place. However, this does not exclude the possibility of a structure like Figure 6.4 either, where both *bazı* and the universally quantified NPI simply take scope above negation.

(58′) *Hasan bazı insan-lar-a hiçbir resm-i göster-me-di.*
Hasan some person-PL-DA NPI picture-ACC show-NEG-PST
'Hasan didn't show any pictures to some people.' (Kelepir, 2001, (208a))

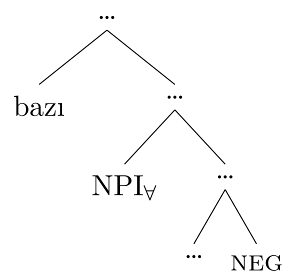


Figure 6.4: Structure for (58) with ∀ NPI

This same contrast exists for quantificational adverbs as well. Like *herkes* 'everybody', the adverb *her zaman* 'always' also must take scope under negation. In contrast, *genellikle* and *genelde* 'usually' scope over negation. Consequently, when NPIs are added, we observe the same behavior (61-62) as what was between (57) and (58).

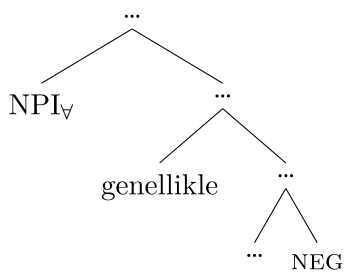
(61) ?? *Bu ders-e her zaman kimse git-miyor-muş-ø.*
this class-DAT always NPI go-NEG-EVID-3SG
'It is always the case that nobody goes to class.' (Kelepir, 2001, (206))

(62) *Bu ders-e genellikle kimse git-miyor-muş-ø.*
this class-DAT usually NPI go-NEG-EVID-3SG
'It is usually the case that nobody goes to class' (Kelepir, 2001, (227))

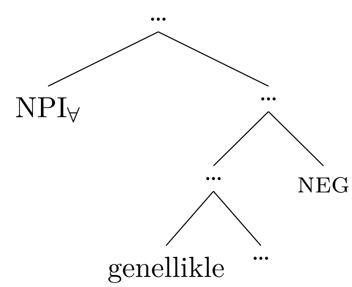
Now let us consider the datapoint where the NPI c-commands the quantified element that normally must take wide-scope over negation. Such data is illustrated in (63). In Kelepir's (2001) analysis, these types of sentences should be unacceptable, because the NPI has to scope under negation, and by c-commanding *genellikle*, *genellikle* is forced to be under the scope of negation as well. This violates the constraint that says *genellikle* always takes wide scope. Note first, however that even according to Kelepir (2001), (63) is marginal, and not straight out unacceptable.

(63) ? *Bu ders-e kimse genellikle git-miyor-muş-ø.* Kelepir (2001),(227)
this class-DAT NPI usually go-NEG-EVID-3SG
'It is usually the case that nobody goes to class'

Moreover, the same data can be accounted for even if the NPI is universally quantified and takes scope over negation. It is possible that (63) is less acceptable because *genellikle* intervenes in the licensing relation between the NPI and negation (Figure 6.5a). It is also possible that *genellikle* is still in a position lower than negation in the sentence (Figure 6.5b).



(a) *Genellikle* intervenes between NPI and negation



(b) *Genellikle* scopes under negation

Figure 6.5: Possible structures for (63), with ∀ NPI

This latter possibility is borne out from te fact that informants rated (64) low, ranking it at 2.19 out of 5 on average. If *genelde* or *genellikle* simply cannot appear in an immediately pre-verbal position, and the unacceptability of (63) bears nothing on the quantifier type of the NPI in it.

(64) * *Hasan kahvalt-ı genelde et-me-z.*
Hasan breakfast-ACC usually eat-NEG-3SG
'Hasan usually doesn't eat breakfast.'

Another reason to distrust Kelepir's (2001) assumptions comes from data reported by Görgülü (2018). In Turkish, sentences with indefinites are ambiguous;[6] for example, (65) has the two possible meanings conveyed in (65a) and (65b). When an NPI is introduced, as in (66), Kelepir (2001) claims that the ambiguity disappears; since the NPI must stay in the scope of negation, the indefinite c-commanded by the NPI is forced to stay within the scope of negation as well. However, this judgment is

[6] Indefinites modified by *bir* 'a' have a different distribution from items modified by *bazı* 'some'; the latter always have to scope above negation, while the former, as discussed here, is ambiguous.

disputed by Görgülü (2018), who maintains that many native speakers still find (66) to be ambiguous. Furthermore, (67) shows that the wide-scope reading of the indefinite is still available.

(65) *Leyla bir arkadiş-ım-ı davet et-me-miş*
Leyla a friend-1SG-ACC invite do-NEG-EVID

a. There is a friend of mine such that Leyla didn't invite them. $\exists \gg \neg$

b. Leyla didn't invite even one friend of mine. $\neg \gg \exists$

(66) *Kimşe bir akadiş-ım-ı davet et-me-miş*
NPI a friend–1SG-ACC invite do-NEG-EVID
'Nobody invited a friend of mine.'

(67) *Kimşe bir akadiş-ım-ı parti-ye davet et-me-miş. Bu yüzden gel-e-me-di.*
anybody a friend-1SG-ACC party-DAT invite do-NEG-PERF this reason come-ABIL-NEG-PST
'A friend of mine is such that nobody invited her/him to the party. That is why s/he couldn't come.' (Görgülü, 2018, (24))

In sum, data incorporating quantificational elements into sentences with NPIs do not decisively diagnose Turkish NPIs as either type of quantifier. In fact, all data could be accounted for with either option.

6.3.5.2 Almost-modification

In Turkish, the NPI can be modified by *'almost'* 68, which indicates that the NPIs are most likely universally quantified.

(68) *Neredeyse hiç-kimsey-i gör-med-im* *Turkish*
Almost any-thing-ACC see-NEG-PST.1SG
'I didn't see almost anything.'

Universally quantified items can also be modified by *almost*:

(69) *Neredeyse her dilbilimci müzikçi-dir.*
almost every linguist musician
'Almost every linguist is a musician.' (Özyıldız, 2017, (519))

6.3.6 Summary of Turkish NPI behavior

I have discussed the case of Turkish in this section. Taking everything together, I have shown that tests such as surface position, fragment answerhood, long-distance licensing, and island effects all suggest that Turkish NPIs are universally quantified. Moreover, I argued that data shown in Kelepir (2001) meant to show that Turkish NPIs are existentials do not hold, and can be either explained even if they are universally quantified or are disputed by others.

6.4 Romance languages

Data from a number of Romance languages pose a challenge to the account of NPI-licensing typology posited here.[7] I am in particular focusing on items that have been variably called 'n-words', 'Negative Concord Items (NCIs)', or 'negative indefinites' – in the rest of this discussion, I will refer to them as NCIs.[8] Table 6.2 shows a paradigm of these items for Italian, Portuguese, Spanish, and Catalan.

English	Italian	Portuguese	Spanish	Catalan
anybody/nobody	nessuno	ninguém	nadie	ningú
anything/nothing	niente	nada	nada	res
never	mai	nunca	nunca	mai

Table 6.2: Paradigm of NCIs in Romance languages

[7] There is a lot of typological variation between individual Romance languages and their variants. Here, I will mainly discuss data from Italian, Portuguese, Spanish, and Catalan, while I exclude Romanian and French. Romanian NPIs have more in common with Slavic NPIs than with other Romance NPIs (Falaus and Nicolae, 2016). French NPIs such as *rien* and *personne* are incompatible with standard French sentential negation, and in general behave more like negative quantifiers (Déprez, 1995).

[8] There are NPIs in Romance languages that pattern the same as English *any*-NPIs. For example, Zanuttini (1991) discusses Italian *alcunché* 'anything' as such, and contrasts it with the behavior of items like *niente*. I call *niente*-type items NCIs to separate them for these other NPIs.

Romance NCIs conform to the definition of negative polarity in that they need to be licensed in post-verbal positions. Without negation, the sentences containing NCIs become unacceptable (70-73).

(70) Italian

a. *Non ho visto nessuno.*
NEG have.1SG saw NPI.body
'I haven't seen anybody.' (Zanuttini, 1991, (170a))

b. * *Ho visto nessuno.*
have.1SG saw NPI.body
'I haven't seen anybody.' (Zanuttini, 1991, (170a))

(71) Portuguese

a. *Não veio ningém.*
NEG came NPI.body
'Nobody came.' (De Swart, 2010, (21a))

b. * *Veio ningém.*
came NPI.body
'Nobody came.' (De Swart, 2010, (21a))

(72) Spanish

a. *No funciona nada.*
NEG work.3SG NPI.thing
'Nothing works.' (Vallduví, 1994, (36a))

b. * *Funciona nada.*
work.3SG NPI.thing
'Nothing works.' (Vallduví, 1994, (36a))

(73) Catalan

a. *No funciona res.*
NEG work.3SG NPI.thing
'Nothing works.' (Vallduví, 1994, (26a))

b. * *Funciona res.*
work.3SG NPI.thing
'Nothing works.' (Vallduví, 1994, (26a))

6.4.1 Ambiguity approach

An interesting feature of these items is that they display divergent behaviors based on their syntactic positions: unlike in post-verbal positions, where they required a licensor, they do not need one in pre-verbal contexts, both as subjects and pre-posed topics (74-77). This characteristic makes them different from both ∀- and ∃-type NPIs – recall that ∀-NPIs could be in a subject position, but must be licensed, whereas ∃-NPIs cannot be in the subject position at all.

(74) Italian:

a. *Nessuno è venuto.*
NPI.body is.3SG come
'Nobody has come.' (Zanuttini, 1991, (168a))

b. *Niente, ho detto.*
NPI.thing have.1SG said
'Nothing, I have said.' (Zanuttini, 1991, (168c))

(75) European Portuguese:

a. *Ninguém veio.*
NPI.body came
'Nobody came.' (De Swart, 2010, (21b))

(76) Spanish:

a. *Nada funciona.*
NPI.thing work.3SG
'Nothing works.' (Vallduví, 1994, (36b))

(77) Catalan:

a. *Res (no) funciona.*
NPI.thing NEG work.3SG
'Nothing works.' (Vallduví, 1994, 26b)

One way to explain this asymmetry between pre-verbal and post-verbal NCIs in Romance is to propose that these items are ambiguous between being negative quantifiers and NPIs (Herburger, 2001; Déprez and Martineau, 2004; Espinal and Tubau, 2016).[9] As NPIs, they must be licensed; whereas as negative quantifiers, they do not need licensing – in fact, whenever they are not licensed as NPIs, they can only be interpreted as negative quantifiers. Consequently, they are able to be in a pre-verbal position without licensing (74-77). This also explains why they are able to license post-verbal NCIs themselves (78-81). As to what type of NPIs these items are when they do behave like NPIs, I will discuss in Section 6.4.2.

(78) *Nessuno ha detto niente.* Italian
NPI.body have.3SG said NPI.thing
'Nobody has said anything.' (Zanuttini, 1991, (169b))

(79) *Ninguem disse nada.* Portuguese
NPI.body said NPI.thing
'Nobody said anything.' (Zanuttini, 1991, (169e))

(80) *Nunca han llamado a nadie.* Catalan
NPI.ever have.3PL called to NPI.nobody
'They never called anybody.' (Espinal et al., 2016, (8b))

(81) *Ningú ha fet res.* Catalan
NPI.body have.3SG done NPI.thing
'Nobody has done anything.' (Espinal et al., 2016, (7b))

There are a few pieces of evidence for the ambiguity approach, all related to having the DN reading available for sentences featuring NCIs. For example, while older sources state that NCIs in subject positions cannot co-occur with sentential negation, it turns out that they can with certain intonational patterns, and yield a DN reading. This is possible if these items are interpreted as negative quantifiers due to lack of licensing (82-83).[10]

[9] Ambiguity-based accounts to NCIs vary in terms of which linguistic mechanism the authors think is responsible. For example, while Herburger (2001) proposed simple lexical ambiguity, Espinal and Tubau (2016) derive the ambiguity from different syntactic features. These details are unimportant for the current discussion.

[10] Catalan is different from the other Romance languages in this respect, as pre-verbal NCIs with negation can yield both NC and DN readings – in fact, native speakers were more likely to get the DN reading when sentential negation was included (Espinal and

(82) *Nessuno non ha telefonato.* Italian
NPI.body NEG have.3SG called
'Nobody didn't call.' (Zeijlstra, 2004, Ch. 7, (36b))

(83) *Nadie no vino.* Spanish
NPI.body NEG came
'Nobody didn't come.' (Zeijlstra, 2004, Ch. 7, (51))

Additionally, it turns out that sentences with non-subject NCIs and negation can have a DN reading as well, though this interpretation might be more marked or require certain prosody (84-85). In these cases, a DN reading is only possible if the NCI is a negative quantifier, contributing its own semantic negation to the sentence. Sentences with only multiple NCIs have also been shown experimentally to have ambiguous readings (see Déprez et al. (2015) for Catalan and Iacoponi and Déprez (2018) for Italian).

(84) *Proprio niente, non ho detto.* Italian
absolutely NPI.thing, NEG have.1SG said
(Zanuttini, 1991, (214))

a. I haven't said anything. Negative Concord

b. I haven't said nothing. Double Negation

(85) *El bebé no está mirando a nadie.* Spanish
the baby NEG is looking at NPI.body
(Herburger, 2001, (28))

a. The baby is not looking at anybody. Negative Concord

b. The baby is not looking at nobody. Double Negation

(86) *No lluiten per res.* Catalan
NEG fight for NPI.thing
(Déprez et al., 2015, (8a))

a. They don't fight for anything. Negative Concord

Tubau, 2016). The availability of the DN reading shows that Catalan NCIs can be either negative quantifiers or NPIs.

b. They don't fight for nothing. Double Negation

There are even rare cases where post-verbal NCIs can appear without a licensor (87). Herburger (2001) presents additional ones collected from various written texts.

(87) *Temen que el bebé sea autista. Se pasa el tiempo mirando a nada.* Spanish
fear.3PL that the baby is.SUBJ autistics he spends the time looking at NPI.thing
'They fear the baby is autistic. He spends the time looking at nothing.' (Herburger, 2001, (23a))

6.4.2 The nature of Romance NPIs

If Romance NCIs are in fact ambiguous between negative quantifiers and NPIs, the next thing to address is their quantifier type as NPIs: are they universal quantifiers or are they indefinites? In this section, I go through supporting evidence for both, and conclude that there is no definitive answer, given what is currently known.

6.4.2.1 Fragment answers

I start with the fragment answer test, because it is the least informative for the case of Romance. One well-known characteristic of Romance NCIs is that they can serve as fragment answers (88-90). While this behavior was used to diagnose NPIs as universal quantifiers previously, in the case of Romance these items can also be negative quantifiers and require no licensing due to that. Thus, fragment answer data becomes uninformative as a diagnostic, because fragment answers likely involve negative quantifiers.

(88) *Chi hai visto? Nessuno.* Italian
who have.2SG seen NPI.body
'Who have you seen?' 'Nobody.' (Zanuttini, 1991, (188))

(89) *A quién has visto? A nadie.* Spanish
a who have.2SG seen a NPI.body
'Who'd you see? Noone.' (Vallduví, 1994, (35))

(90) *Qui has vist? Ningú.* Catalan
who have.2SG seen NPI.body
'Who'd you see? Noone' (Vallduví, 1994, (20a))

6.4.2.2 Surface position

Surface position seems to point toward Romance NCIs being indefinites as NPIs. Earlier, I have established that the availability to be in a position higher than negation meant that the NPI was likely to be a universal quantifier. In Romance, on the other hand, this test becomes muddled by the possibility of ambiguity; except for Catalan, Romance NCIs worked like negative quantifiers when in a pre-verbal position.

The account is straightforward, if Romance NPIs are indefinites that are required to be in the scope of negation to be licensed. In that case, pre-verbal NCIs are always negative quantifiers (as they are not licensed), and post-verbal NCIs can be NPIs (if they are licensed).

If they are universal quantifiers, Romance NCIs should be grammatical in an 'NCI + NEG' sequence with Negative Concord (NC) reading, like in Hungarian or Slavic languages. We have seen that, except for in Catalan, the 'NCI + NEG' sequence yielded only the Double Negation (DN) reading (82-83). Thus, they can only be negative quantifiers in that position. If one was to assume nevertheless that Romance NPIs are universal quantifiers, they would have to explain why these items would be blocked in a pre-verbal position as NPIs.

6.4.2.3 Locality of licensing

The observation has been that universally quantified NPIs are only licensed locally due to constraints on QR, whereas indefinites can be licensed long-distance. Romance NPIs behave more like universally quantified NPIs in this respect.

Generally, post-verbal NPIs in Romance are not licensed across tensed, finite clauses.[11]

[11] Herburger (2001) presents exceptions to this generalization; but, as Zeijlstra (2004) points out, all her examples feature *dudo* 'doubt' as the matrix verb. It is possible that

(91) * *Non ho deciso [che faro niente].* Italian
NEG have.1SG decide that do.FUT.1SG NPI.thing
'I haven't decided that I'll do anything.' (Zanuttini, 1991, (256b))

(92) * *No crec [que ve ningu].* Catalan
NEG believe.1SG that comes NPI.body
'I do not believe that anyone is coming.' (Progovac, 1994, (44))

Interestingly, pre-verbal NCIs in the same contexts do not cause ungrammaticality, but they can only be interpreted as negative quantifiers, further supporting the ambiguity hypothesis. It might be that post-verbal NCIs would also be fine the same way they were in (87), but the judgment is hard to get.

(93) *Non ho detto [che nessuno e arrivato].*
NEG have.1SG said that NPI.body has arrived.
(Zeijlstra, 2004, (89))

a. * I haven't said that anybody has arrived. NC

b. I haven't said that nobody has arrived. DN

On the other hand, these NPIs are licensed if the embedded verb is an infinitive (94) or a subjunctive (95). This might be due subjunctives and non-finite clauses being more transparent for movement than tensed, finite clauses are.

(94) *Non ho deciso [di fare niente].* Italian
NEG have.1SG decide to do NPI.thing
'I have't decided to do anything.' (Zanuttini, 1991, (256a))

(95) *Non pretendo [che tu arresti nessuno].* Italian
NEG require.1SG that you arrest.SUBJ NPI.body
'I don't require that you arrest anyone.' (Progovac, 1994, Chapter 8, (8))

6.4.2.4 Island effects

NPIs in Romance are sensitive to island effects, which is additional evidence that they undergo movement. This again supports the hypothesis that they are universal quantifiers. While all these islands might look like there are clause-boundaries

dudo, having a negative meaning, independently creates an NPI-licensing context.

involved, all these clauses are non-finite, and are transparent for licensing, as discussed in §6.4.2.3. The <> brackets indicate islands.

(96) Complex NP island

a. * *Non approverei <la tua proposta di vedere nessuno>.* Italian
NEG approve the your proposal of see.INF NPI.body
'I wouldn't approve your proposal of seeing anybody.' (Zanuttini, 1991, (265b))

(97) Coordinate Structure island

a. * *Non pretendo che tu <dica questo o chiami nessuno>.* Italian
NEG require that you say this or call NPI.body
'I don't expect that you say this or call anyone.' (Zanuttini, 1991, (266a))

b. *Non pretendo <che tu dica niente> o <che chiami nessuno>.*
NEG expect that you say NPI.thing or that call NPI.body
Italian

'I don't expect that you say anything or call anyone.' (Zanuttini, 1991, (277a))

(98) Adjunct island

a. * *Non fa il suo dovere <per aiutare nessuno>.* Italian
NEG do.3SG his own duty to helpINF NPI.body
'He doesn't do his duty to help anyone.'

(Zanuttini, 1991, (267a))

6.4.2.5 Almost-modification

Finally, Romance NPIs can be modified by 'almost', even when they act as NPIs. Note that the *almost*-test has been disputed by many as a legitimate test of quantifier type; but, taken together with all other evidence, it strengthens the idea that Romance NPIs are universal quantifiers.

(99) *Non ha detto quasi niente.* Italian
NEG has said almost NPI.thing
'He said almost nothing.' (Zanuttini, 1991, (192b))

(100) *No he vist gairebé ningú.* Catalan
NEG have.3SG seen almost NPI.body
'I have seen almost noone.' (Vallduví, 1994, (57a))

6.4.2.6 Summary of Romance NPI behavior

In this section, I have gone through how Romance NPIs fare with the various quantifier tests that were used previously. Table 6.3 summarizes what each test result suggests, and for the most part, Romance NPIs pattern with universal quantifiers. However, we need to be cautious about these results; the fact that they do not seem to behave like universal quantifiers when it comes to their pre-verbal behavior still needs explanation. As I discussed in §6.4.2.2, one possibility is that pre-verbal NCIs default to negative quantifiers, and block universally quantified NPIs from appearing there.

Fragment answers	$\forall$
Surface position	$\exists$
Locality of licensing	$\forall$
Island effects	$\forall$
Almost-modification	$\forall$

Table 6.3: Summary for Romance NPI behavior

They also do not completely behave like Hungarian or Slavic NPIs in another aspect. In both Hungarian and Slavic, NPIs were only licensed by negation; I have accounted for this by proposing that universally quantified NPIs are required to QR to NegP in order to take scope over negation. Existential NPIs, on the other hand, were only required to be in the scope of a downward-entailing or non-veridical licensor, not necessarily negation. Romance NPIs display mixed behaviors on this front: Italian NPIs can be licensed by both questions and in protesis of conditionals (Zanuttini, 1991), while Spanish NPIs cannot be (Vallduví, 1994). Any unified analysis of Romance NPIs would need to account for this diverging behavior.

Finally, I should note that there are a number of existing, different theories for the nature of these items. Most of the accounts assume that Romance NPIs are non-negative indefinites, similarly to English NPIs (see discussion in Giannakidou and Zeijlstra (2017)). However, this cannot be completely true, since, as I have shown here, in many instances, they do not behave like indefinites. There are some existing work that explain the more problematic parts away. For example, Zeijlstra (2004) proposes that Romance NPIs are indefinites with a negative agreement requirement, and their licensing relation is locally bound because the Agree relation must be local. One problem with Zeijlstra (2004) idea, however, is that it does not explain the instances where Romance NPIs are licensed in non-negative, downward-entailing contexts.

In summary, Romance NPIs do not fit neatly as either universal quantifiers or indefinites. Either option raises problems for some of the data, and moreover, newer, experimentally collected data contradicts previous published judgments in the literature. Consequently, a more complete and accurate database is needed before we can unambiguously diagnose them as either existentially or universally quantified NPIs.

6.5 Summary of the chapter

In this chapter, I have discussed a number of typologically unrelated languages, and how they fare in the proposed quantifier-based framework. I have found that Slavic *ni*-NPIs pattern clearly with universally quantified NPIs, whereas Mandarin Chinese NPIs pattern as indefinites.

Turkish and Romance proved to be harder to fit into the typology. Turkish data suggested mostly that it has universally quantified NPIs that do not pattern like positive universal quantifiers in the language. Romance NPIs showed contradictory behavior, sometimes behaving like universal quantifiers, and other times behaving like existentials. However, Romance NCI data is currently undergoing experimental re-evaluation, and it is possible that newer findings will confirm the nature of Romance NPIs, one way or another.

Part III

A MODEL-THEORETIC APPROACH TO NPI-LICENSING

This part presents the computational results of the thesis where I seek to answer the following question: how complex are the tree languages that satisfy the quantifier-based NPI-licensing constraints proposed by Giannakidou (2000)? Computational complexity is a mathematically precise way to classify the difficulty of a given computational problem. In formal language theory, the problem is often formulated as a *membership problem*: given a language $\mathcal{L}$, is a given object a member of $\mathcal{L}$? A way to solve this problem is to use computational tools, such as logic or automata, to characterize $\mathcal{L}$. Then from the nature of these tools, we can infer the complexity of $\mathcal{L}$.

A rough and general hierarchy of complexity classes are often referred to as the Chomsky-hierarchy (Figure 6.6), and it shows how some of these different classes relate to each other: in this figure, the least complex class is the class of finite languages, and the most complex one is the class of recursively enumerable languages. Our focus will mainly be the hierarchy *within* the class of regular languages, called the *subregular hierarchy*.

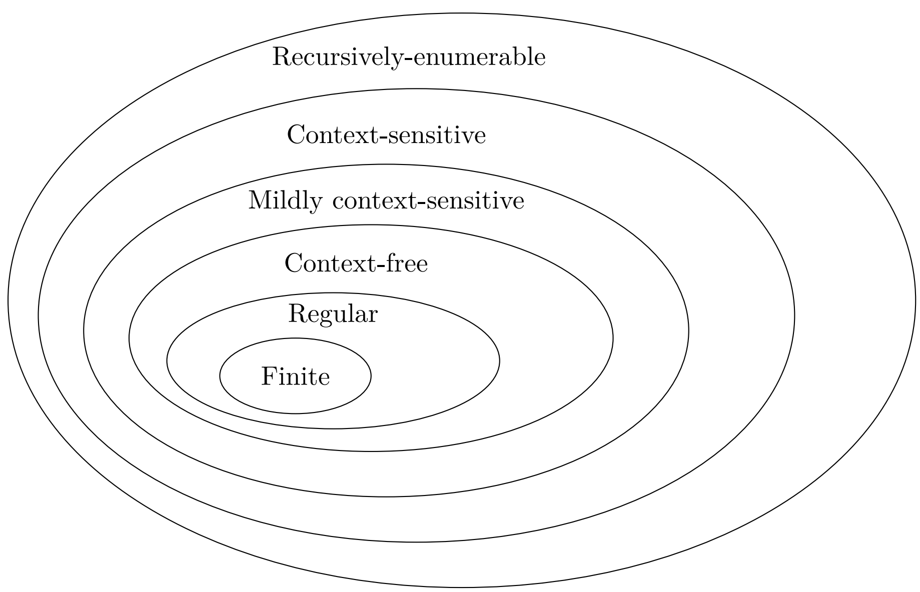


Figure 6.6: A simplified version of the Chomsky-hierarchy

Applied to NPI-licensing patterns, we characterize the set of sentences that are acceptable regarding NPI-licensing and then infer the complexity of the overall pattern based on this characterization. Before starting, we need to establish two things: 1) the tools that we will use to measure computational complexity, and 2) the representation of the sentences in question.

I will use a model theoretic approach to linguistic complexity. Model theory studies the complexity of a language through the logical toolset required to describe constraints that would exclusively generate the members of that language. How we choose to represent members of a given language in turn can largely effect the nature of the logic required to describe them. Here, I will choose derivation trees in the MGs framework as our representation of syntactic data structure.

The reason to use them is that derivation trees are computationally well-studied. As long as they are MSO-definable and the transduction from derivation trees into derived trees is MSO-definable as well, the string yields of their derived tree outputs are Multiple Context Free Languagess (MCFLs) (Michaelis, 2001; Graf, 2012b). These are welcome results because MCFLs are one of the formal characterizations of mildly context-sensitive languages that Joshi (1985) conjectured to be the upper bound of natural language syntax. In other words, the patterns that were described as multiple context-free string languages can be modeled with regular tree languages, if these tree languages are MGs derivation tree languages. In fact, the current hypothesis is that the relevant class of tree-languages is not only regular, but *subregular* (Graf et al., 2018).

This possibility ties into the latest results in the complexity of phonological patterns, which have suggested that phonological patterns can be described with logical constraints within various classes in the subregular hierarchy over string representations. If syntactic patterns, modeled with derivation trees, also turn out to have the same logical complexity as phonological patterns, then it would suggest that the difference between phonology and syntax does not lie in the nature of logic required to adequately describe their constraints, but rather it lies in their different data structures. This conclusion would follow from decades of existing practice in generative linguistics: illustrating most phonological patterns on strings, and syntactic patterns on trees. The hypothesis that all modules of language require constraints of the same complexity is captured by the *cognitive parallelism hypothesis* (Graf et al., 2018).

(101) **Cognitive parallelism hpyothesis** (Graf et al., 2018)
Phonology, morphology, and syntax have the same subregular complexity over their respective structural representations.

In particular, the class of TSL languages and its extensions, I-TSL and MITSL, defined first in De Santo and Graf (2019) for strings, have been hypothesized to be the most relevant classes for syntactic patterns, as well as for some long-distance phonological patterns. One reason for this is that they are able to capture long-distance dependencies, ubiquitous in syntax, with functions and constraints that rely only on local context. Besides, there are also promising learnability results for tier-based languages; for example, Jardine and McMullin (2017) have written an efficient k-TSL learning algorithm for a given k.

As for syntactic results, Graf (2018) has shown that satisfying the basic MGs derivation tree constraints, such as the ones that ensure well-formed `Merge` and `Move`, are I-TSL. Vu et al. (2019) show in a case study of case assignment that c-command dependencies are also I-TSL, as long as movement does not play a role.

I extend on these results by taking quantifier-based NPI-licensing constraints as a case study. In this process, I show that c-command that takes movement into account is not I-TSL, while `Cluster` and locality constraints are I-TSL.

The part is organized as follows. In Chapter 7, I introduce the model theoretic approach, provide a model theoretic definition of derivation trees, and show that NPI-licensing patterns can be described with MSO logic, which means that regular tree languages are able to satisfy NPI-constraints. Then in Chapter 8, I take it one step further by defining various classes in the subregular hierarchy and investigate how NPI-licensing patterns can be characterized with subregular constraints.

For all formal definitions in this part, I assume familiarity with sets, tuples, strings, and MSO logic.

Chapter 7

NPI CONSTRAINTS ARE REGULAR

7.1 Introduction

In Chapter 2, I have informally introduced MGs derivation trees as the central data structure for syntactic objects. The version introduced there deviated from previous ones in that it differentiates between new types of movements and adds new types of features. After introducing model theory in §7.2, I show in §7.3 that despite all these additions, the tree languages that I adopt are still regular.

In §7.4, I show that the quantifier-based NPI-licensing constraints I proposed are also MSO-definable. This renders the tree languages that satisfy either English- or Hungarian-type NPI-licensing as also regular.

7.2 Model theory

In this section, I introduce model theory as an approach to studying relational structures, show how model theory can describe strings, and give a model-theoretic definition for trees in §7.2.1.

Model theory is a field that uses mathematical logic to study relational structures (Enderton, 2001). A *model* of a relational structure is a description of that structure. In this thesis, I only consider models of finite size (Libkin, 2004).

A *model signature* encodes the type of information that describes a set of relational structures; models of the same type share the same signature. For linguistic structures discussed here, such as strings and trees, all model signatures will take the form of a tuple $\langle \mathfrak{D}, \mathfrak{R} \rangle$, where $\mathfrak{D}$ is the finite domain of elements that make up the structure, and $\mathfrak{R}$ is a set of k-ary relations, $k \in \mathbb{N}$. These relations describe the ways elements in the domain relate to each other and to themselves.

For example, Figure 7.1 depicts a commonly used model signature for strings (Rogers and Pullum, 2011; Rogers et al., 2013), and the interpretation of each component.

$$\mathfrak{M}^{\triangleleft} = \langle \mathcal{D}, \mathcal{R}_{\triangleleft}, \mathcal{R}_{\sigma} | \sigma \in \Sigma \rangle, \text{ where}$$

- $\mathcal{D} \stackrel{def}{=} \{i \in \mathbb{N} | 0 \leq i < |w|\}$, where $|w|$ is the size of a given string w,
- $\mathcal{R}_{\triangleleft} = \{\langle i, i+1 \rangle \in \mathcal{D} \times \mathcal{D}\}$,
- $\mathcal{R}_{\sigma}$ for each $\sigma \in \Sigma$ is a unary relation that denotes the set of nodes in $\mathcal{D}$ that are labeled σ.

Figure 7.1: A model signature for strings

Conventionally, I will use the infix notation $x \triangleleft y$ to denote $\langle x, y \rangle \in \mathcal{R}_{\triangleleft}$; that is, node x is succeeded by node y. For unary relations used for labeling, I write $\sigma(x)$ iff $x \in \mathcal{R}_{\sigma}$.

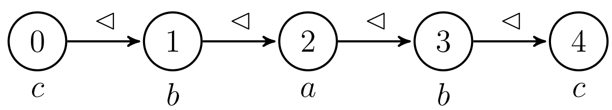
Next I demonstrate how to construct the model for a particular string using the model signature in Figure 7.1. Let $\Sigma = \{a, b, c\}$ and let w be the string '*cbabc*'. Then the model of w is $\mathcal{M}_w$ and it is constructed the following way. The size of w is 5, thus the domain $\mathcal{D} = \{0, 1, 2, 3, 4\}$. The binary relation $\mathcal{R}_{\triangleleft}$ defines a successor relationship between the nodes; according to the interpretation, $\mathcal{R}_{\triangleleft} = \{\langle 0, 1 \rangle, \langle 1, 2 \rangle, \langle 2, 3 \rangle, \langle 3, 4 \rangle\}$. Finally, the unary labeling relations, $\mathcal{R}_a, \mathcal{R}_b, \mathcal{R}_c$ define which nodes are labeled with each symbol in Σ. For w, $\mathcal{R}_a = \{2\}$,$\mathcal{R}_b = \{1, 3\}$, and $\mathcal{R}_c = \{0, 4\}$.

Example 1 shows the summary and a graph illustration of $\mathcal{M}_w$. In the graph, each node is an element of the the domain $\mathcal{D}$, the directed edges represent $\mathcal{R}_{\triangleleft}$ relations, and the labels are shown below each node.

Example 1. *Let $\Sigma = \{a, b, c\}$ and let w be the string 'cbabc'. Then the model of w is as follows:*

- $\mathcal{D} = \{0, 1, 2, 3, 4\}$,
- $\mathcal{R}_{\triangleleft} = \{\langle 0, 1 \rangle, \langle 1, 2 \rangle, \langle 2, 3 \rangle, \langle 3, 4 \rangle\}$,

- $\mathcal{R}_a = \{2\}$,
- $\mathcal{R}_b = \{1, 3\}$,
- $\mathcal{R}_c = \{0, 4\}$



So far I have shown how to describe a relational structure in this framework. With these model-theoretic descriptions, we can now evaluate whether a given logical statement is true when applied to a model or set of multiple models. If the statement is true for a model, we say that the model *satisfies* the statement. Given a logical statement φ, $\mathcal{M}_w \models \varphi$ denotes that $\mathcal{M}_w$ satisfies φ, and $\mathcal{M}_w \not\models \varphi$ denotes that it does not satisfy φ. A language $L(\varphi)$ denotes the set of words whose model satisfies φ. Formally, $L(\varphi) = \{w \in \Sigma^* | M_w \models \varphi\}$ (Strother-Garcia et al., 2016).

Consider w again, its model $\mathcal{M}_w$, and the First Order (FO) statement φ in (7.1), which says that there exists nodes x and y such that x is labeled "c", y is labeled "b", and x is succeeded by y. This is true for $\mathcal{M}_w$, since w starts with with the letters 'cb'. Thus, $\mathcal{M}_w \models \varphi$.

$$\varphi = \exists x, y \big[c(x) \wedge b(y) \wedge x \lhd y \big] \tag{7.1}$$

As another example, take the statement ϱ in (7.2), which states that for any node x labeled 'a', there is no node y such that y follows x; in other words, every node labeled 'a' must be the last node in the string. This is clearly not true for $\mathcal{M}_w$, because there is a node labeled as 'a' that is followed by another node in the model. In this case, $\mathcal{M}_w \not\models \varrho$.

$$\varrho = \forall x \big[(a)x \rightarrow \neg \exists y [x \lhd y] \big] \tag{7.2}$$

In the following section, I provide the model signature for tree structures.

7.2.1 A model theoretic definition of trees

This model-theoretic definition of tree languages follows the ones in Rogers (1998) and Graf (2013). The specific model signature that I adopt is given in Figure 7.2. Each component is defined below.

$$\mathfrak{M}^{\triangleleft,\prec^+} = \langle \mathcal{D}, \mathcal{R}_{\triangleleft}, \mathcal{R}_{\prec}{}^{+}, \mathcal{R}_{\sigma} | \sigma \in \Sigma \rangle$$

Figure 7.2: Model signature for trees

For the finite domain $\mathcal{D}$, I adopt tree domains as defined in Gorn (1965). A tree domain is a finite subset of $\mathbb{N}^*$ such that for $w \in \mathbb{N}^*$ and $j \in \mathbb{N}$, $w \cdot j \in \mathcal{D}$ implies both $w \in \mathcal{D}$ and $w \cdot i \in \mathcal{D}$ for all $i < j$.

The binary relation $\mathcal{R}_{\triangleleft}$ here denotes *immediate dominance*. That is, given nodes $m, n \in \mathcal{D}$, $\langle m, n \rangle \in \mathcal{R}_{\triangleleft}$ iff $n = m \cdot i$ and $i \in \mathbb{N}$. As a shorthand for $\langle m, n \rangle \in \mathcal{R}_{\triangleleft}$, I again use the infix notation $m \triangleleft n$ to mean that m immediately dominates n. In this case, we say that m is the *parent* of n, and n a *child* of m.

By definition, $\mathcal{R}_{\triangleleft}$ is irreflexive, asymmetric, and intransitive. The transitive closure of immediate dominance is *proper dominance*, $\triangleleft^+$, and its reflexive, transitive closure is *reflexive dominance*, $\triangleleft^*$. Both can be defined from immediate dominance with MSO statements, as shown below. I use $\approx$ as the equality predicate, where $x \approx y$ is interpreted as node x is identical to node y in the model.

$$\text{closed}(R, X) \overset{def}{=} \forall x, y[X(x) \wedge R(x, y) \rightarrow X(y)] \tag{7.3}$$

$$x \triangleleft^+ y \overset{def}{=} \forall X[\text{closed}(\triangleleft, X) \wedge X(x) \rightarrow X(y)] \tag{7.4}$$

$$x \triangleleft^* y \overset{def}{=} x \triangleleft^+ y \vee x \approx y \tag{7.5}$$

The other binary relation over trees is *left-of*, denoted $\mathcal{R}_{\prec}{}^{+}$. Left-of can also be defined through the tree domain. Given nodes $m, n \in \mathcal{D}$, $\langle m, n \rangle \in \mathcal{R}_{\prec}{}^{+}$ iff $m = w \cdot i$,

$n = w \cdot j$, $w \in \mathbb{N}^*, i, j \in \mathbb{N}$, and $i < j$. As with dominance, I use the infix notation $x \prec^+ y$ to denote that $\langle x, y \rangle \in \mathcal{R}_{\prec^+}$.

Additionally, I define an enhanced *left-of* binary predicate that is inherited via dominance, denoted $\prec^+_{\triangleleft}$. Its FO definition in 7.6 states that x is left-of y via dominance iff there exist nodes w, z such that w is left-of z, w reflexively dominates x and z reflexively dominates y. This means that a node x and all of its children are left-of via dominance x's right siblings and these siblings' children. This predicate will be particularly relevant for defining the class of TSL tree-languages in §8.1.2.

$$x \prec^+_{\triangleleft} y \overset{def}{=} \exists w, z[w \prec^+ z \wedge w \triangleleft^* x \wedge z \triangleleft^* y] \tag{7.6}$$

Finally, for each $\sigma \in \Sigma$, the unary relation $\mathcal{R}_\sigma$ denotes the set of nodes in $\mathcal{D}$ that are labeled σ. For example, $\mathcal{R}_a$ is the set of nodes labeled as a. I use the shorthand $\sigma(n)$ to denote that $n \in \mathcal{R}_\sigma$. I will also use a function, label(x) that outputs the label of node x.

Now let us look at a concrete example of a tree, and how its model would look like using the model signature introduced here. If $\Sigma = \{a, b, c\}$, the tree model signature would be $\langle \mathcal{D}, \mathcal{R}_\triangleleft, \mathcal{R}_{\prec^+}, \mathcal{R}_a, \mathcal{R}_b, \mathcal{R}_c \rangle$.[1] Using this model signature, we can describe tree structures whose nodes are labeled with either a, b, or c.

Suppose that T, depicted in Figure 7.3, is such a tree.

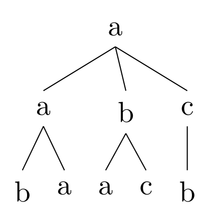


Figure 7.3: The tree T

The model of T, $\mathcal{M}_T$ then would be defined as follows:

- $\mathcal{D} = \{\varepsilon, 0, 1, 2, 00, 01, 10, 11, 20\}$,

[1] Note that all I did here was expanding the generalized model signature in Figure 7.2.

- $\mathcal{R}_{\lhd} = \{\langle \epsilon, 0\rangle, \langle \epsilon, 1\rangle, \langle \varepsilon, 2\rangle, \langle 0, 00\rangle, \langle 0, 01\rangle, \langle 1, 10\rangle, \langle 1, 11\rangle, \langle 2, 20\rangle\}$,
- $\mathcal{R}_{\prec^+} = \{\langle 0, 1\rangle, \langle 0, 2\rangle, \langle 1, 2\rangle, \langle 00, 01\rangle, \langle 10, 11\rangle\}$,
- $\mathcal{R}_a = \{\varepsilon, 0, 01, 12\}$,
- $\mathcal{R}_b = \{1, 00, 20\}$,
- $\mathcal{R}_c = \{2, 11\}$

Figure 7.4 gives a graphical illustration of the model. In the graph, each node is a domain element numbered according to its Gorn address, binary $\mathcal{R}_{\lhd}$ and $\mathcal{R}_{\prec}{}^{+}$ relations are represented by directed edges, and unary relations are shown as labels beside the nodes.

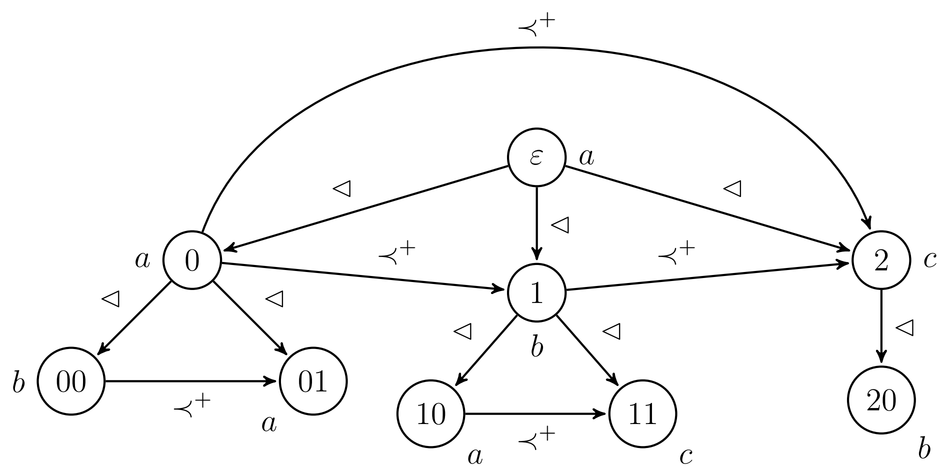


Figure 7.4: Illustration of the model T

In the interest of keeping the illustration in Figure 7.4 clean, I do not show left-of via dominance ($\prec^{+}_{\lhd}$) there. Instead, I list the pairs of nodes in $\mathcal{M}_T$ for which this predicate is true below. For example, $\langle 00, 11\rangle$ in this list means that the node at address 00 is left-of the node at address 11 via dominance.

- $\langle 0, 1\rangle$, $\langle 0, 2\rangle$, $\langle 0, 10\rangle$, $\langle 0, 11\rangle$, $\langle 0, 20\rangle$
- $\langle 1, 2\rangle, \langle 1, 20\rangle$
- $\langle 00, 01\rangle, \langle 00, 1\rangle, \langle 00, 10\rangle, \langle 00, 11\rangle, \langle 00, 2\rangle, \langle 00, 20\rangle$
- $\langle 01, 1\rangle, \langle 01, 10\rangle, \langle 01, 11\rangle, \langle 01, 20\rangle$

- $\langle 10, 11\rangle, \langle 10, 2\rangle, \langle 10, 20\rangle$
- $\langle 11, 2\rangle, \langle 11, 20\rangle$

The depth of a tree is the length of the longest Gorn address in the tree. For example, in $\mathcal{M}_T$, the longest Gorn address is 2 digits long. This makes T a tree of depth 2, for example.

Next, I demonstrate how T can satisfy a given logical statement, φ. Let φ be the formula defined in (7.7). This formula states that for every node y that is labeled with "b'', there exists a node x that immediately dominates it. This is true for $\mathcal{M}_T$, as all nodes labeled "b'' have a parent. In this case, $\mathcal{M}_T \models \varphi$.

$$\varphi = \forall y[b(y) \rightarrow \exists x(x \lhd y)] \tag{7.7}$$

Now let us look at another logical formula, ϱ (7.8), which states that every node has a parent. This is not true for $\mathcal{M}_T$: node ϵ does not have a parent node. In fact, no well-formed, finite tree will satisfy ϱ. In this case, $\mathcal{M}_T \not\models \rho$.

$$\varrho = \forall y \exists x[x \lhd y] \tag{7.8}$$

The usual tree axioms are inherently satisfied by how we have defined the tree domain and immediate dominance. Informally, the tree axioms are as follows:

- **Root condition**: there is one node that properly dominates all nodes, and no node dominates it.
- **At most one parent condition**: all nodes have at most one parent.

The root condition holds because by the definitions of the tree domain and immediate dominance. For every node $n \in \mathcal{D} = m \cdot j$ ($m \in \mathcal{D}$, $j \in \mathbb{N}$), n is immediately dominated by m. Going upward in the tree, we reach $n' = \varepsilon \cdot j$, $j \in \mathbb{N}$, and the parent of n' for any j must be ε. The node at address ε cannot be further broken down into the concatenation of some $m \in \mathcal{D}$ and $j \in \mathbb{N}$, and thus cannot have a parent, and therefore must be the root of the tree.

The "at most one parent" condition holds because by the definition of immediate dominance, for all nodes $n \in \mathcal{D} = m \cdot j$, $m \in \mathcal{D}$, $j \in \mathbb{N}$, the parent of n can only be node m, and no other node.

7.3 A model theoretic definition of derivation trees in MGs

In this section, I provide a model-theoretic definition for MGs derivation trees. The definition presented here is largely based on Graf (2012a, 2013), and Laszakovits (2018), with two additions: 1) `Cluster` is defined separately from `Move`, and 2) there are LF and PF movement and clustering operations, labeled `S-move`, `P-move`, `S-cluster`, and `P-cluster`.

The goals of this section are twofold. First, it provides a precise definition of the tree languages that I adopt for modeling NPI-licensing constraints. Second, it demonstrates that these tree languages are definable using only MSO constraints, and as such are regular tree languages.

7.3.1 Model signature for MGs derivation trees

The model signature for derivation trees is the same as for trees: it contains the tree domain $\mathcal{D}$, the binary relations $\triangleleft$ and $\prec^{+}$, and the unary relations $\mathcal{R}_{\sigma}$, where each $\sigma \in \Sigma$ denotes a member of a given alphabet Σ. For the derivation trees discussed here, Σ is going to be {*Lex* ∪ `Merge` ∪ `Move` ∪ `S-move` ∪ `P-move` ∪ `Cluster` ∪ `S-cluster` ∪ `P-cluster`}.[2] *Lex* corresponds to the lexicon and the rest are the names of the operations that can occur during the derivation.

The lexicon *Lex* is a set of Lexical Items (LIs). Each LI has a phonological component p, a semantic component s, and a finite string of features $f_1 \ldots f_n$, where each f_k, $1 \leq k \leq n$ is a member of the set *Feat* of syntactic features. For the purposes of the current discussion, I write LIs as [p :: $f_1 \ldots f_n$], and omit the semantic component.

[2] I adopt this alphabet specifically for this thesis. Other model-theoretic implementations of MGs derivation trees might use a different set of operation names.

Each syntactic feature $f \in Feat$ has four attributes: name (ν), polarity (π), operation (ω), and representation (ρ). Formally, each feature is a four-tuple $\langle \nu, \pi, \omega, \rho \rangle$. The name of the feature is what we decide to call it; for example, if f is a noun category feature n, then its name is $\nu(f)$ =n . The polarity of a feature can be either positive or negative; this corresponds to whether they are selectors/licensors, in which case their polarity is positive, or categories/licensees, which would mean their polarity is negative. The operation of a feature is the derivational operation that would check it off. Here this would be `Merge`, `Move`, or `Cluster`. And finally, the representation attribute of f is whether it is relevant at PF, LF, both, or neither. Accordingly, $\rho(f)$ can be [+sem,+phon], [+sem,-phon], [-sem,+phon], or [-sem,-phon]. The shorthands for each feature type is summarized in Table 7.1.[3]

shorthand	ν	ω	π	ρ
f	f	`Merge`	$-$	[+sem,+phon]
=f	f	`Merge`	$+$	[+sem,+phon]
$-$f	f	`Move`	$-$	[+sem,+phon]
$+$f	f	`Move`	$+$	[+sem,+phon]
$-_s$f	f	`Move`	$-$	[+sem,$-$phon]
$+_s$f	f	`Move`	$+$	[+sem,$-$phon]
$-_p$f	f	`Move`	$-$	[$-$sem,+phon]
$+_p$f	f	`Move`	$+$	[$-$sem,+phon]
$\triangle$f	f	`Cluster`	$-$	[+sem,+phon]
$\triangledown$f	f	`Cluster`	$+$	[+sem,+phon]
$\triangle_s$f	f	`Cluster`	$-$	[+sem,$-$phon]
$\triangledown_s$f	f	`Cluster`	$+$	[+sem,$-$phon]
$\triangle_p$f	f	`Cluster`	$-$	[$-$sem,+phon]
$\triangledown_p$f	f	`Cluster`	$+$	[$-$sem,+phon]

Table 7.1: Summary of MGs feature shorthands

As an example, take the movement licensee feature $-$nom, which is formally a tuple, $\langle \text{nom}, -, \texttt{Move}, [+\text{sem}, +\text{phon}] \rangle$. To pick out a specific attribute, we can write $\nu(-\text{nom}) = \text{nom}$, $\pi(-\text{nom}) = -$, $\omega(-\text{nom}) = \texttt{Move}$, and $\rho(-\text{nom})$ =[+sem,+phon].

[3] I assume that all `Merge` takes place at both LF and PF. I also omit [-sem,-phon] operations in the current discussion.

Each individual LI contains a finite string of features. Let $|\gamma|$ be the maximum number of positive features and $|\delta|$ the maximum number of Move and Cluster licensee features. All feature strings will have a strict order of at most $|\gamma|$ positive features followed by their category feature (their negative Merge feature), followed by at most $|\delta|$ negative licensee features. This fixed order prescribes the order of operations an LI can go through: all of the LI's positive features have to be checked off before it can be selected via Merge, and only after that can it undergo any movement or clustering.

When referring to an LI node in a derivation tree, I will denote it with only its phonological component as a shorthand, as in Mary(x); however, the full label of the LI also contains its feature string. If, for example, the full entry of Mary is [Mary :: d], then the actual label of x is [Mary :: d]. For operations, I will write for example Merge(x) to denote that node x is labeled Merge. Every node that is not an LI is an *interior* node.

7.3.2 Constraints on MGs derivation trees

There are a number of additional MSO statements that every MGss derivation tree has to satisfy to be well-formed. These constraints essentially ensure that each feature on every LI gets checked off once and in order, and states when the derivation can stop. In this section, I follow Graf (2012b) and Graf (2013) in describing these constraints. At points, I will give an informal definition of some of the ancillary predicates.

7.3.2.1 Ancillary predicates

The concept of *roots* and *leaves* should be familiar from both the linguistic and computational literature. If node x reflexively dominates all nodes in the tree, then x is the root of the whole tree. Vice versa, if x does not dominate any node, then x is a leaf in the tree.

$$\text{root}(x) \stackrel{def}{=} \forall y[x \lhd^* y] \tag{7.9}$$

$$\text{leaf}(x) \overset{def}{=} \neg\exists y[x \lhd y] \tag{7.10}$$

A pair of related predicates are root(x, X) and leaf(x, X), which pick out the root or leaf of a set of nodes X. Node x is the root of a set of nodes X iff x is in X and it dominates all nodes in X. On the other hand, node x is a *leaf* in X iff there are no other nodes in set X that x dominates.

$$\text{root}(x, X) \overset{def}{=} X(x) \wedge \forall y[X(y) \rightarrow x \lhd^* y] \tag{7.11}$$

$$\text{leaf}(x, X) \overset{def}{=} X(x) \wedge \forall y[X(y) \rightarrow \neg(x \lhd^* y)] \tag{7.12}$$

Next, I provide a few predicates to describe LIs. To say that a particular node is a lexical item, its label must come *Lex*, the set of LIs.

$$\text{lex}(l) \overset{def}{=} \bigvee_{\lambda \in Lex} \lambda(l) \tag{7.13}$$

To identify specific negative features on any given LI, I define the following predicates. For category features, $\text{f}(l, cat)$ states that l has category feature f. For licensee features, $\text{f}(l, n)$ states that the nth negative feature of l is f, where $\text{f} \in \text{Feat}$, $\pi(\text{f}) = -$, and $\omega(\text{f}) \neq$ `Merge`.

Example 2. *Suppose that LI l is* [which :: =n d −nom −wh]*. Then we can state the following about the features of l:*

- $\text{d}(l, cat)$*: the category feature of l is* d
- $-\text{nom}(l, 1)$*: the first movement licensee feature on l is* −nom
- $-\text{wh}(l, 2)$*: the second movement licensee feature on l is* −wh

Now suppose that another LI, k is [what :: ▽wh d △wh $-_p$top]*. Then the following statements are true for k:*

- $\text{d}(k, cat)$*: the category feature of k is* d
- $\triangle\,\text{wh}(k, 1)$*: the first negative feature of k after its category feature is* △wh
- $-_p\,\text{top}(k, 2)$*: the second negative feature of k after its category features is* $-_p$top

7.3.2.1.1 Slices

Next, I define *slices* and *occurrences*. Informally, the *slice* of LI l corresponds to the nodes that check off the positive features on l, and the *occurrences* of l correspond to the interior nodes in the derivation where the negative features of l are checked off. In the corresponding derived tree, the slice of l is roughly the phrasal projection headed by l, and its occurrences are the places where l "appears", i.e. its based position and movement positions.

More formally, a set X of nodes is a *slice* of LI l with n positive features $(\mathrm{slice}(\mathrm{X}, \mathrm{l}))$, iff X contains only l and the n lowest nodes that properly dominate l. In other words, a slice X consists of the LI that heads it and the interior nodes that check off X's positive features. This formal definition of slices uses the fact that feature strings are strictly ordered in listing all positive features before the negative ones. We denote that a set of nodes X is a slice $(\mathrm{slice}(X))$ iff there exists an l such that $\mathrm{slice}(X, l)$.

For every node m in slice X, LI l *hosts* m $(\mathrm{hosts}(l, m))$ iff $\mathrm{slice}(\mathrm{X}, \mathrm{l})$. Note that hosting is reflexive, because an LI will always host itself. Hosts correspond to the head of their projection in a derived tree. Node x is the *slice root* of LI l $(\mathrm{sliceroot}(x, l))$ iff x is the root of l's slice. Slice roots correspond to the highest node in a maximal projection.

Figure 7.5 shows all the slices in the derivation tree originally presented in Figure 2.5, highlighting the *slice root* and framing the *host* of each slice.

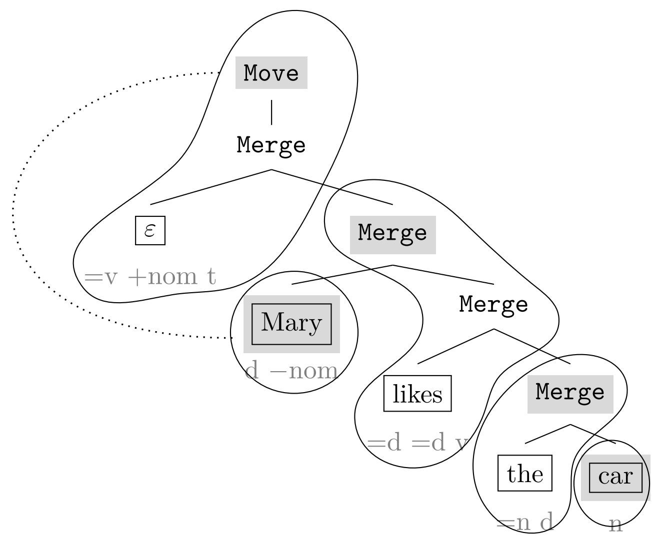


Figure 7.5: Derivation tree with slices indicated, slice roots highlighted, and hosts framed.

For another example that demonstrates slices in a derivation tree, see Figure 7.6. This tree shows an example of multiple wh-movement in Hungarian (3), and as such, it involves clustering. `Cluster` nodes adhere to the definition of slices the same way as other interior nodes did: they belong to the same slice as the LIs that host them.

An interior node m is *associated* with feature f, iff m is the ith lowest node that dominates l and f is the ith positive feature on l; in other words, m checks feature f. We denote the association of m with f as associate(m, f). For example, the higher `Move` node in Figure 7.6 is *associated* with the feature +wh, because it checks that feature off on [ε:: =t +wh c].

We say that an interior node m *matches* feature f (match(m, f)) iff m is associated with feature g, and f is identical to g in all attributes, except for polarity. The same `Move` node discussed in the previous paragraph *matches* the feature −wh, because that is the feature it checks on [who-NOM :: $\nabla d - nom - wh$].

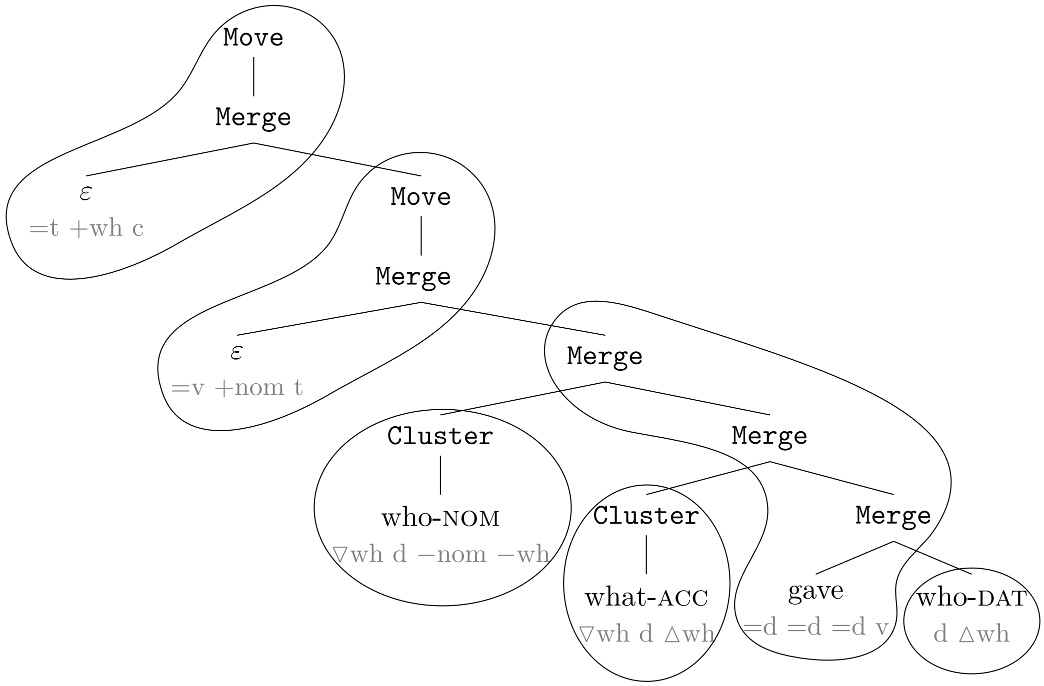


Figure 7.6: Derivation tree of (3) with slices indicated

7.3.2.1.2 Occurrences

We can now define occurrences. Each occurrence of an LI l corresponds to a node that matches a negative feature on l. The 0th occurrence of l is the `Merge` node that matches l's category feature; if this node does not exist because l's slice root is also the root of the tree, then the 0th occurrence of l will be defined as the slice root of l.

This description is reflected in the formula defining predicate $\text{occ}_0(x, l)$, which states that x is the 0th occurrence of LI l either iff it is the slice root of l and the root of the tree, or else, if it is the node that is the parent of l's slice root 7.14.

$$\text{occ}_0(x, l) \overset{def}{=} \forall y \big[\text{sliceroot}(y, l) \wedge [(\text{root}(y) \wedge x \approx y) \vee (\neg\,\text{root}(y) \wedge x \lhd y)]\big] \quad (7.14)$$

Figure 7.7 demonstrates how this definition works by annotating the tree from Figure 2.10 with the 0th occurrence of each LI.

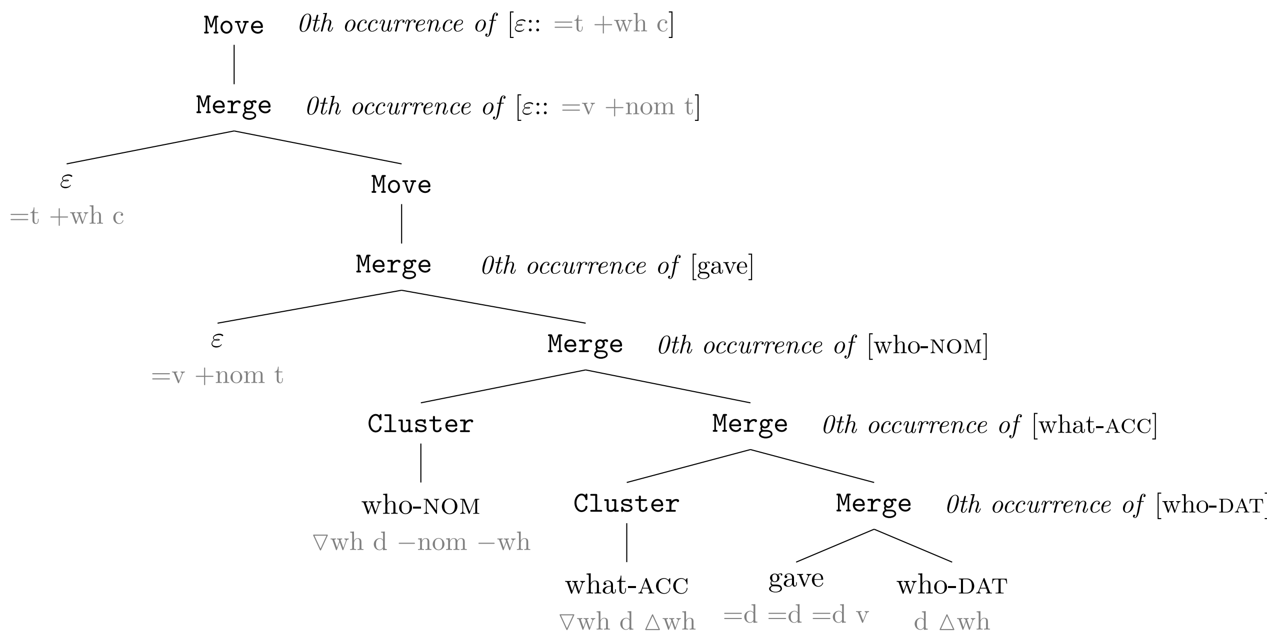


Figure 7.7: Derivation tree of (3) with 0th occurrences indicated

For discussing positive occurrences, I first only consider derivation trees with phrasal movement, which includes `Move`, `S-move`, and `P-move`. In these trees, the positive ith occurrence of l is the lowest node labeled `Move`, `S-move`, or `P-move` that matches the ith licensee feature on l and properly dominates the $(i-1)$-th occurrence of l.

I accordingly define this first version of positive occurrences with the predicate $\texttt{Move}\text{-occ}_{\text{i}}(x, l)$, which states that node x is the ith occurrence of l in trees with only phrasal movement operations (7.15). As a reminder, $|\delta|$ is the maximum number of licensee features on any given LI.

Positive occurrences in trees with only phrasal movement:

$$\bigwedge_{1 \leq i \leq |\delta|} \Big(\texttt{Move}\text{-occ}_{\text{i}}(x, l) \overset{def}{=} \bigvee_{f \in Feat} \Big(\texttt{f}(l, i) \wedge \text{match}(x, f) \wedge \exists y [\texttt{Move}\text{-occ}_{\text{i-1}}(y, l) \wedge x \lhd^+ y \wedge \neg \exists z [x \lhd^+ z \wedge z \lhd^+ y \wedge \text{match}(z, f)]] \Big) \Big) \quad (7.15)$$

The 0th `Move`-occurrence of LI l is identical to the 0th occurrence of l (7.16).

$$\texttt{Move}\text{-occ}_0(x, l) \stackrel{def}{=} \text{occ}_0(x, l) \tag{7.16}$$

For an example of how this definition of positive occurrence work, see the derivation tree in Figure 7.8, which is annotated with the occurrences of the LI *who*. The slice hosted by *who* is just the LI by itself, because it does not have any positive feature. The 0th occurrence of *who* is the `Merge` node that immediately dominates it.

The lower `Move` node, by definition, is associated with the +nom feature and matches the −nom feature, the 1st licensee feature on *who*. Moreover, it is the lowest `Move` node to match the 1st licensee feature of *who* that properly dominates the 0th occurrence of *who*. It thus satisfies the definition of positive occurrences as the 1st occurrence of *who*. The higher `Move` node similarly satisfies the definition as the 2nd occurrence of *who* by matching its 2nd licensee feature, while being the lowest such node to properly dominate the 1st occurrence of *who*.

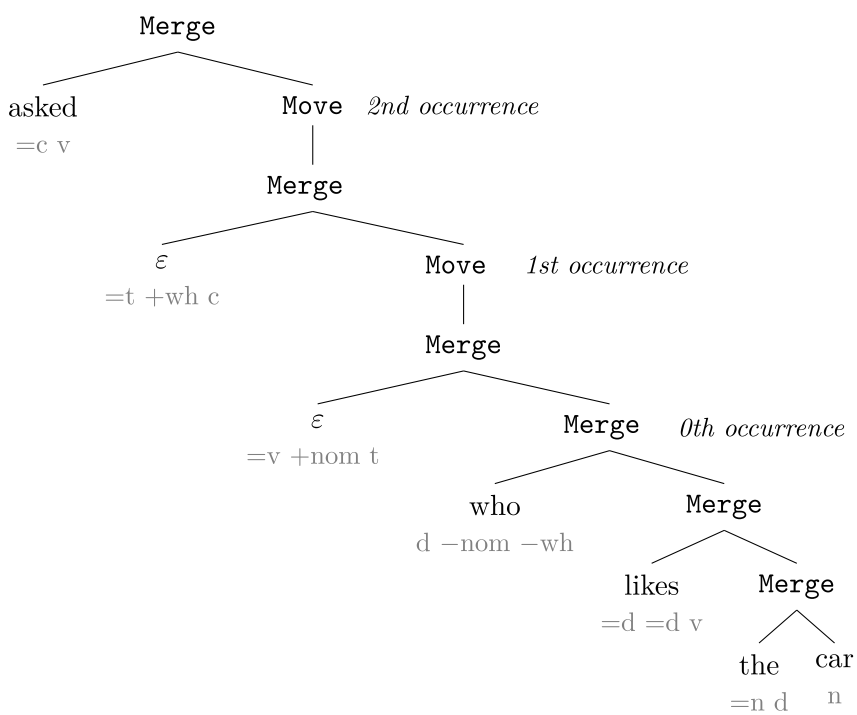


Figure 7.8: Derivation tree labeled with the occurrences of the LI *who*

This definition also ensures that we can uniquely select the ith occurrence of a particular LI even when there are multiple nodes in a tree that match the same licensee feature. For example, consider a tree where there are two clauses, where each clause has a T^0 that triggers subject movement via the +nom feature. Figure 7.9 shows an example of this with only the relevant nodes.

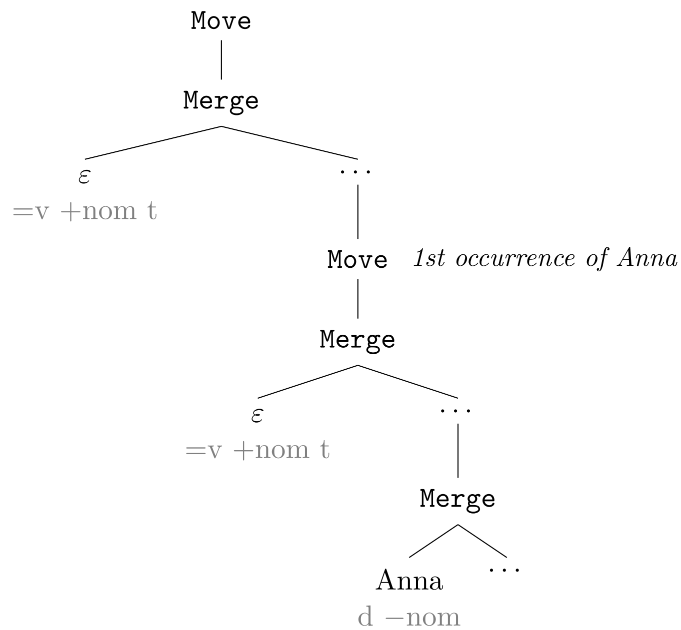


Figure 7.9: Derivation tree where both `Move` nodes match the same licensee feature on *Anna*

In this tree, both `Move` nodes match the −nom feature on *Anna*; and thus both are its potential 1st occurrence. The definition of positive occurrences however eliminates the higher `Move` node as it states that there can be no node between the ith and $(i-1)$th occurrences that matches the same feature. Here the lower `Move` node is such a node, and so the higher `Move` node cannot be the 1st occurrence of *Anna*. This leaves the lower `Move` node to be the only candidate to satisfy the definition.

Adding `Cluster` into the system necessitates a change to the definition of positive occurrences. To see why, consider the VP part of the tree in Figure 7.6, shown in Figure 7.10. In this tree, the 0th occurrence of the LI who-DAT is the `Merge` node that immediately dominates it, as indicated in the figure. Intuitively, the 1st occurrence of who-DAT should be the `Cluster` node , since this is the lowest node that can match the LI's 1st licensee feature, △ wh. However, this `Cluster` node does not dominate the 0th occurrence of who-DAT, and thus does not follow the definition of positive occurrences above in (7.15), which required that the ith occurrence of an LI properly dominates the $(i-1)$-th occurrence of that same LI.

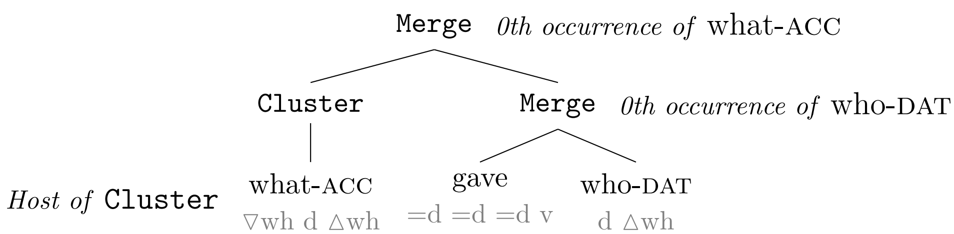


Figure 7.10: Reproduction of the VP part of Figure 7.6

To resolve this problem, we define a different relation, *slice containment*, and will require this relation to hold between the i-th and $(i-1)$-th occurrences of a given LI when the ith occurrence matches a `Cluster` feature. Formally, x *slice-contains* y (slice-contains(x, y)), iff the 0th occurrence of the LI that hosts x properly dominates y (7.17).

$$\text{slice-contains}(x, y) \overset{def}{=} \exists l, u[\text{hosts}(l, x) \wedge \text{occ}_0(u, l) \wedge u \triangleleft^+ y] \tag{7.17}$$

Looking at Figure 7.10 again, the `Cluster` node slice-contains the 0th occurrence of *who*-DAT. The LI that hosts the `Cluster` node is [what-ACC :: ▽*whd* △ *wh*]. The 0th occurrence of [what-ACC] is the `Merge` node immediately dominating `Cluster`. As the 0th occurrence of what-ACC properly dominates the 0th occurrence of who-DAT, the `Cluster` node in question slice-contains the 0th occurrence of *who*-DAT.

Using slice containment, now we can define positive occurrences for trees that also include clustering. The first half of the definition from (7.15) stays the same: in all circumstances, a node x is the ith occurrence of an LI l if x matches the i-th licensee feature of l, f. Now there are two options for $\omega(f)$: it is either `Move` or `Cluster`. If $\omega(f)$ is `Move`, then the same applies as in (7.15); x properly dominates the $(i-1)$-th occurrence of l and there is no distinct node z such that z matches f, and x properly dominates z, z properly dominates y. If $\omega(f)$ instead is `Cluster`, then we now replace all proper dominance with slice-containment: x must slice-contain y, and there must not be another node z that matches f such that x slice-contains z and z slice-contains y. This definition ensures that all occurrence of an LI is accounted for, whether it checks off a `Move` or `Cluster` feature.

The MSO formulation of the predicate $occ_i(x,l)$ reflects just this in (7.18).

$$\bigwedge_{1\leq i\leq|\delta|}\Big(\mathrm{occ_i}(x,l)\overset{def}{=}\bigvee_{f\in Feat}\Big(f(l,i)\wedge\mathrm{match}(x,f)\wedge$$
$$\Big[\sigma(f)=\texttt{Move}\rightarrow\exists y\big[\,\mathrm{occ}_{i-1}(y,l)\wedge x\lhd^{+}y\wedge$$
$$\neg\exists z[\mathrm{match}(z,f)\wedge x\lhd^{+}z\wedge z\lhd^{+}y]\big]\Big]\wedge$$
$$\Big[\sigma(f)=\texttt{Cluster}\rightarrow\exists y\big[\,\mathrm{occ}_{i-1}(y,l)\wedge\text{slice-contains}(x,y)\wedge$$
$$\neg\exists z[\mathrm{match}(z,f)\wedge\text{slice-contains}(x,z)\wedge\text{slice-contains}(z,y)]\big]\Big]\Big)\Big)\tag{7.18}$$

I demonstrate how this definition works using Figure 7.11, a version of the tree in Figure 7.7, annotated with the 0th and positive occurrences of two LIs, *who*-ACC and *who*-NOM. Because the first licensee feature on *what*-ACC is △wh, a `Cluster` feature, its 1st occurrence must slice-contain its 0th occurrence; and this is the case here, as the higher `Cluster` node slice-contains the `Merge` node that is the 0th occurrence of *who*-ACC. On the other hand, both licensee features on *who*-NOM are `Move` features, which means the ith occurrence of it properly dominates the $(i-1)$-th occurrence of it. This is the case, as the 1st occurrence of *who*-NOM properly dominates its 0th occurrence, and its 2nd occurrence properly dominates its 1st occurrence.

Based on $\mathrm{occ_i}(x,l)$ I define $\mathrm{occ}(x,l)$, a predicate that picks out any node x that is an occurrence of LI l.

$$\mathrm{occ}(x,l)\overset{def}{=}\bigvee_{1\leq i\leq|\delta|}\mathrm{occ_i}(x,l)\tag{7.19}$$

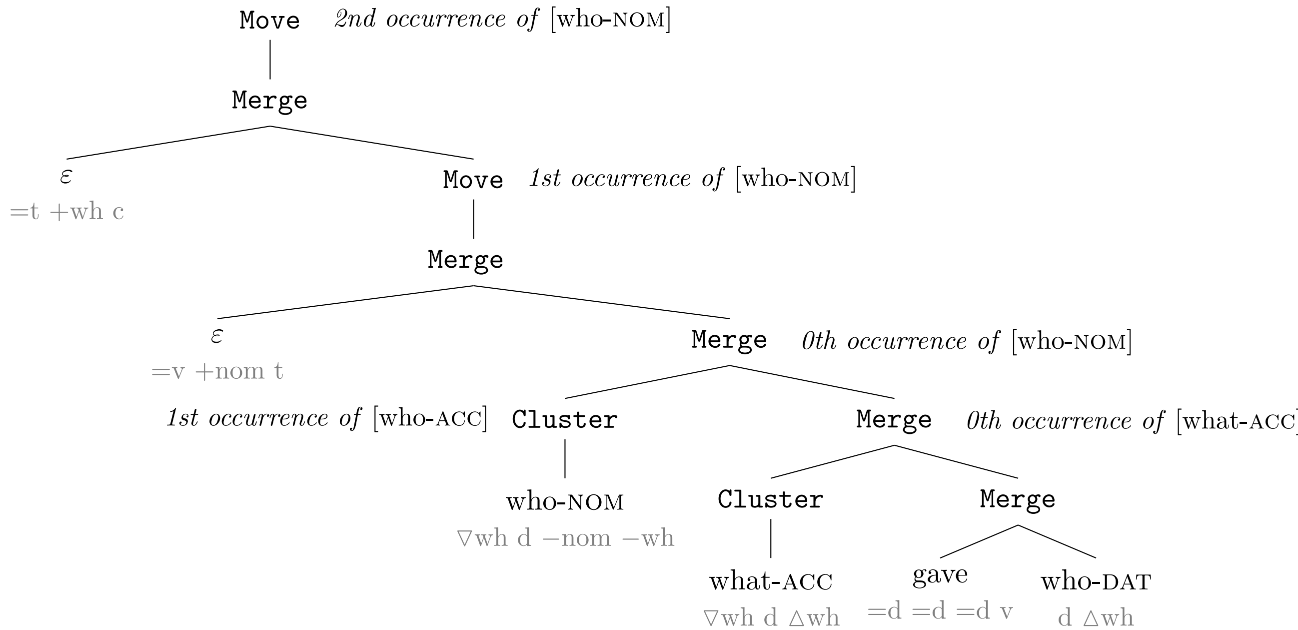


Figure 7.11: Derivation tree of (3) with 0th occurrences indicated

Often we will need to pick the *last* occurrence of an LI; this is the node that checks off the LI's last licensee feature. The predicate $\text{occ}_{fin}(x, l)$ provides a means to do so.

$$\text{occ}_{\text{fin}}(x, l) \overset{def}{=} \bigvee_{i \in \mathbb{N}} \text{occ}_{\text{i}}(x, l) \wedge \neg \exists y [\text{occ}_{\text{i+1}}(y, l)] \tag{7.20}$$

7.3.2.2 Well-formedness constraints

Given the ancillary predicates above, we can now provide the constraints that every MGs derivation tree must satisfy in order to be well-formed. All of them can be stated with MSO formulas.

The first one is **Partition**, which makes sure that every node only belongs to one slice (7.21). In this formula, I use $X \approx Y$ to mean that $\forall x[X(x) \leftrightarrow Y(x)]$.

$$\forall x \exists X \big[X(x) \wedge \text{slice}(X) \wedge \forall Y [(\text{slice}(Y) \wedge Y(x)) \rightarrow X \approx Y]\big] \tag{7.21}$$

Labeling ensures that each node is either an LI or labeled as one of the operations (7.22).

$$\forall x[\text{lex}(x) \lor \texttt{Merge}(x) \lor \texttt{Move}(x) \lor \texttt{P-move}(x) \lor \texttt{S-move}(x) \lor \texttt{Cluster}(x) \lor \texttt{P-cluster}(x) \lor \texttt{S-cluster}(x)] \quad (7.22)$$

Arity states that every node has the appropriate number of children. That means all LIs are leaves, all `Merge` nodes have exactly two children, and all `Move` (including `P-move` and `S-move`) and all `Cluster` (including `P-cluster` and `S-cluster`) nodes have exactly one child (7.23).

$$\forall x\Big[\big[\text{lex}(x) \leftrightarrow \text{leaf}(x)\big] \land \Big[\big[\texttt{Move}(x) \lor \texttt{S-move}(x) \lor \texttt{P-move}(x) \lor \texttt{Cluster}(x) \lor \texttt{S-cluster}(x) \lor \texttt{P-cluster}(x)\big] \leftrightarrow \exists y\big[x \triangleleft y \land \forall z[x \triangleleft z \rightarrow z \approx y]\big]\Big] \land \Big[\texttt{Merge}(x) \leftrightarrow \exists y \exists z\big[x \triangleleft y \land x \triangleleft z \land y \not\approx z \land \forall u[x \triangleleft u \rightarrow (u \approx y \lor u \approx z)]\big]\Big]\Big] \quad (7.23)$$

Association makes sure that every interior node is associated with features of the right kind of operation (7.24).

$$\forall x\Big[\big(\texttt{Merge}(x) \leftrightarrow \bigvee_{\omega(f)=\texttt{Merge}} \text{associate}(x,f)\big)\wedge$$
$$\big(\texttt{Move}(x) \leftrightarrow \bigvee_{\substack{\omega(f)=\texttt{Move}\\ \rho(f)=[+\text{sem},+\text{phon}]}} \text{associate}(x,f)\big)\wedge$$
$$\big(\texttt{P-move}(x) \leftrightarrow \bigvee_{\substack{\omega(f)=\texttt{Move}\\ \rho(f)=[-\text{sem},+\text{phon}]}} \text{associate}(x,f)\big)\wedge$$
$$\big(\texttt{S-move}(x) \leftrightarrow \bigvee_{\substack{\omega(f)=\texttt{Move}\\ \rho(f)=[+\text{sem},-\text{phon}]}} \text{associate}(x,f)\big)\wedge$$
$$\big(\texttt{Cluster}(x) \leftrightarrow \bigvee_{\substack{\omega(f)=\texttt{Cluster}\\ \rho(f)=[+\text{sem},+\text{phon}]}} \text{associate}(x,f)\big)\wedge$$
$$\big(\texttt{P-cluster}(x) \leftrightarrow \bigvee_{\substack{\omega(f)=\texttt{Cluster}\\ \rho(f)=[-\text{sem},+\text{phon}]}} \text{associate}(x,f)\big)\wedge$$
$$\big(\texttt{S-cluster}(x) \leftrightarrow \bigvee_{\substack{\omega(f)=\texttt{Cluster}\\ \rho(f)=[+\text{sem},-\text{phon}]}} \text{associate}(x,f)\big)\Big] \quad (7.24)$$

Final gives the end condition of a tree derivation by stating that the root of the tree must be hosted by an LI of category c. This means that all fully formed trees are CPs.

$$\forall x,l[\text{root}(x)\wedge \text{hosts}(l,x)\rightarrow c(l,cat)] \quad (7.25)$$

Merge regulates that all `Merge` nodes match the correct category feature (7.26).

$$\forall x\Big[\texttt{Merge}(x)\rightarrow \exists y,l\big[x\lhd y\wedge \text{sliceroot}(y,l)\wedge \bigvee_{f\in Feat}\big(f(l,cat)\wedge \text{match}(x,f)\big)\big]\Big] \quad (7.26)$$

Move/Cluster ensures that each licensee feature is matched by an occurrence (7.27). The definition of ith occurrences in (7.18) has already covered how to calculate occurrences for `Move` and `Cluster` features.

$$\forall x [\bigwedge_{1 \leq i \leq |\delta|} \big(\mathrm{f}(x, i) \rightarrow \exists y [\mathrm{occ_i}(y, x)] \big)] \tag{7.27}$$

Finally, **SMC** regulates that each `Move` and `Cluster` node can be an occurrence of only one LI (7.28).

$$\forall x [(\texttt{Move}(x) \vee \texttt{Cluster}(x)) \rightarrow \exists l [\mathrm{occ}(x, l) \wedge \forall k [\mathrm{occ}(x, k) \rightarrow l \approx k]]] \tag{7.28}$$

A tree is a well-formed MGs derivation tree iff it satisfies the conjunction of **Partition**, **Labeling**, **Arity**, **Association**, **Final**, **Merge**, **Move/Cluster**, and **SMC**. While this version of MGs derivation tree languages had additional types of operations, everything was still MSO-definable. This means that the weak generative capacity of the derivation tree languages introduced here is not greater than the capacity of previously defined derivation tree languages; their string yields are still MCFL.

7.4 NPI constraints are regular

In this section, I define NPI-licensing constraints for both existentially and universally quantified NPIs, in terms of MSO logic. Doing so demonstrates that regular tree languages are able to satisfy NPI-licensing constraints.

7.4.1 Existential NPIs in English

As described in Chapter 3, indefinite NPIs are licensed by a c-commanding licensor at LF. To formalize this constraint on a derivation tree, I have to define a number of shorthand predicates first. To keep it as simple as possible, these definitions assume derivation trees without `Cluster`; that is, the only available operations are `Merge`, `Move`, `S-move`, and `P-move`. This is because `Cluster` is not relevant for licensing existential NPIs in English.

As a result, we can use the simpler $\texttt{Move-occ}_\text{i}(x, l)$ when discussing positive occurrences, and assume that the 0th Move-occurrence of l is identical to its 0th occurrence. As a reminder, in this version the ith occurrence of l always properly dominates the $(i-1)$th occurrence of l. The predicate $\texttt{Move-occ}(x, l)$ then just picks out all positive occurrences of l.

$$\texttt{Move-occ}(x, l) \overset{def}{=} \bigvee_{1 \leq i \leq |\delta|} \texttt{Move-occ}_\text{i}(x, l) \tag{7.29}$$

We can define $\texttt{Move-occ}_\text{fin}(x, l)$ then as the occurrence of l that no other occurrence of l properly dominates it (7.30).

$$\texttt{Move-occ}_\text{fin}(x, l) \overset{def}{=} \texttt{Move-occ}(x, l) \wedge \neg \exists y[\texttt{Move-occ}(y, l) \wedge y \triangleleft^+ x] \tag{7.30}$$

To define the constraints for existential NPIs, we need to define c-command relations at LF. The particular definition of c-command I adopted in Chapter 2 comes from Reinhart (1976): "α c-commands β iff the first branching node that dominates α also dominates β, and α does not dominate β" in derived trees. This definition implies two crucial things about c-command: 1) specifiers c-command their head, and 2) heads c-command their complement. The reason to adopt this particular understanding of c-command was because a quantifiers have scope over every element of the subtree they attach to (as discussed in Chapter 2), and it was especially relevant for Hungarian where the NPI moves to Spec,NegP and takes scope over the head of NegP.

For English *any*-NPIs, however, it is not relevant whether the specifier c-commands the head or not. To my knowledge, there is no configuration in English where two quantificational elements are in a specifier-head position, and therefore we never need to determine how the specifier-head relation maps to scope. Moreover, assuming that heads c-command both their specifiers and complements results in a more straightforward and readable MSO statement. Thus for now, I define c-commands with this assumption at the cost of not being completely loyal to Reinhart's (1976) c-command definition. To signal that this is a different version of c-command from the one in

Reinhart (1976) and specific to English NPI-licensing, I will use the subscript E for predicates in this section.

In what follows, I define c-command in multiple steps. The end goal of this discussion is to provide an MSO definition of c-command at LF that takes phrasal movement into consideration, but does not require that specifiers c-command their head.

The simplest case is c-command between nodes that do not undergo any movement, nor do they move as part of a larger phrase. I call this version of c-command *base* c-command. Base c-command can be defined using 0th occurrences, since neither of the LIs in question undergo movement (7.31).

$$\text{base-ccom}_{\text{E}}(x, y) \overset{def}{=} \forall u, v[\text{occ}_0(u, x) \wedge \text{occ}_0(\text{v}, \text{y}) \wedge u \triangleleft^+ v] \tag{7.31}$$

To see how base c-command works, consider the example in Figure 7.12, which corresponds to sentence (1). Here the 0th occurrences of negation and *anybody* are the framed `Merge` nodes. Because the 0th occurrence of negation properly dominates the 0th occurrence of the NPI, negation base c-commands the NPI.

(1) We did not see anybody.

Movement introduces complications to the definition. There are two configurations to consider here: 1) either of the LIs in question head phrasal movement, or 2) they are moved as part of a larger phrase.

In the first case, a modified definition of base c-command can work. Instead of requiring the 0th occurrences to dominate each other, we require the *final* `Move`-occurrences to do so now.

Consider the tree in Figure 7.13, which corresponds to sentence (2). Here the final occurrence of negation is the same as in Figure 7.12, but the final occurrence of *anybody* is now the highlighted `Move` node. Because this `Move` node is not dominated by the final occurrence of negation anymore, negation does not c-command the NPI.

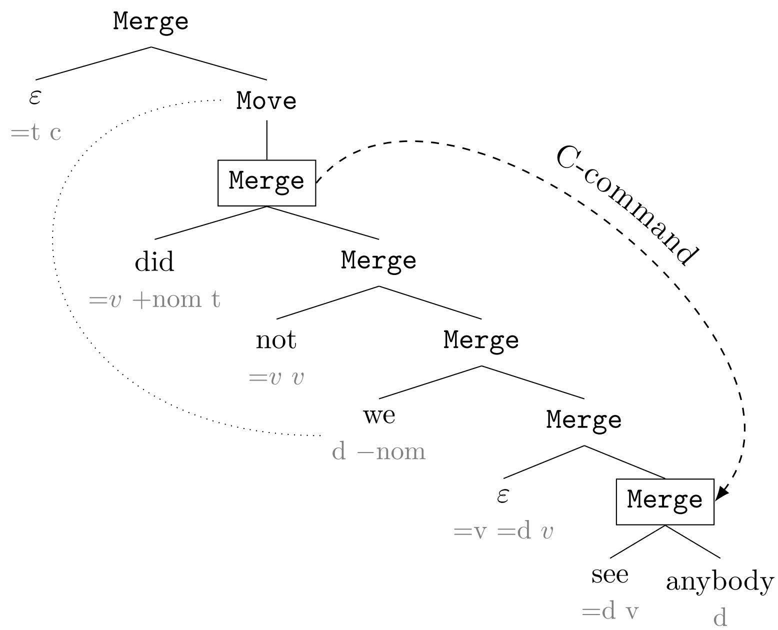


Figure 7.12: Base c-command in a derivation tree: *not* c-commands *anybody*

If the NPI moved somewhere *below* negation, on the other hand, negation would still c-command it as expected.

(2) * Anybody did not leave.

In the second case, where LIs might move as part of a larger phrase, we will also have to check whether the c-commandee is contained by a phrase that moves higher than the c-commander. For example, in Figure 7.14, corresponding to sentence (3), the final occurrence of negation properly dominates the final occurrence of *anything*, like in Figure 7.12, but *anything* has moved above negation as part of the DP headed by *a doctor*. Because of the DP movement, negation does not c-command NPI anymore.

(3) A doctor who knew anything was not intelligent.

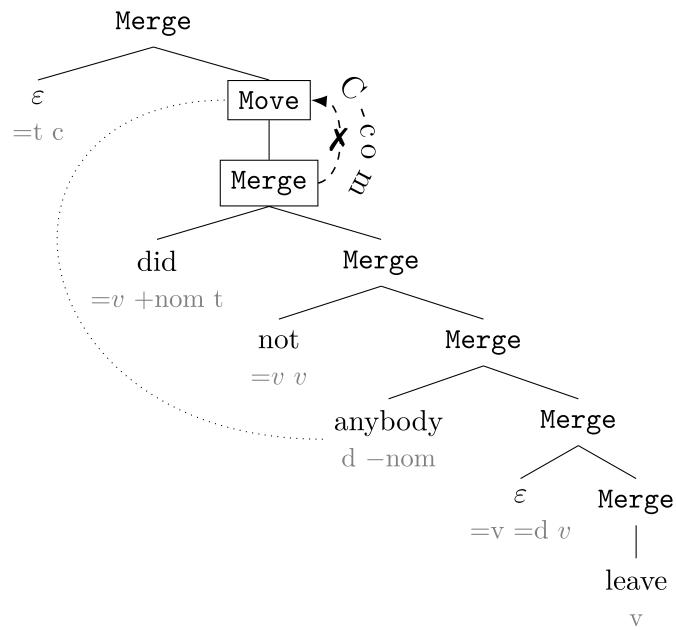
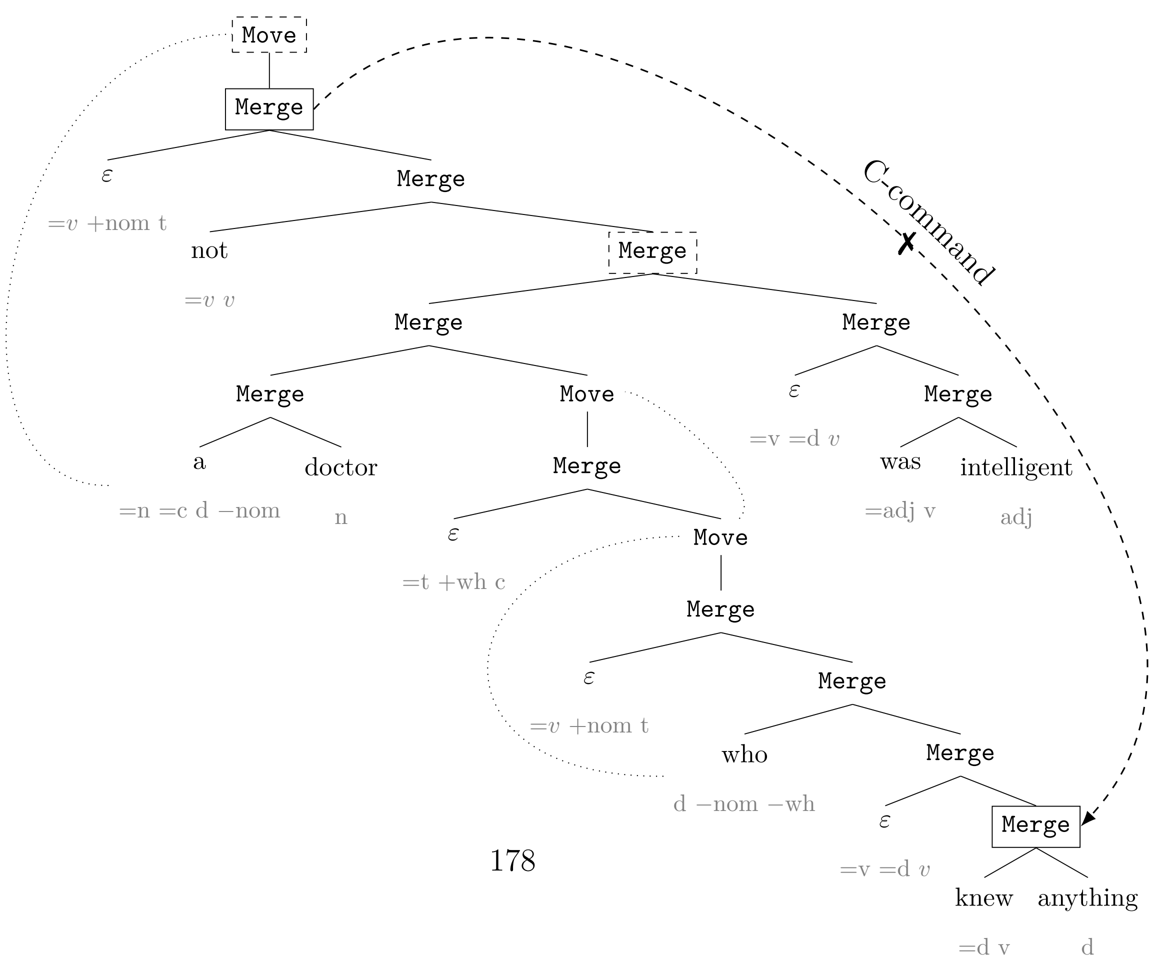


Figure 7.13: C-command relation disturbed by `Move`: *not* does not c-command *anybody*

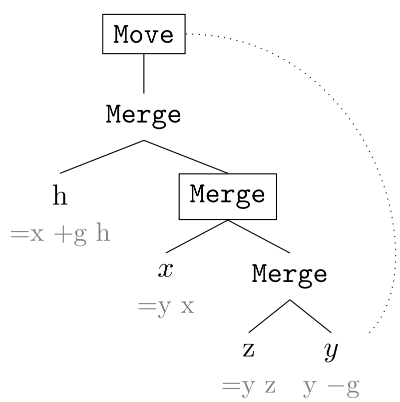


To properly exclude such cases, we need to define containment. In a derived tree, LI x contains LI y, iff y is within the maximal projection of x. For derivation trees, I define containment in two steps. First I only consider the case where y cannot move as part of a larger phrase, and call it *base containment*.

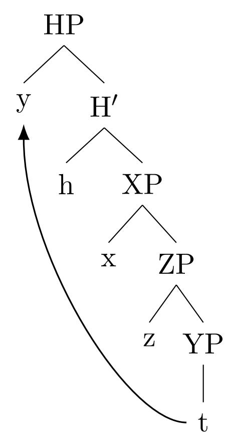
Base containment can simply be defined using slice root and final occurrence: x base-contains y when the slice-root of x dominates the final occurrence of y (7.32).

$$\text{base-contains}_{\text{E}}(x, y) \overset{def}{=} \forall u, v[\text{slice-root}(u, x) \wedge \texttt{Move}\text{-occ}_{\text{fin}}(v, y) \wedge u \triangleleft^{*} v] \qquad (7.32)$$

Base containment is illustrated in the figures below. In Figure 7.15, x does not base-contain y, because the slice root of x (the framed `Merge` node) does not dominate the final occurrence of y (the framed `Move` node). In Figure 7.16, on the other hand, the slice root of x still dominates the final occurrence of y, and thus x base-contains y.



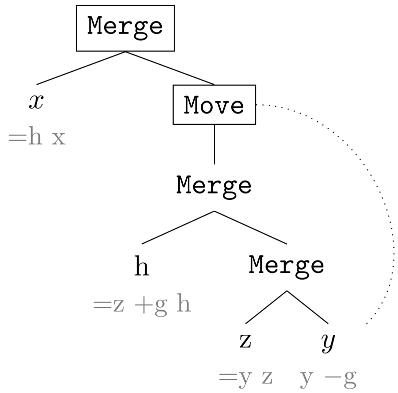
(a) Derivation tree



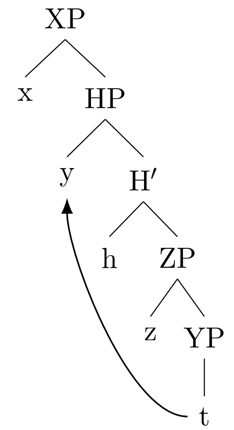
(b) Derived tree

Figure 7.15: x no longer base-contains y due to movement

In the next step, I take into account the possibility that the contained LI moves out from the base containment relation as part of a larger phrase as in Figure 7.17. To do so, I define containment as follows: x *contains* y iff x base-contains y and there is no z such that z base-contains y, and x base c-commands z, but does not base-contain z (7.33); a configuration that is only possible if z was base-generated below x but then moved higher.



(a) Derivation tree

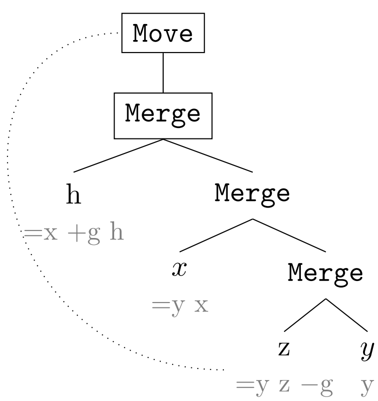


(b) Derived tree

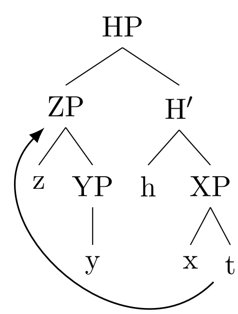
Figure 7.16: x contains y despite movement

$$\text{contains}_{\text{E}}(x, y) \stackrel{def}{=} \text{base-contains}_{\text{E}}(x, y) \land \neg\exists z \big[\, \text{base-contains}_{\text{E}}(z, y) \land \text{base-ccom}_{\text{E}}(x, z) \land \neg\, \text{base-contains}_{\text{E}}(x, z) \big] \quad (7.33)$$

Figure 7.17 illustrates this definition. Here x base-contains y, since its slice root dominates the final occurrence of y; however, there is a z such that z also base-contains y, and x c-commands but not base-contains z. As a result, x does not contain y.



(a) Derivation tree



(b) Derived tree

Figure 7.17: x no longer contains y, because y has moved as part of ZP

Now we can go back to the example in Figure 7.14, where negation does not actually c-command the NPI, because the NPI has moved out as part of a larger DP. To account for such configurations, I define c-command using containment: x c-commands y iff the final Move-occurrence of x properly dominates the final Move-occurrence of y and there is no z such that z contains y, z does not base-contain x, and the final Move-occurrence of z properly dominates the final Move-occurrence of x.

$$\begin{aligned}\text{ccom}_\text{E}(x,y) \overset{def}{=} \forall u,v\Big[&\texttt{Move-occ}_\text{fin}(u,x) \wedge \texttt{Move-occ}_\text{fin}(v,y) \wedge u \lhd^+ v \wedge \\ &\neg\exists z\big[\,\text{contains}_\text{E}(z,y) \wedge \neg\,\text{base-contains}_\text{E}(z,x) \wedge \\ &\forall w[\texttt{Move-occ}_\text{fin}(w,z) \wedge w \lhd^+ u]\big]\Big] \end{aligned} \quad (7.34)$$

To illustrate this definition on a tree that is simpler than in Figure 7.14, consider the tree in Figure 7.17 again. There x base c-commands y in addition to base-containing it, as the 0th occurrence of x properly dominates the 0th occurrence of y. However, there is a z such that z contains y while it does not base-contain x, and the final occurrence of z properly dominates the final occurrence of x. Because of that x does not c-command y.

The next ingredient toward defining the English NPI constraint is to define *semantic* c-command, which is only calculated at LF. The necessity for this comes from sentence (4), which looks identical to (3) on the surface, yet it is acceptable unlike (3). I have explained the contrast between the two by positing that in (4) negation c-commands NPI at LF, because in this case the DP *a doctor* reconstructs – that is, it underwent only `P-move` rather than `Move`.

(4) A doctor who knows anything about acupuncture was not available. Linebarger (1987)

To define semantic c-command, we will have to define semantic `Move` occurrences and semantic containment. Semantic `Move`-occurrences can simply be picked out by making sure that the feature the occurrence is matching is [+sem,±phon] (7.35). The final semantic $\texttt{Move}$-occurrence is defined similarly as the final $\texttt{Move}$-occurrence was, except now it is defined in terms of semantic occurrences.

$$\texttt{Move}\text{-occ}^{\text{s}}(x,l) = \texttt{Move}\text{-occ}(x,l) \wedge \forall f\big[\,\text{match}(x,f) \wedge \rho(f) = [+sem, \pm phon]\big] \quad (7.35)$$

$$\texttt{Move}\text{-occ}^{\text{s}}_{\text{fin}}(x,l) = \texttt{Move}\text{-occ}^{\text{s}}(x,l) \wedge \neg\exists y[\texttt{Move}\text{-occ}^{\text{s}}(y,l) \wedge y \lhd^{+} x] \quad (7.36)$$

To define *semantic* base-containment and containment, we change $\texttt{Move}\text{-occ}_{\text{fin}}$ to $\texttt{Move}\text{-occ}^{\text{s}}_{\text{fin}}$; this way, we only take containment at LF into account.

$$\text{base-contains}^{\text{s}}_{\text{E}}(x,y) \overset{def}{=} \forall u,v[\text{occ}_0(u,x) \wedge \texttt{Move}\text{-occ}^{\text{s}}_{\text{fin}}(v,y) \wedge u \lhd^{+} v] \quad (7.37)$$

$$\begin{aligned}\text{contains}^{\text{s}}_{\text{E}}(x,y) \overset{def}{=} {} & \text{base-contains}^{\text{s}}_{\text{E}}(x,y) \wedge \neg\exists z\big[\,\text{base-contains}^{\text{s}}_{\text{E}}(z,y) \wedge \\ & \text{base-ccom}_{\text{E}}(x,z) \wedge \neg\,\text{base-contains}^{\text{s}}_{\text{E}}(x,z)]\big] \quad (7.38)\end{aligned}$$

Then we define the predicate $\text{c-com}^{\text{s}}_{\text{E}}(x,y)$, which uses semantic occurrence and containment to state that x c-commands y at LF.

$$\begin{aligned}\text{ccom}^{\text{s}}_{\text{E}}(x,y) \overset{def}{=} \forall u,v\Big[& \texttt{Move}\text{-occ}^{\text{s}}_{\text{fin}}(u,x) \wedge \texttt{Move}\text{-occ}^{\text{s}}_{\text{fin}}(v,y) \wedge x \lhd^{+} y \wedge \\ & \neg\exists z\big[\,\text{contains}^{\text{s}}(z,y) \wedge \neg\,\text{contains}^{\text{s}}(z,x) \wedge \\ & \forall w[\text{occ}^{\text{s}}_{\text{fin}}(w,z) \wedge w \lhd^{+} u]\big]\Big] \quad (7.39)\end{aligned}$$

Next, to state the English NPI constraint, I define shorthands for the groups of LIs that are relevant for the discussion. These are going to be any-NPI(x) and lic(x). Any-NPIs are defined as all English NPIs that are *any*-pronouns.

$$\text{any-NPI}(x) \overset{def}{=} \texttt{anything}(x) \vee \texttt{anybody}(x) \vee \texttt{anywhere}(x) \vee \ldots \quad (7.40)$$

For our current purposes, I define lic(x) as nodes labeled with various negative items. This definition can be extended to any other NPI-licensing operator one might propose, such as downward entailing ones.

$$\text{lic}(x) \overset{def}{=} \texttt{not}(x) \vee \texttt{nobody}(x) \vee \texttt{nothing}(x) \vee \ldots \tag{7.41}$$

Finally, the English NPI-licensing constraint can simply be stated the following way: if x is an *any*-NPI, then there must be a y such that y is a licensor and it c-commands x at LF.

$$\text{any-NPI}(x) \rightarrow \exists y[\text{lic}(y) \wedge \text{ccom}^{\text{s}}_{\text{E}}(y, x)] \tag{7.42}$$

The fact that English NPI-licensing is definable as MSO constraints over derivation trees means that we can model English NPI-licensing with regular derivation tree languages. In the next section, I examine whether the same can be done for Hungarian NPI-licensing.

7.4.2 Universal NPIs in Hungarian

7.4.2.1 Constraint stated in terms of c-command

I have analyzed Hungarian NPIs to be universal quantifiers, which are required to scope over negation at LF *and* observe a clause-boundary restriction. This would amount to a c-command constraint where universal NPIs must c-command negation within the same clause. However, the c-command definition given in (7.39) is no longer adequate to cover all cases in Hungarian for two reasons: we need to account for clustering and specify that specifiers c-command their heads.

These two changes to the definition require us to state a host of complicated exceptions to the definition in (7.39). In this section, I explain why these exceptions would be necessary if we are to state the Hungarian NPI-licensing constraint in terms of c-command, informally sketch out the definitions, and then provide an alternative way of looking at Hungarian NPI-licensing in §7.4.2.2.

First, I have proposed that Hungarian NPIs ensure that they scope over negation by raising to Spec,NegP via QR. If there are multiple NPIs, the lower ones first move to higher NPIs via `Cluster`. Introducing clustering into our current model requires that we rethink how c-commanding works, because clustered items can c-command from a position that is higher than their final occurrence.

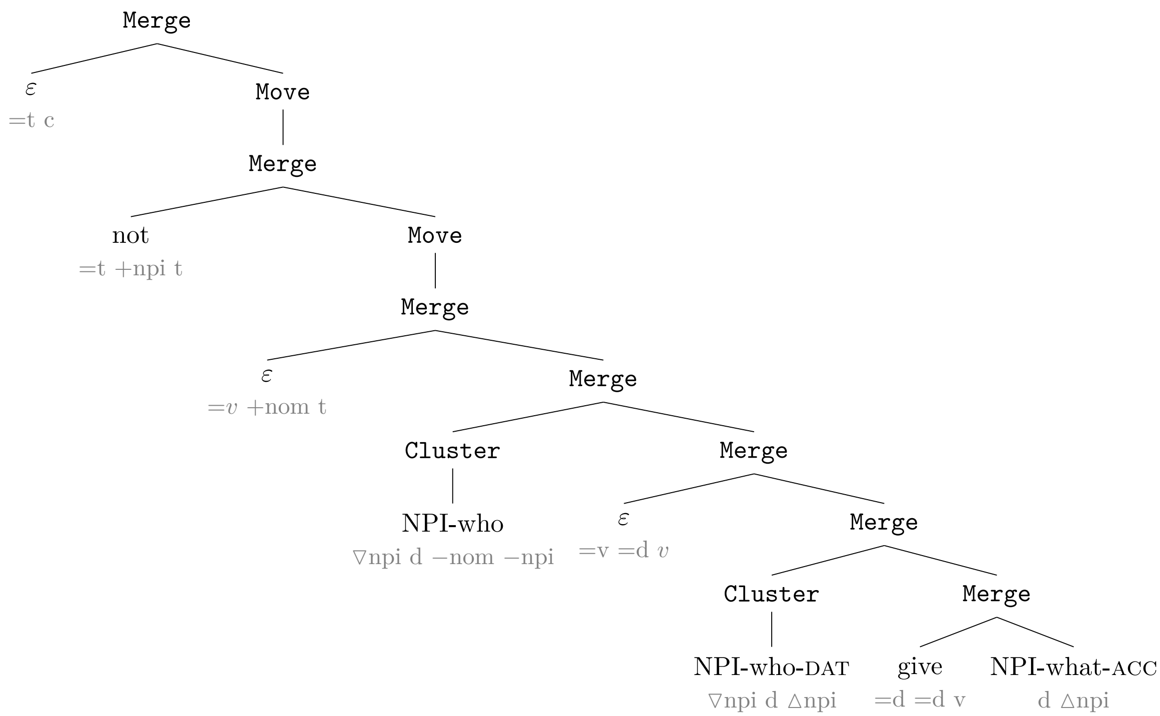
As a reminder, we defined c-commanding by comparing final occurrences: x c-commands y iff the final occurrence of x properly dominates the final occurrence of y. Now consider the trees in Figure 7.18, corresponding to (5), which features multiple NPI-licensing.

(5) *Sen-ki* *sen-ki-nek* *sem-mi-t* *nem* *ad-ott* .
NPI-who NPI-who-DAT NPI-what-ACC NEG give-PST.3SG
'Nobody gave anything to anybody.'

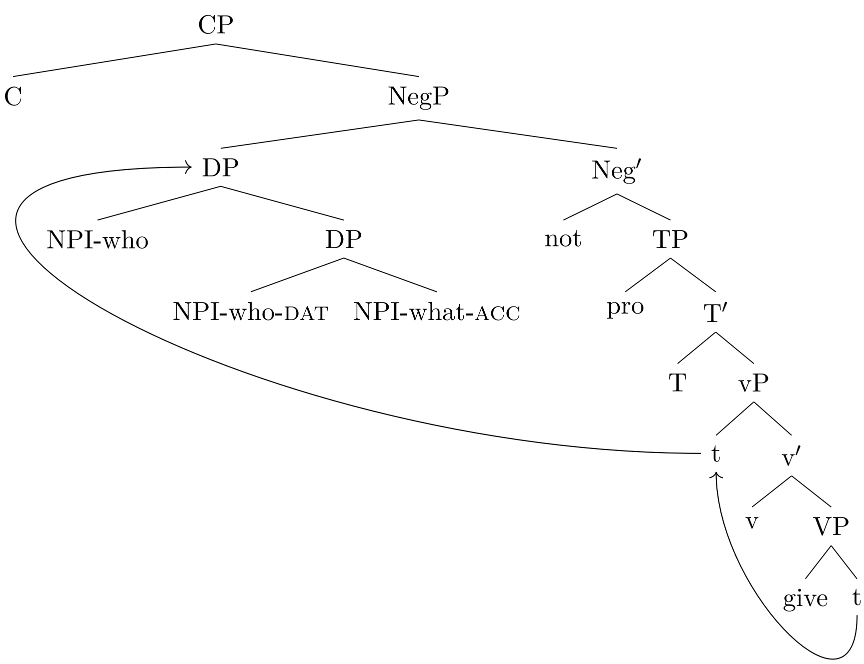
The final occurrences of NPI-what-ACC and NPI-who-DAT are the two `Cluster` nodes in the tree, which do *not* properly dominate the final occurrence of negation. Nevertheless, we know that they c-command negation as a result of moving as a cluster headed by NPI-who. In other words, when lexical items are moved as part of a cluster in the derivation, they can come to c-command something without their final occurrence dominating it.

Accommodating clustering in the MSO definition of c-commanding thus would require us to define a special case for LIs whose final occurrence is a `Cluster` node. For those nodes, we would have to define a 'real' final occurrence, which is the `Move` node where they ultimately end up as part of the cluster they belong to.

Second, according to the definition in of English c-command (7.39) the head c-commands its specifier as well as its complements as the final occurrence of a head will always properly dominate the final occurrence of its specifier unless the specifier moves even higher. My proposal for Hungarian, on the other hand, requires that specifiers c-command and thus scope over their head: the universally quantified NPI undergoes QR to Spec,NegP to take scope over negation in the head of NegP. This then would require a definition where specifiers c-command their head.



(a) Derivation tree



(b) Derived tree

Figure 7.18: Clustering and c-command in Hungarian

This definition of c-command is complicated to achieve in MGs (and Minimalism in general) because there is no formal distinction between specifiers and complements in the formalism; they are both added to the tree by matching the head's selector features. A way to address this problem would be to manually distinguish specifiers from complements: the LI that checks off the first selector feature on the head is a complement, and all LIs afterwards are specifiers. This again would be possible to state with an MSO statement, albeit very technical.

Here we have seen that stating the constraint on universally quantified NPI-licensing in terms of c-command leads to significant complications to the definition of c-command itself. However, there is another way to state these constraints that do not require the use of c-command. Since universally quantified NPIs always move overtly or covertly to take scope over negation, as discussed in previous chapters, we could state the NPI-licensing constraint in terms of `Move` and `Cluster` constraints, given certain assumptions about the feature strings on NPIs and negation in Hungarian. In the next section, I spell out these assumptions and provide the MSO formula of universally quantified NPI-licensing, in terms of `Move`/`Cluster`.

7.4.2.2 Constraint stated in terms of `Move` and `Cluster`

According to the proposal, universally quantified NPIs move to Spec,NegP to take scope over negation in the head of NegP. In the current model, this is accomplished by the highest NPI undergoing `Move` to NegP, and all subsequent NPIs undergoing `Cluster` as in Figure 7.18. Both `Move` and `Cluster` can be either overt or covert.

This requirement for mandatory movement or clustering in order to be licensed allows us to state the NPI-licensinig constraint for Hungarian in terms of `Move` and `Cluster` constraints. The requirement assumes that all Hungarian NPIs have either a `Move` licensee feature that can only be checked by negation or a `Cluster` licensee feature that can only be checked by another NPI. Here I will assume that these features will be $-$npi, $\triangle$npi and their LF-only varieties, $-_s$npi and $\triangle_s$npi.

Accordingly, I assume that the possible feature strings on NPIs and NPI-licensors in Hungarian are the ones listed in Table 7.2.[4] For example, if an NPI undergoes overt movement to Spec,NegP, then it must have a $-_s$npi feature on it, and its licensor has a $+_s$npi feature. Note that `Cluster` is always licensed by an NPI that has a $\triangledown$npi `Cluster` licensor feature, followed by its category feature, and then by a `Move` or `Cluster` licensee feature. The licensee feature in the end makes sure that all NPIs end up being licensed by negation, as negation is the only item that has a +npi or $+_s$npi feature.

	`Move`/`Cluster` licensee	`Move`/`Cluster` licensor
Overt `Move`	NPI :: d −npi	nem :: =t +npi t
Covert `Move`	NPI :: d $-_s$npi	nem :: =t $+_s$npi t
Overt `Cluster`	NPI :: d $\triangle$npi	NPI :: $\triangledown$npi d $\triangle_{(s)}$npi/$-_{(s)}$npi
Covert `Cluster`	NPI :: d $\triangle_s$ npi	NPI :: $\triangledown_s$npi d $\triangle_{(s)}$npi/$-_{(s)}$npi

Table 7.2: Possible feature strings associated with NPIs and negation, grouped by operation type

With these LIs in hand, we then only need two constraints to ensure that universally quantified NPIs are licensed in derivation trees. The first one is the same as the `Move`/`Cluster` constraint introduced in Section 7.3.2.2 that made sure that every `Move` or `Cluster` licensee feature had a corresponding occurrence (7.43).

$$\forall x\Big[\bigwedge_{1\leq i\leq|\delta|}\big(\mathrm{f}(x,i)\rightarrow\exists y[\mathrm{occ_i}(y,x)]\big)\Big] \tag{7.43}$$

The second constraint has to do with the locality of movement. As discussed in Chapter 4, in Hungarian overt movement of a single NPI can be long-distance (6), but covert movement is clause-bound (7). Locality constraints are less clear when it comes to clustering, partly because sentences that involve long-distance movement and clusters become hard for native speakers to evaluate for grammaticality. Thus to keep

[4] All NPIs in this table have d as their category feature, but this can be changed to adverbs or adjectives, for example.

it simple, I will not describe locality constraints with regards to clustering, only for phrasal movement.

(6) *Sen-ki-vel*$_i$ *nem gondol-t-am, hogy Péter találkoz-na* t_i.
NPI-who-COM NEG think-PST-1SG that Peter meet-COND.3SG
'I did not think that Peter would meet with anyone.'

(7) * *Nem gondol-t-am, hogy Péter találkoz-na sen-ki-vel.*
NEG think-PST-1SG that Peter meet-COND.3SG
'I did not think that Peter would meet with anyone.'

We thus need to state that there cannot be a clause boundary between an NPI and its final occurrence if the NPI has a $-_s$npi licensee feature. First, we define Hungarian NPIs so we can refer to them more easily.

$$\text{se-NPI}(x) \overset{def}{=} \texttt{semmi}(x) \vee \texttt{senki}(x) \vee \texttt{sehol} \vee \ldots \tag{7.44}$$

The licensor is defined as sentential negation:

$$\text{lic}(x) \overset{def}{=} \texttt{nem}(x) \tag{7.45}$$

Finally, I define CP(x) as the slice-root of any LIs with category c. In other words, this predicate picks out the nodes that would correspond to CP in a derived tree.

$$\text{CP}(x) = \exists y[\text{c}(y, cat) \wedge \text{sliceroot}(x, y)] \tag{7.46}$$

The formula in (7.47) covers the locality requirements outlined above: it states that if LI x has $-_s$npi as its ith licensee feature, then there cannot be a CP boundary between the LI and its ith occurrence.

$$\forall x \Bigg[\bigvee_{1 \leq i \leq |\delta|} \Big(-\,\text{npi}_\text{s}(x, i) \rightarrow \neg \exists z \big[\forall u[\text{occ}_\text{i}(u, x) \wedge \text{CP}(z) \wedge z \triangleleft^* x \wedge u \triangleleft^* z] \big] \Big) \Bigg] \tag{7.47}$$

In the end, I have shown that universal NPI-licensing can be handled with the same well-formedness constraints that were necessary for defining well-formed derivation trees with an additional locality constraint. The one caveat is that we had to assume very specific feature strings for NPIs and negation. If the derivation tree satisfies all of these constraints, then the NPI is licensed.

7.5 Summary

In this chapter I have shown that my adopted a version of MGss derivation tree languages are regular, and the added NPI-licensing constraints do not require anything more complex than MSO logic. Moreover, I have argued that while English NPI-licensing can be stated as a c-command restriction, Hungarian NPI-licensing is more straightforward as a `Move/Cluster` constraint with locality restrictions. In the next chapter, I go further and investigate whether these same NPI-licensing patterns can be restated with subregular constraints.

Chapter 8

MOST NPI-LICENSING CONSTRAINTS ARE MITSL

In Chapter 7, I have shown that the tree languages that satisfy the NPI-licensing constraints discussed in this thesis are regular, as the constraints are definable with MSO-formula. The goal of this chapter is to examine whether they are also Input-local Tier-based Strictly Local (I-TSL), a class in the subregular hierarchy.

The subregular hierarchy consists of the complexity classes between Finite languages and Regular languages. Part of the hierarchy can be found in Figure 8.1, which is based on recent results in De Santo and Graf (2019). In the diagram, arrows show which classes properly subsume other ones. For example, in the center of the figure, MITSL properly subsumes both Multiple Tier-based Strictly Local (M-TSL) and I-TSL, but M-TSL and I-TSL are incomparable.

Intuitively, a language belongs to the class of SL languages, if all their constraints can be written as a conjunction of negative literals of a bounded size. In other words, we can exclude all non-belonging structures from the language by simply listing all substructures that should not be part of any structure in the language. The class of TSL languages is an extension to SL in that it lets us erase all parts of the structure that are not relevant for the given constraint, while projecting all relevant nodes onto a 'tier'. Then we can apply SL constraints over the resulting tier. In this way, TSL turns long-distance constraints into local ones.

In I-TSL, the erasing function is generalized to a type of function that lets us take local context into account, called an Input Strictly Local (ISL) function, when deciding what nodes to project to the tier. And finally, the class of MITSL languages allows the projection of multiple tiers with different ISL functions, and separate sets of SL constraints on each tier.

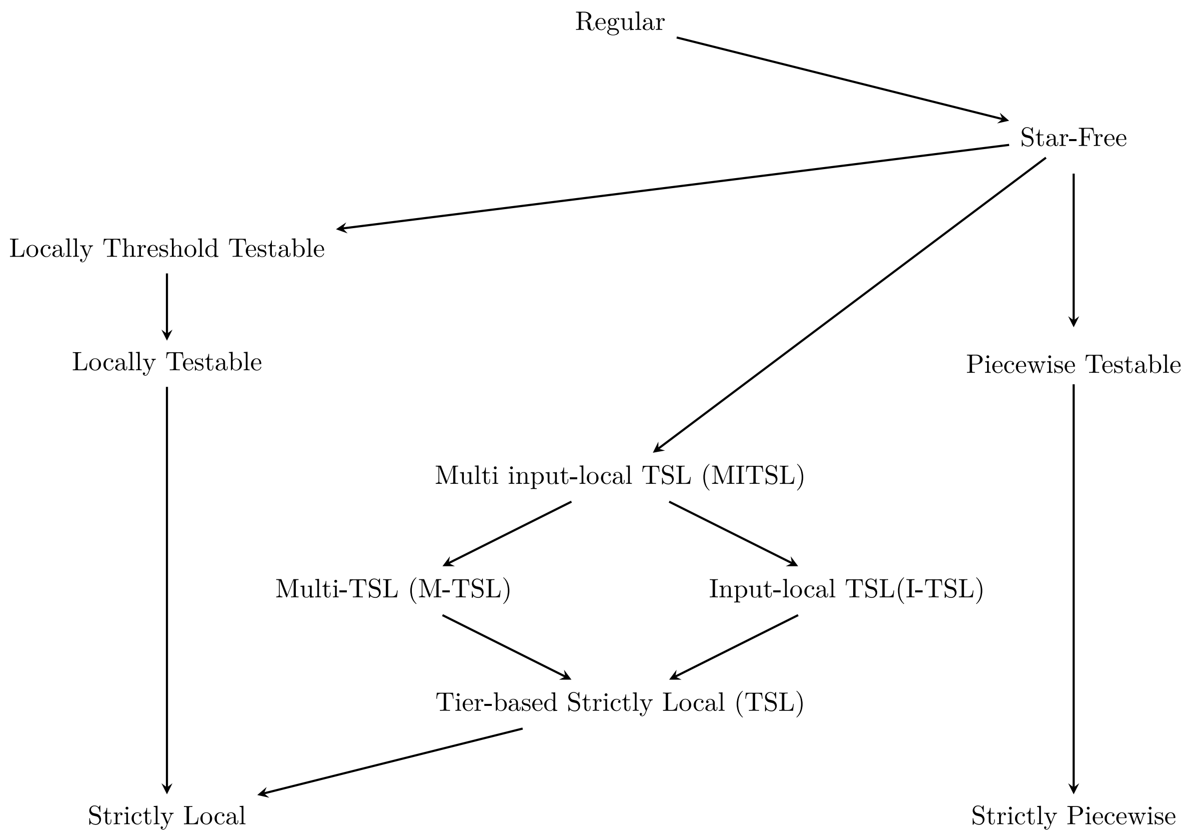


Figure 8.1: The subregular hierarchy

The subregular hierarchy over strings has been studied extensively for phonology (Heinz, 2009, 2010). One reason to believe that phonological patterns are subregular rather than regular is because there are many regular patterns that are not attested in natural language. One such unattested pattern that is regular would be something akin to the '*even a*' language, where all well-formed strings are required to have an even number of of *a*s.

Chandlee (2014) has shown that all *local* phonotactic patterns in fact fit into the SL class. For most long-distance patterns, such as front-back vowel harmony, either the Strictly Piecewise (SP) or the TSL classes would work (Heinz et al., 2011; McMullin, 2016). Even phonological patterns that rely on structural hierarchies instead of strings, such as tones (Jardine, 2016) and syllabification Strother-Garcia (2019) were shown to be fairly low in the hierarchy.

There is less work on how the subregular hierarchy fares when it comes to constraints over trees. Graf and Heinz (2015) has shown that standard MGs operations, such as `Merge` and `Move` can be stated with I-TSL constraints, and Graf (2018) shows that `Merge` with recursive adjunction is I-TSL as well. Taken together, this would make MGs derivation tree languages MITSL so far.

Other syntactic constraints, such as base c-command restrictions have also been shown to be I-TSL over derivation trees (Vu et al., 2019). Another line of work, by Graf and Shafiei (2019), has proposed an algorithm to turn derivation trees into strings which they call *c-strings*, and has shown that c-command restrictions can be modeled on c-strings as Input-output Local TSL (IO-TSL) constraints, which is another extension of TSL. And finally, Graf and De Santo (2019) has proposed that an upper threshold for all syntactic constraints is the class of tree languages recognizable by Sensing Tree Automata (STA), which properly subsumes all current results of subregular syntax. While Graf and De Santo (2019) believe that these tree languages can handle derived c-command restrictions also, the formal details are yet to be worked out.

In this chapter, I reiterate some of these results, but applied to NPI-licensing, as well as expand on them. I show how base c-command restrictions are I-TSL, while derived c-command restrictions are not when it comes to NPI-licensing in English. I also show how `Move` well-formedness can be handled with I-TSL, and expand on that result by showing that `Cluster` and locality constraints are also I-TSL.

In what follows, I give formal definitions for the classes of SL string languages and I-TSL tree languages, based on Rogers and Pullum (2011); Heinz et al. (2011); De Santo and Graf (2019), in §8.1. Then in §8.2, I present the I-TSL treatments for NPI-licensing constraints.

8.1 Subregular tree-languages

In this section, I define the following subregular classes: Strictly Local (SL) string languages and Input-local Tier-based Strictly Local (I-TSL) tree languages, and their extension, Multiple Input-local Tier-based Strictly Local (MITSL) tree languages. For all definitions, I assume that Σ is the alphabet.

8.1.1 SL string languages

I interpret strings according to the model signature I introduced in Chapter 7, shown again in Figure 8.2.

$$\mathfrak{M}^{\lhd} = \langle \mathcal{D}, \mathcal{R}_{\lhd}, \mathcal{R}_{\sigma} | \sigma \in \Sigma \rangle \text{, where}$$

- $\mathcal{D} \overset{def}{=} \{i \in \mathbb{N} | 0 \leq i < |w|\}$, where $|w|$ is the size of a given string w,
- $\mathcal{R}_{\lhd} = \{(i, i+1) \in \mathcal{D} \times \mathcal{D}\}$,
- $\mathcal{R}_{\sigma}$ for each $\sigma \in \Sigma$ is a unary relation that denotes the set of nodes in $\mathcal{D}$ that are labeled σ.

Figure 8.2: A model signature for strings

In order to define the class of SL languages, we need to first define k-literals. Intuitively, k-literals are strings of k-length.

Definition 2 (k-literal on string models)**.** *A k-literal is a string $a_1 a_2 \dots a_{k-1} a_k$ defined as the following FO formula, where $a_1, a_2, \dots, a_k \in \Sigma$:*

$$\exists x_1, x_2, \dots x_k [x_1 \lhd x_2 \wedge x_2 \lhd x_3 \wedge \cdots \wedge x_{k-1} \lhd x_k \wedge a_1(x_1) \wedge a_2(x_2) \wedge \cdots \wedge a_k(x_k)]$$

Definition 3 (Strictly Local Tree Grammars)**.** *A Strictly k-Local grammar $\mathcal{G}$ is a conjunction of negative k-literals constructed over alphabet Σ.*

Then, SL languages are defined as in Definition 4.

Definition 4 (Strictly Local Languages)**.** *Assuming that the augmented alphabet $\Sigma' = \{\Sigma \cup \{\rtimes, \ltimes\}\}$ and given a Strictly k-Local grammar $\mathcal{G}$ constructed over Σ', a string w satisfies $\mathcal{G}$, iff $\rtimes^{k-1} w \ltimes^{k-1} \models \mathcal{G}$.*

The string set licensed by $\mathcal{G}$ is the set of all strings that satisfy it.

$$L(\mathcal{G}) \stackrel{def}{=} \{w | \rtimes^{k-1} w \ltimes^{k-1} \models \mathcal{G}\}$$

A set of strings is Strictly k-Local (SL_k) iff it is $L(\mathcal{G})$ for some strictly k-local definition of $\mathcal{G}$. It is Strictly Local iff it is SL_k for some k.

Example 3. *Let $\Sigma = \{a, b\}$ and $\mathcal{G} = \neg \rtimes b \wedge \neg aa \wedge \neg bb \wedge \neg a \ltimes$. Then $L(\mathcal{G})$ is all strings that start with a, end with b, and have no sequence of aa or bb in them. For example, $w = ababab$ is in $L(\mathcal{G})$, but $w' = aaabb$ is not.*

8.1.2 I-TSL and MITSL tree-languages

For tree languages, I assume the model signature for trees that I adopted in Chapter 7, summarized in Figure 8.3.

$$\mathfrak{M}^{\triangleleft, \prec^+} = \langle \mathcal{D}, \mathcal{R}_\triangleleft, \mathcal{R}_\prec{}^+, \mathcal{R}_\sigma | \sigma \in \Sigma \rangle, \text{ where}$$

- $\mathcal{D} \stackrel{def}{=} \{w \in \mathbb{N}^*\}$, where w is a Gorn-address
- $\mathcal{R}_\triangleleft = \{\langle m, n \rangle \in \mathcal{D} \times \mathcal{D} | n = m \cdot i, i \in \mathbb{N}\}$,
- $\mathcal{R}_\prec{}^+ = \{\langle m, n \rangle \in \mathcal{D} \times \mathcal{D} | m = w \cdot i, n = w \cdot j, w \in \mathcal{D}, i, j \in \mathbb{N}, i < j\}$
- $\mathcal{R}_\sigma$ for each $\sigma \in \Sigma$ is a unary relation that denotes the set of nodes in $\mathcal{D}$ that are labeled σ.

Figure 8.3: A model signature for trees

In general, I-TSL can be defined in two parts: first we project a tier-tree using an ISL function, and then we apply SL constraints to the tier-tree.

I define the ISL projection function in terms of *tree contexts*, following De Santo and Graf (2019) and Chandlee and Heinz (2018). These tree-contexts are trees of bound depth and branching factor, and describe the immediate context of the node we want to project. To define them, I first define m, n-bounded trees, which ensure that a given tree is of $m - 1$ depth and n branching factor (Definition 5).

Definition 5 (m, n-bounded tree)**.** *An m, n-bounded tree* $\text{tree}_{m,n}(X)$ *is a tree of at most $(m - 1)$ depth and each of its node has at most n children.*

$$
\begin{aligned}
\text{tree}_{m,n}(X) \overset{def}{=} \neg\exists y_1, y_2, ...y_{m+1}[X(y_1) \wedge X(y_2) \wedge ... \wedge X(y_m) \wedge \\
y_1 \lhd y_2 \wedge y_2 \lhd y_3 \wedge ... \wedge y_m \lhd y_{m+1}] \wedge \\
\forall x \neg\exists y_1, y_2, ...y_{n+1}[X(x) \wedge X(y_1) \wedge X(y_2) \wedge ... \wedge X(y_m) \wedge \\
x \lhd y_1 \wedge x \lhd y_2 \wedge ... \wedge x \lhd y_{n+1} \wedge \\
y_1 \prec y_2 \wedge y_2 \prec y_3 \wedge ... \wedge y_n \prec y_{n+1}]
\end{aligned}
\quad (8.1)
$$

A tree context then is defined as in 6.

Definition 6 (Tree contexts)**.** *An m, n-tree-context of node x, $\gamma_{m,n}(x)$, is a m, n-bounded tree that contains x. Each tree context can be described as an FO-formula that can specify the labels of and relations between the nodes that make up the tree.*

For an example for an m, n-tree-context, see below.

Example 4. *Let $\varphi_{2,1}(x)$ be the following tree context:*

$$\varphi_{2,1}(x) = \texttt{Merge}(x) \wedge \exists y[x \lhd y \wedge \text{n}(\text{label}(y), cat)]$$

This formula describes the tree context below, where x is the node with superscript T. In lay terms, this tree context picks out all `Merge` *nodes that are parents of nodes with category* n*.*

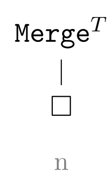


Figure 8.4: Tree-context $\varphi_{2,1}(x)$

In later discussions, I will illustrate tree contexts as in Figure 8.4 instead of writing out the full FO formula that describes them.

Next, we move on to define tier-trees. Given a set of m, n-context-trees, the tier projection is then essentially an m, n-Input Strictly Local (m, n-ISL) function that takes a tree as input and outputs a tier-tree. A tier-tree consists of nodes that are on the tier based on a set of tree-contexts, and the usual immediate dominance and left-of relations between nodes on the tier are defined with the help of FO formulas (Definition 7).

Definition 7 (Tier-trees)**.** *Let t be a tree and $t' = [\top[t]]$, which is t with $\top$ added to it as its root.*

Let C be an m, n-tree-context set over Σ. Then we define the shorthand $T(x)$ for x iff any of the $\gamma_{m,n}$ tree-contexts in C apply to x or if x is labeled with $\top$. We say that x is on the tier *iff $T(x)$ is true.*

$$T(x) \overset{def}{=} \top(x) \vee \bigvee_{\gamma_{m,n} \in C} \gamma_{m,n}(x) \tag{8.2}$$

We then define tier-based immediate dominance, where $x \lhd_T y$ iff x properly dominates y, both x and y are on the tier, and there is no z such that x properly dominates z, z properly dominates y, and z is also on the tier.

$$x \lhd_T y \overset{def}{=} x \lhd^+ y \wedge T(x) \wedge T(y) \wedge \neg\exists z[x \lhd^+ z \wedge z \lhd^+ y \wedge T(z)] \tag{8.3}$$

We also define tier-based left-of relations, where $x \prec_T^+ y$ iff x was left-of y through dominance and there is a z that dominates x and y on the tier.

$$x \prec_T^+ y \overset{def}{=} x \prec_\lhd^+ y \wedge \exists z[z \lhd_T x \wedge z \lhd_T y] \tag{8.4}$$

Then the tier-tree of t consists of the set of nodes $x \in t'$ where $T(x)$, and for two nodes $x, y \in t'$, x dominates y on the tier iff $x \lhd_T y$, and x is left-of on the tier y iff $x \prec_T^+ y$.

As an example, let the tree contexts be the ones depicted in Figure 8.5. These contexts will result in projecting all nodes labeled a if they immediately dominate a node labeled b, and all nodes labeled c if they have a parent labeled a or b in the tree. In this case, all contexts are 2,1-tree-contexts.

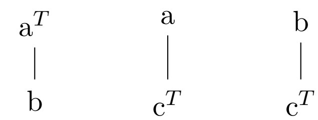


Figure 8.5: Example 2,1-tree-contexts

Now and in further discussions, I will show the tier-tree projected based on these contexts by constructing a new tree. The tier-tree only contains the nodes that are on the tier, and its dominance and precedence relations are technically the $\lhd_T$ and $\prec_T^+$ relations in the original tree, calculated as described in Definition 7.

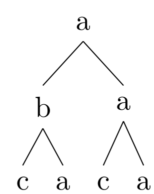


Figure 8.6: Example tree over $\Sigma = \{a, b, c\}$

Given a tree such as the one depicted in Figure 8.6, we project the tier-tree based on the contexts in Figure 8.5. The resulting tier-tree is depicted on the right side of Figure 8.7.

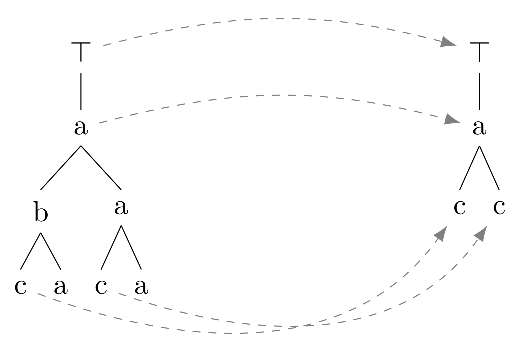


Figure 8.7: A tree mapped to a tier-tree based on the tree-contexts in Figure 8.5

Note that the tier-tree was projected from a version of the original tree that was enhanced with the $\top$ marker as its root, which always projects to the tier, to make sure the tier-tree has a root. The enhancement was not strictly necessary for this tree, but would be relevant for a tier-projection where the tier-tree would otherwise not have a root. For example, see the tree in Figure 8.8, where without the ⊤ marker, the tier-tree would have no root.

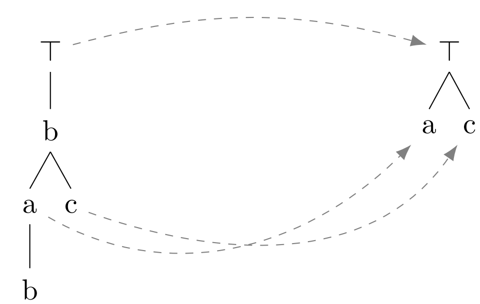


Figure 8.8: A tier projection where root enhancement is necessary

Now that I have shown how tier-projection works for trees, I next describe how constraints can apply to the tier-tree. Because tier-trees can have unbounded branching factors, we cannot simply apply a conjunction of negative tree k-literals to it, as tree k-literals are trees of bound depth and branching factor. Instead, we will apply constraints to the daughter strings of each node in the tier-tree that matches a certain context. For this, we will have to define bounded tree-contexts on tier-trees and daughter strings.

First, I define tree-contexts on tier-trees. The definition will be very similar to the definition of m, n-tree-contexts above, except now all dominance and left-of relations apply on the tier.

Definition 8 (k, l-bounded tree on the tier)**.** *We first define immediate left-of on the tier relations $\prec_T$ relations as follows:*

$x \prec_T y \overset{def}{=} x \prec_T^+ y \wedge \neg\exists z[x \prec_T^+ y \wedge z \prec_T^+ y]$

A k, l-bounded tree ($\text{tree}_{k,l}(X)$*) is a tree of at most* $(k-1)$ *depth and each of its node has at most l children.*

$$\begin{aligned}\text{tree}_{k,l}(X) \overset{def}{=} \neg\exists y_1, y_2, ...y_{k+1}[X(y_1) \wedge X(y_2) \wedge ... \wedge X(y_{k+1})\wedge \\ y_1 \lhd_T y_2 \wedge y_2 \lhd_T y_3 \wedge ... \wedge y_k \lhd_T y_{k+1}]\wedge \\ \forall x \neg\exists y_1, y_2, ...y_{l+1}[X(x) \wedge X(y_1) \wedge X(y_2) \wedge ... \wedge X(y_{l+1})\wedge \\ x \lhd_T y_1 \wedge x \lhd_T y_2 \wedge ... \wedge x \lhd_T y_{l+1}\wedge \\ y_1 \prec_T y_2 \wedge y_2 \prec_T y_3 \wedge ... \wedge y_l \prec_T y_{l+1}] \quad (8.5)\end{aligned}$$

A tree context on the tier then is defined as below.

Definition 9 (Tree contexts on the tier)**.** *An k, l-tree-context of node x, $\delta_{k,l}(x)$, is a k, l-bounded tree that contains x. Each tree context can be described as an FO-formula that can specify the labels of and relations between the nodes that make up the tree.*

I will illustrate tree-contexts on the tier similarly to how I illustrated them for tree-contexts in general; instead of T, I will superscript the nodes that match the context with D, as below.

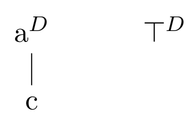


Figure 8.9: Example 2,1-tree-contexts on the tier

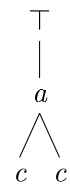
Next, I define daughter strings on tier-trees. Intuitively the daughter-string of a node is a concatenation of all of its daughters on the tier.

Definition 10 (Daughter-strings in tier-trees)**.** *A daughter string $a_1a_2...a_{m-1}a_m$ on a tier-tree is then defined as follows, where $a_1, a_2, ..., a_m \in \Sigma$:*

$$\begin{aligned}\exists x, y_1, y_2, ..., y_m\big[x \lhd_T y_1 \wedge y_1 \prec_T y_2 \wedge y_2 \prec_T y_3 \wedge ... \wedge y_{m-1} \prec_T y_m\wedge \\ a_1(y_1) \wedge a_2(y_2) \wedge ... \wedge a_m(y_m)\wedge \\ \neg\exists z[x \lhd_T z \wedge y_1 \not\approx z \wedge y_2 \not\approx z \wedge ... \wedge y_m \not\approx z]\big] \quad (8.6)\end{aligned}$$

We also define the function daughter-string(x) *that yields the daughter-string* w *of* x*, where every member of* w *is dominated by node* x *on the tier.*

Example 5. *Take the tier tree in Figure 8.7, repeated below.*



Then the daughter-string of the node labeled '$\top$*' is 'a', and the daughter-string of the node labeld 'a' is 'cc'.*

Next we defined SL languages on daughter strings on a tier-tree. The definition is essentially identical to SL string languages in Section 8.1.1, except the nodes of daughter-strings are in $\prec_T$ relation to each other.

Definition 11 (Strictly Local languages on tier-tree daughter-strings)**.** *A tier-based daughter-string k-literal* $a_1a_2...a_{k-1}a_k$ *applied to a tree is defined as the following FO formula, where* $a_1, a_2, ..., a_k \in \Sigma$*:*

$$\exists x_1, x_2, \ldots x_k[x_1 \prec_T x_2 \wedge x_2 \prec_T x_3 \wedge \cdots \wedge x_{k-1} \prec_T x_k \wedge a_1(x_1) \wedge a_2(x_2) \wedge \cdots \wedge a_k(x_k)]$$

Given the augmented alphabet $\Sigma' = \{\Sigma \cup \{\rtimes, \ltimes\}\}$*, a Strictly k-Local grammar* $\mathcal{S}$ *on tier-tree daughter strings is a conjunction of negative daughter-string k-literals constructed over alphabet* Σ'*. A daughter string* w *satisfies* $\mathcal{S}$*, iff* $\rtimes^{k-1}w\ltimes^{k-1} \models \mathcal{S}$*, where the edge markers* $\rtimes$ *and* $\ltimes$ *are understood to be left-of and right-of* w *on the tier via the* $\prec_T$ *relation.*

The daughter string set licensed by $\mathcal{S}$ *is the set of all strings that satisfy it.*

$$L(\mathcal{S}) \stackrel{def}{=} \{w | \rtimes^{k-1} w \ltimes^{k-1} \models \mathcal{S}\}$$

A set of daughter strings is Strictly k-Local (SL_k*) iff it is* $L(\mathcal{S})$ *for some strictly k-local definition of* $\mathcal{S}$*. It is Strictly Local (SL) iff it is* SL_k *for some k.*

Then we define I-TSL tree-languages where each node that matches a certain context in the tier-tree is mapped to an SL daughter-string language.

Definition 12 (I-TSL tree-languages)**.** *Given alphabet* Σ*, an* m,n-Input local k,l-Tier-based Strictly Local *(*m,n*-I-TSL*$_{k,l}$*) grammar* $\mathcal{G}$ *is a 4-tuple* $\langle C, D, S, f\rangle$*, where*

- C *is a set of* m,n*-tree contexts that determine the nodes on the tier,*
- D *is a set of* k,l*-tree contexts on tier-trees,*
- S *is a set of SL daughter-string languages,*
- $f : \delta(x) \rightarrow s$*, where* $\delta(x) \in D$ *and* $s \in S$

A tree t *satisfies* $\mathcal{G}$ *(*$t \models \mathcal{G}$*), iff for all nodes* $x \in t$*,* $T(x)$ *implies* daughter-string$(x) \in f(\delta(x)), \delta(x) \in D$*. If a node matches no context* $\delta(x) \in D$*, then* f *maps it to the empty string language. If a node on the tier matches more than one context* $\delta(x) \in D$*, the grammar is ill-formed.*

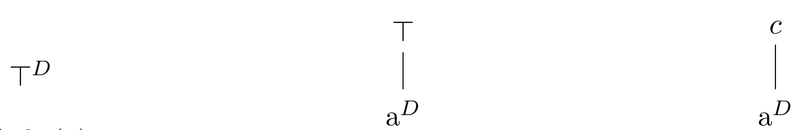
A tree set licensed by $\mathcal{G}$ *is the set of all trees that satisfy it.*

$$L(\mathcal{G}) \stackrel{def}{=} \{t | t \models \mathcal{G}\}$$

A set of trees is m,n*-ITSL*$_{k,l}$ *iff it is* $L(\mathcal{G})$ *for some* m,n*-ITSL*$_{k,l}$ *definition of* $\mathcal{G}$*. It is I-TSL iff it is* m,n*-ITSL*$_{k,l}$ *for some* m*,* n*,* k*,* $l \in \mathbb{N}$*.*

Example 6 shows an example of a full I-TSL tree grammar, and Example 7 shows how this grammar applies to the example trees in Figure 8.6 and Figure 8.8.

Example 6 (I-TSL grammar)**.** *Let* C *be the set of tree-contexts in Figure 8.5 and* D *be a set of the following tree-contexts on the tier:*

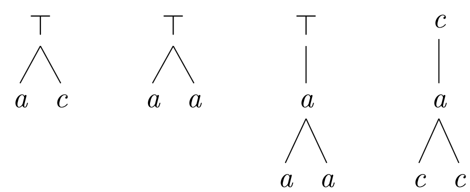


(a) $\delta_{\top}$(x) (b) δ_{a1}(x) (c) δ_{a2}(x)

Figure 8.10: D, a set of tree-contexts on the tier

Let there be the following SL daughter string-grammars: $G_\top = \neg ac \wedge \neg aa$, $G_{a1} = \neg aa$, *and* $G_{a2} = \neg cc$. *Then let* S *be the set of SL daughter string-languages* $L_\top = \{w | w \models G_\top\}$, $L_{a1} = \{w | w \models G_{a1}\}$, *and* $L_{a2}\{w | w \models G_{a2}\}$. *Then let* f *be the function that maps* $\delta_\top(x)$ *to* $L_\top$, $\delta_{a1}(x)$ *to* L_{a1}, *and* δ_{a2} *to* L_{a2}.

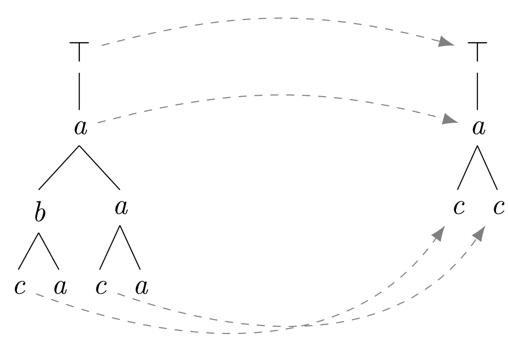
The function f *can be illustrated as banned subtrees, as below. For example, the node labeled "a" that is dominated by* $\top$ *on the tier cannot have "aa" as its daughter-string, and the node labeled "a" that is dominated by c cannot have 'cc' as its daughter string. In all future discussions, I will illustrate D, S and f with subtrees like this rather than writing out the full daughter-string grammars.*



An I-TSL tree grammar G then would be the 4-tuple $\langle C, D, S, f \rangle$.

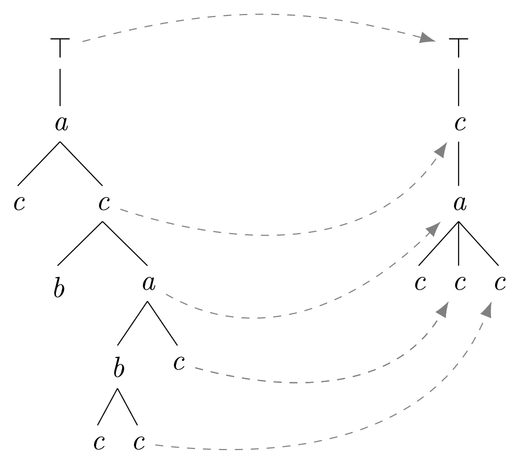
Example 7 (Applying an I-TSL tree grammar to trees)**.** *Take the I-TSL tree grammar G described in Example 6.*

Now consider the tree in Figure 8.6, whose tier-projection is reproduced below.



The resulting tier-tree does not violate any of the local constraints. The daughter-string of the node labeled with "$\top$*" is 'a', and there are no constraints that ban that. Similarly, the daughter-string of the node labeled "a" that is dominated by "*$\top$*" is 'cc', which is also not banned. This tree thus satisfies the G.*

Next, consider the following tree and its projection:



The tier projection of this tree violates one of the constraints: the node labeled "a" dominated by "c" has the string-daughter that contains 'cc', which matches one of the banned subtrees. Thus this tree does not satisfy G.

The intersection closure of multiple I-TSL tree languages are the MITSL tree languages:

Definition 13 (MITSL tree languages)**.** *A multiple m, n-Input local TSL$_{k,l}$ (j, m, n-MITSL$_{k,l}$) tree language is the intersection of j distinct m, n-ITSL$_{k,l}$ tree languages for $j, m, n, k, l \in \mathbb{N}$.*

In this section, I have provided a formal MSO-based definition of I-TSL tree languages, and also defined MITSL tree languages. In the next section, I show how quantifier-based NPI-licensing constraints can be described with I-TSL grammars.

8.2 I-TSL treatment of NPI constraints

8.2.1 Existential NPIs in English

Existential NPIs have to be c-commanded by their licensor at LF. To keep the discussion simple, I assume only negative items to be NPI-licensors. In what follows, I look at two separate types of c-command: base c-command and derived c-command.

For base c-command, we only take into account the base positions when calculating the c-command relationship; that is, it only works if neither licensor nor NPI has undergone movement or has been moved as part of a larger phrase. As we will see, base c-command can be described with I-TSL constraints.

If either negation or NPI has moved, we have to calculate the c-command relation based on their *final* occurrence at LF. For this, we have to use derived c-command, which calculates c-command relations while taking movement into account. I show that derived c-command is not I-TSL.

8.2.1.1 Base c-command is I-TSL

In this section, I consider the simplest case: neither negation nor the NPI undergoes movement or gets moved through containment. In these configurations, it is sufficient to determine whether the NPI is c-commanded by negation at base position. This problem is very similar to the ones tackled in Vu et al. (2019) for case-licensing, and my I-TSL treatment for NPI-licensing here closely follows the steps delineated there.

The tree-tier is constructed with the help of C, a set of of m, n-tree contexts; they specify the nodes to be projected to the tier based on local context. For English NPIs, I assume C to be the 2,1-tree contexts in Figure 8.11.[1] We will project all `Merge` nodes whose child is negation and all nodes that are NPIs.

$\texttt{Merge}^T$ NPI^T
|
neg

Figure 8.11: Tree contexts for the I-TSL treatment of the base c-command requirement in English NPI-licensing

Next, we define the constraints that must hold over the tier. Since LIs would never have children, we can define the daughter-string languages for only the nodes labeled with '⊤' and '`Merge`'. For base c-command, the constraint will be simply state that every NPI must be immediately dominated by a `Merge` node on the tier; or in

[1] I describe the size of the tree context set by the largest tree-context in the set.

other words, no NPI can be dominated by a node labeled ⊤. This banned subtree is illustrated in Figure 8.12.

Figure 8.12: Banned subtree for English NPI-licensing, without `Move`

In the following, I go through various configurations of negation and NPIs in English, from simpler to more complex cases, to demonstrate that this constraint is sufficient to determine whether NPI-licensing holds in the derivation. In all cases discussed here, `Move` does not change the c-command relations between negation and NPI. To make the trees easier to read, empty functional heads, such as C, T, or *v* are simply labeled as such instead of listing their full feature strings.

First, consider the simplest case, where the NPI is licensed by sentential negation, and neither of them have moved (1). In this case, we get the tier tree depicted on the right in Figure 8.13. This tree-tier clearly does not violate the constraint, since ⊤ does not immediately dominate the NPI.

(1) We did not see anybody.

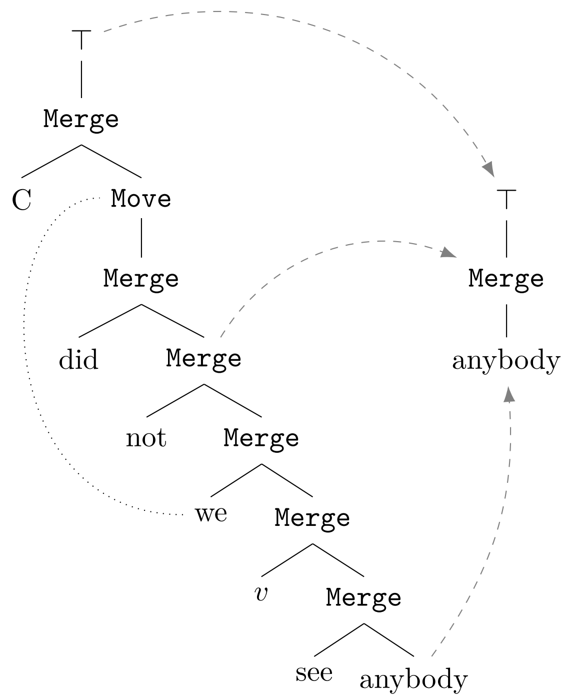


Figure 8.13: Tier projection for (1)

Next, consider a sentence where the NPI is not licensed, because its licensor is missing (2). The tier projection is shown in Figure 8.14. The resulting tree-tier violates the constraint, since ⊤ directly dominates the NPI.

(2) * We saw anybody.

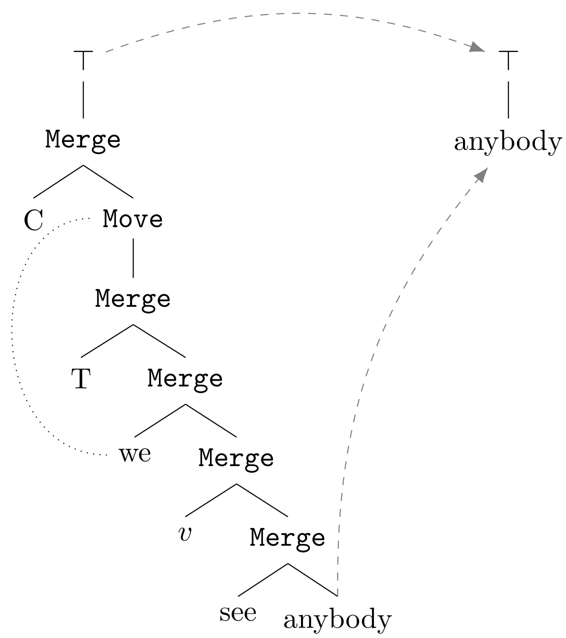


Figure 8.14: Tier projection for (2)

In (3), multiple NPIs are licensed by one negative marker. This is not a problem for our constraints, since again ⊤ does not immediately dominate any NPI (Figure 8.15). Even adding an unbounded number of NPIs to the tree through adjunction would not cause a problem, as long as there is licensor that c-commands all of them.

(3) We did not give anything to anybody.

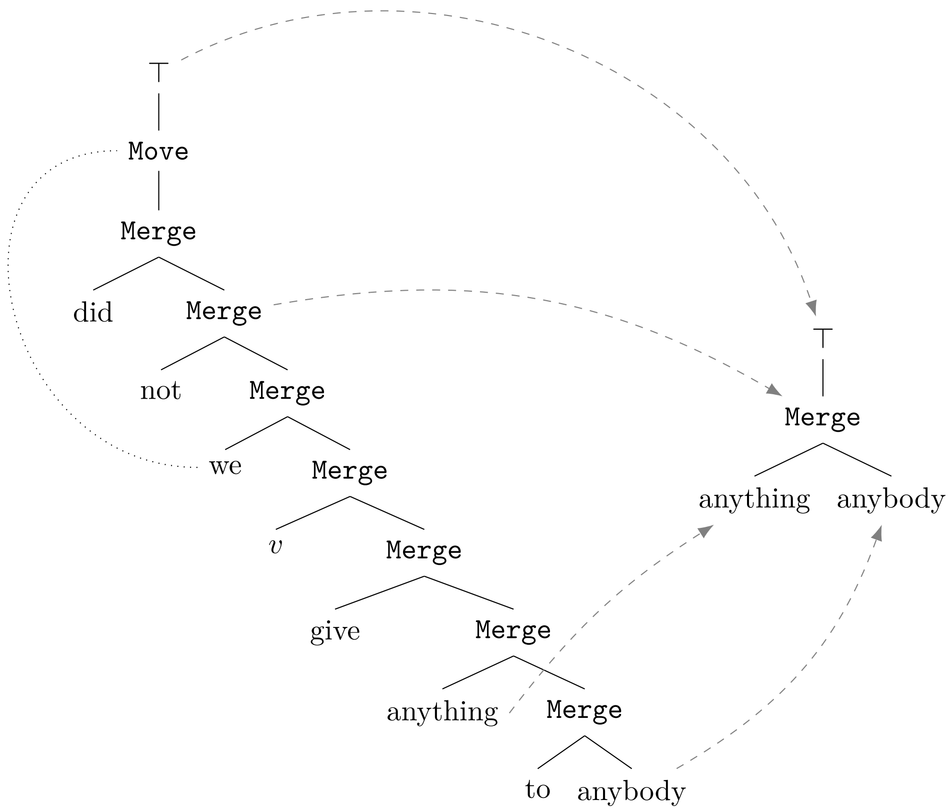


Figure 8.15: Tier projection for (3)

Next, I consider a case where negation is present, but does not c-command the NPI, as in (4). In the tier-tree depicted in Figure 8.16, the `Merge` node does not dominate the NPI, resulting in ⊤ dominating the NPI instead; this is a banned as per the constraint defined in Figure 8.12. The proposed constraint thus correctly identifies (4) as ill-formed.

(4) * That we do not trust him is bothering anyone.

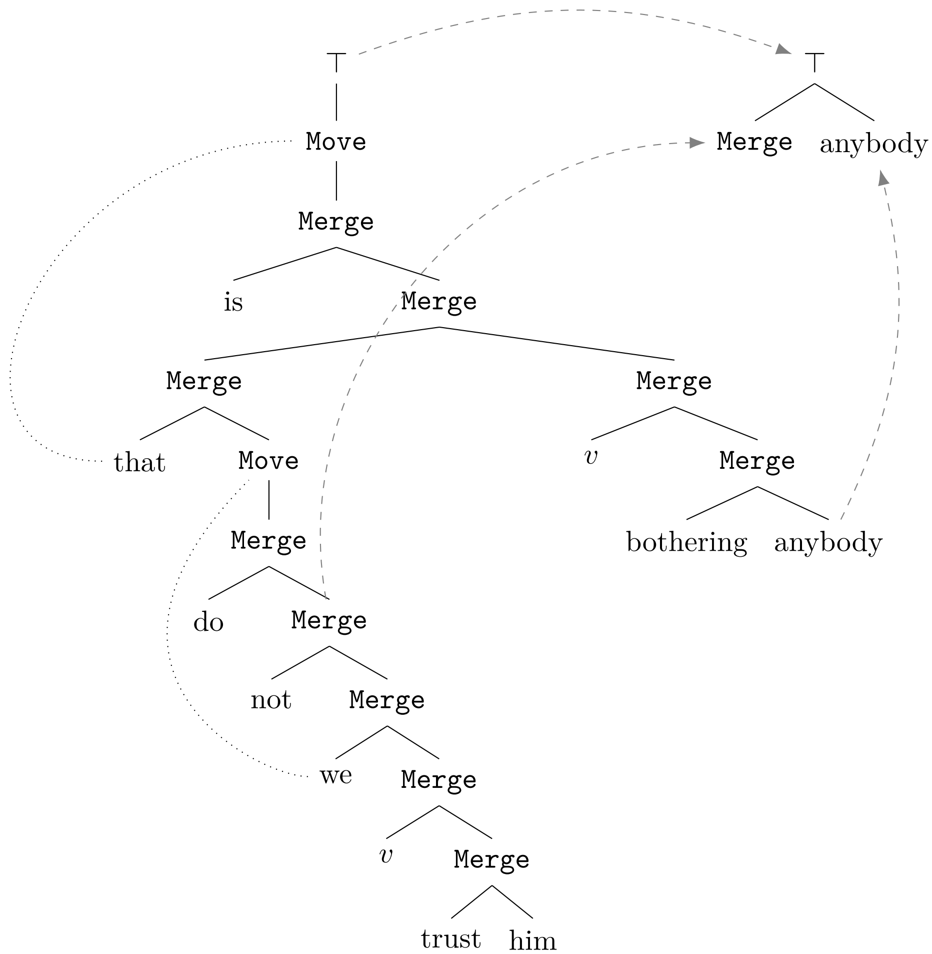


Figure 8.16: Tier projection for (4)

In summary, I have shown that by using a set of 2,1-tree-contexts and applying an SL constraint over the projected tier, we can account for English NPI-licensing, as long as movement does not alter the base c-command relation between negation and NPI. In the next section, I examine cases where `Move` does make a difference, and show that these cases cannot be described with I-TSL constraints anymore.

8.2.1.2 Derived c-command is not I-TSL

Including cases where `Move` matters to the c-command relation encounters many complications. In this section, I show that 1) the projection function for the tree-tier cannot be Input Strictly Local (ISL), and 2) even if there is projection function that outputs the desirable tiers, the constraints on these tiers cannot be stated without an extra relabeling mechanism.

As before, the relevant nodes for the NPI-licensing constraint are negation and NPI. When either of them undergoes movement, we now need to project the relevant *occurrence* of that node. In the previous section, where `Move` did not take place, the relevant occurrence was simply the 0th occurrence, which was possible to project with a local projection function.

However, if an NPI moves to a higher position, then its relevant occurrence becomes the `Move` node that associated with it, but there is no way to know a priori which `Move` nodes in a derivation tree are relevant from just local context. Even if we know which movement licensee features the NPI holds, we cannot know which `Move` node is its occurrence, because there can be multiple `Move` nodes triggered by the same move licensor, and not all of them might move NPIs.

In order to successfully project only the relevant `Move` nodes onto the tier, we need an Output Strictly Local (OSL) function which can see ahead if there are NPIs and negation with move licensees in the tier-tree – however, OSL tier projection functions are not well-defined for trees yet. At the bottom line, there is no ISL function that would be able to project the necessary nodes onto the tier.

Even if there is a function that successfully projects the relevant `Move` nodes onto the tier, it is still not possible to define local constraints that would successfully rule out sentences with unlicensed NPIs, and accept sentences with licensed NPIs. To see why, consider sentences (5) and (6).

In (5), the NPI moves to the subject position, and thus outscopes its licensor, while in (6), it is the negative *nobody* that moves to the subject position, and thus NPI stays licensed. However, if we project all licensors and NPIs along with their final occurrences, we get identical tier-trees for the two sentences, as demonstrated in Figure 8.17 and Figure 8.18.[2] In other words, given only the tier-trees the `Move` node could be

[2] If we omit any of the LIs in the projection, the tier-trees would still be identical. Projecting the final occurrences is necessary to know the relevant nodes for c-command.

associated with either negation or NPI, and thus we would not be able to determine whether negation c-commands the NPI or vice versa.

(5) * Anybody did not leave.

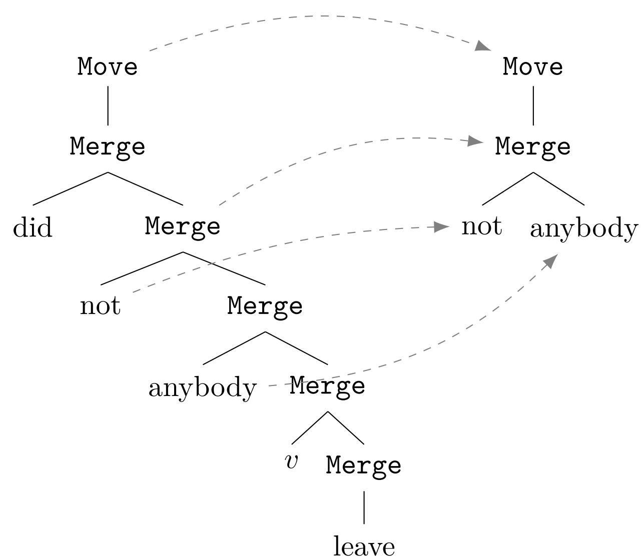


Figure 8.17: Tier projection for (5)

(6) Nobody left anybody.

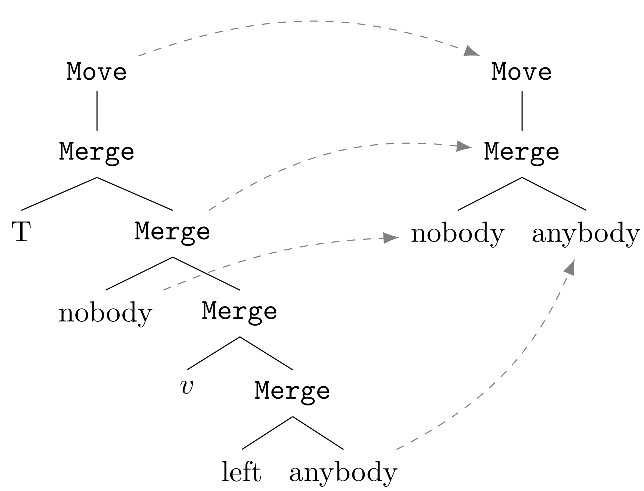


Figure 8.18: Tier projection for (6)

One might say that the we can determine which LI moves based on the feature strings on them: in (5), *anybody* has the −nom feature on it, and in (6), *nobody* does. In that case, our constraints would have to be subtrees of depth 3 to tell the two tier-trees apart in Figure 8.17 and Figure 8.18, which would still be a local constraint over the tier-tree. However, just by introducing additional negative elements or NPIs between the final occurrence and the base position of the moving LI that would also have to be on the tier, an arbitrary number of items could be on the tier between those two positions. In those cases, we would need a constraint of unbounded depth to determine which LI has moved; this means that there is no SL constraint over tree-tiers that can successfully distinguish between (5) and (6).

A possible way to salvage this result would be to have a projection function that is also capable of relabeling. As before, this assumes an existing OSL projection function for trees. During the relabeling process, for each `Move` or `Merge` node, the function would also output the LI these interior nodes are associated with. As an example, see Figure 8.19. In this case, coming up with an SL constraint over the tiers would be straightforward: a node associated with an NPI has to be dominated by a node associated with negation.

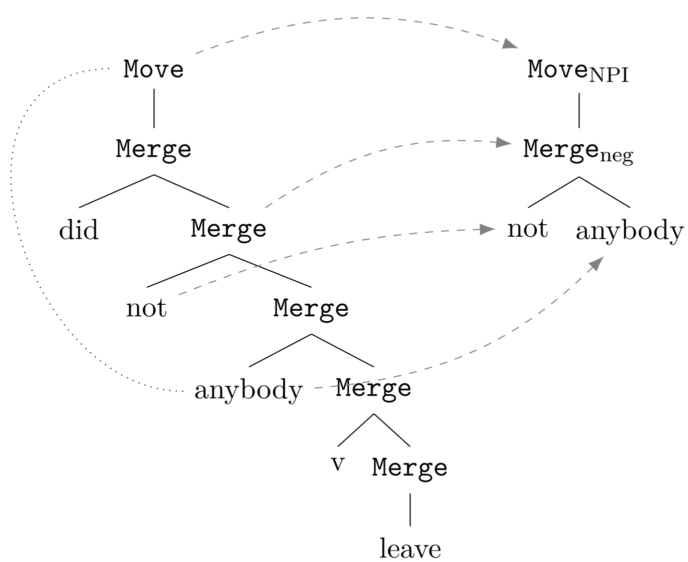


Figure 8.19: Tier projection for (5) with relabeling

In the end, describing derived c-command restrictions with I-TSL tools proved to be impossible. In this section, I have hypothesized that two types of modifications are necessary: have an OSL projection function that can also relabel the nodes as it projects to the tier.

A recent study that started the work toward lowering the complexity of derived c-command constraints from MSO-logic is Graf and De Santo (2019). They describe a class of languages recognizable by Sensing Tree Automata (STA), which they propose to be the upper bound for syntactic derivation tree languages, and which subsumes TSL tree-languages in itself; it should be interesting to see how much lower one can go from STAs and still adequately cover derived c-command restrictions.

8.2.2 Universal NPIs in Hungarian

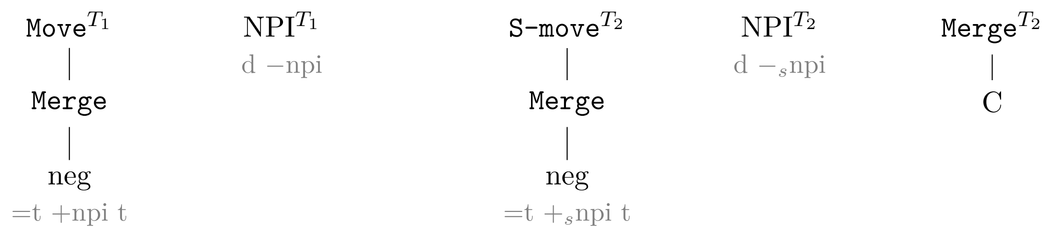
Universal NPIs undergo movement to Spec,NegP to be licensed. This movement is limited by locality constraints: if the NPI moves covertly, it must not cross a clause-boundary doing so, and if the NPI undergoes clustering first, then all NPIs must be in the same clause.

8.2.2.1 `Move` and locality constraints are MITSL

First, I discuss the constraints that govern `Move` and `S-move`. This is the same constraint described in Graf and Heinz (2015), and thereafter in Graf (2016) and Graf et al. (2018). As a reminder, the `Move` constraint in MGs states that for each ith $-f$ feature on each LI, there should be a `Move` node x such that that x is the ith occurrence of that LI. For covert movement, the same constraint applies, with the addition that `S-move` must be clause-bounded.

Because I have proposed that NPIs in Hungarian can undergo either overt (`Move`) or covert movement (`S-move`), there will be two separate tiers: a `Move` tier and an `S-move` tier. The constraints will be very similar on both tiers. Because we describe multiple I-TSL grammars that the tree will have to satisfy, Hungarian NPI-constraints are MITSL.

For the `Move` tier, we project all `Move` nodes that are triggered by a +npi licensee feature – which, as discussed in §7.4.2.2, only sentential negation can hold –, and all NPI nodes with −npi licensee feature. For the `S-move` tier, we project all `S-move` nodes that are triggered by a $+_s$npi feature, all NPI nodes that have the $-_s$npi licensee feature on them, and to satisfy the locality requirements, all `Merge` nodes that dominate C. Figure 8.20 illustrates the 3,1-tree-contexts the `Move` and `S-move` tiers.



(a) Contexts for the `Move` tier (b) Contexts for the `S-move` tier

Figure 8.20: Contexts for the ISL tier-projections for the `Move` and `S-move` tiers in Hungarian

The constraints on the `Move` tier are the following: all `Move` nodes have to have exactly one LI child. To accomplish this, `Move` nodes map to the daughter-string language that satisfies the SL grammar '$\neg \rtimes \ltimes \land \neg$ NPI NPI' on the tier. At the same time, all NPIs must have one `Move` parent – ⊤ nodes thus map to the daughter-string language that satisfies '¬NPI'. These constraints are illustrated as banned subtrees in Figure 8.21.

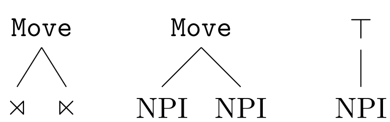


Figure 8.21: Banned subtrees for the `Move` tier

To see how the constraints work, consider sentence (7). The corresponding derivation tree is depicted in Figure 8.22, along with its tier projection. On the tier, the `Move` node has exactly one child; it does not violate any of the constraints depicted in Figure 8.21.

(7) *Sen-ki-t nem lát-t-am.*
NPI-who-ACC NEG see-PST-1SG
'I did not see anyone.'

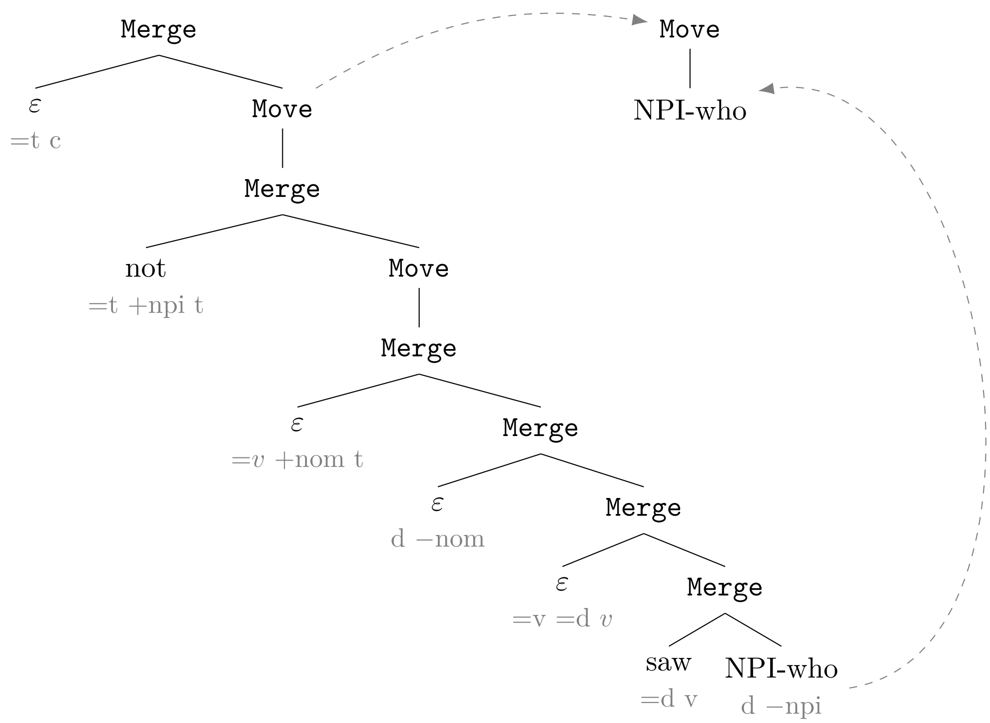


Figure 8.22: Tier projection for (7)

Now consider a case where the NPI is not licensed (8). Assuming that in this case the NPI has a −npi licensee feature on it, the resulting tree tier is depicted in Figure 8.23. This one matches the banned subtree in Figure 8.21 where the NPI is orphaned, and thus is ruled out by the constraint.

(8) * *Lát-t-am sen-ki-t.*
see-PST-1SG NPI-who-ACC

The constraints necessary over the `S-move` tier are the same as the ones over the `Move` tier, except for the added locality constraint. Therefore, there are all the same movement related constraints that ensure that all `S-move` node has exactly one child, and there is an additional constraint that bans any `S-move` node from having a `Merge` node as a child, as well as any `Merge` node from having an NPI as a child. These constraints are depicted in Figure 8.24.

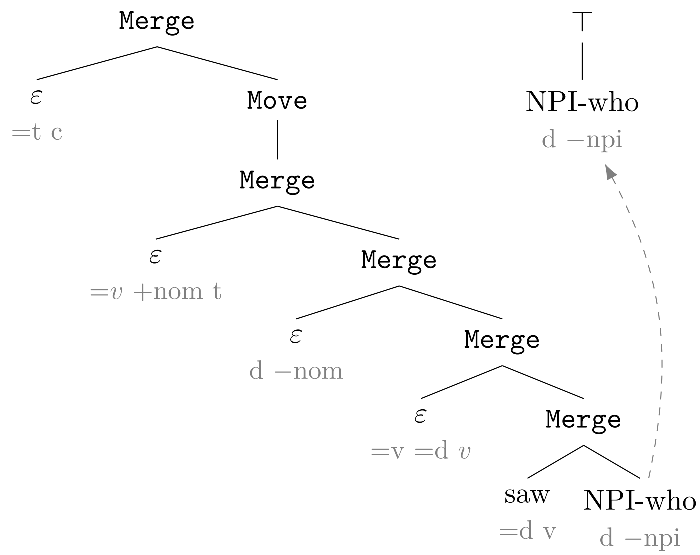


Figure 8.23: Tier projection for (8)

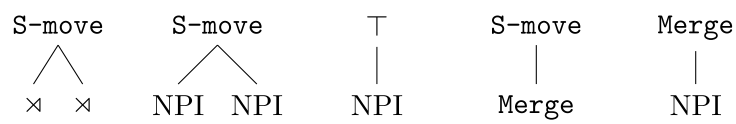


Figure 8.24: Banned subtrees for the `S-move` tier

In (9), the NPI is licensed by covertly moving to NegP to check off its $-_s$npi feature against the $+_s$npi feature on negation. The resulting tier-tree has the `S-move` node and the NPI projected (Figure 8.25), which conforms to the `S-move` constraints, as the `S-move` node has exactly one LI child.

(9) *Nem lát-t-am sen-ki-t.*
NEG see-PST-1SG NPI-who-ACC
'I did not see anyone.'

If in (8) the NPI had the covert movement licensee feature $-_s$npi, instead of the overt one, the resulting tier tree would be the same as the one in Figure 8.23. The NPI would be parentless on the `S-move` tier instead of the `Move` tier, but otherwise the structure would be ruled out for the same reasons: it violates the movement constraints depicted in Figure 8.24.

(8′) * *Lát-t-am sen-ki-t.*
see-PST-1SG NPI-who-ACC

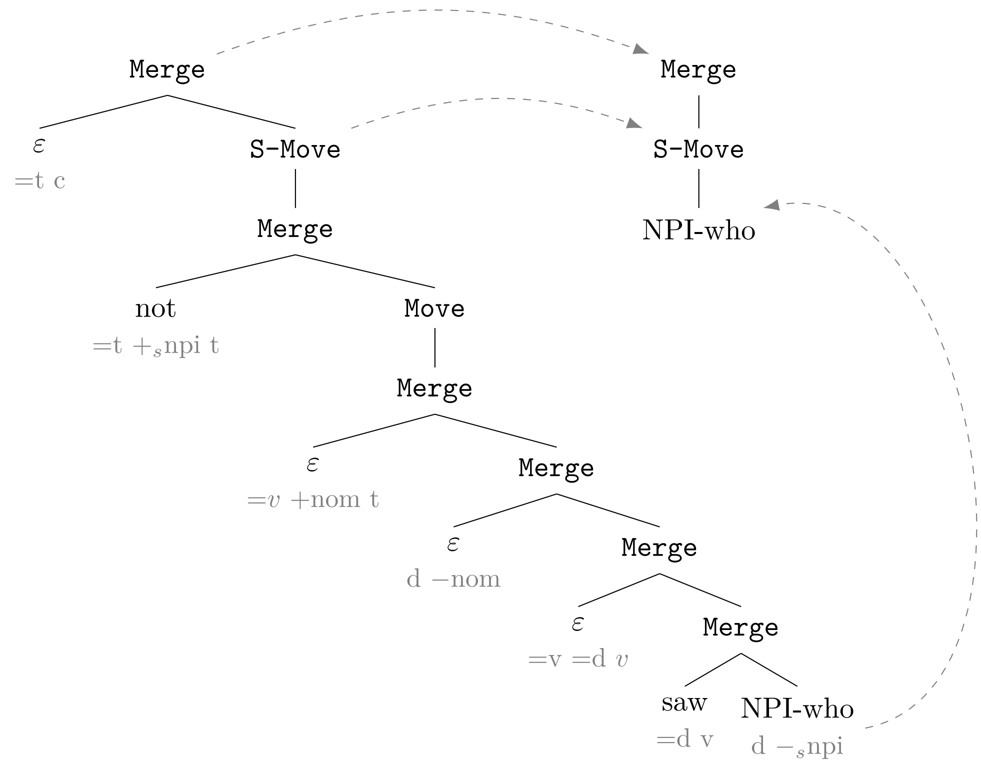


Figure 8.25: Tier projection for (9)

Next, I demonstrate how long-distance licensing is allowed for overt movement, but successfully ruled out for covert movement with the proposed I-TSL constraints. Take again the contrast between (6) and (7), and their respective tree-tier projections in Figure (8.26) and Figure (8.27).

(6′) *Sen-ki-vel$_i$ nem gondol-t-am, hogy Péter találkoz-na t_i.*
NPI-who-COM NEG think-PST-1SG that Peter meet-COND.3SG
'I did not think that Peter would meet with anyone.'

(7′) * *Nem gondol-t-am, hogy Péter találkoz-na sen-ki-vel.*
NEG think-PST-1SG that Peter meet-COND.3SG
'I did not think that Peter would meet with anyone.'

In Figure 8.26, the tier projection is identical to the projection in Figure 8.22, where the NPI was similarly licensed through overt movement. Because clause boundaries play no role in this case, they were not projected to begin with, and since the `Move` constraint is satisfied, the sentence is not ruled out by the grammar, as expected.

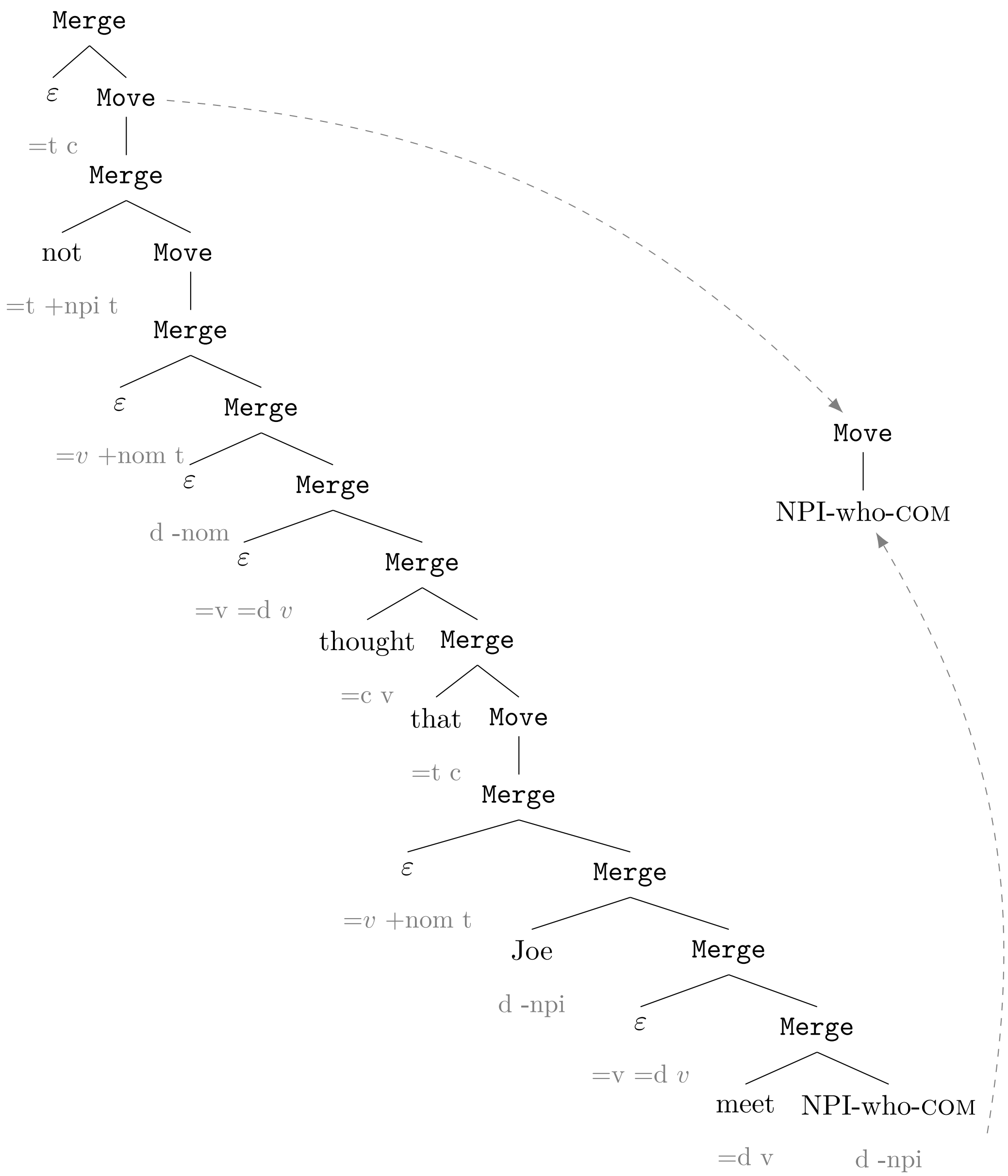


Figure 8.26: Tier projection for (6)

In Figure 8.27 the NPI-licensing fails, because the NPI cannot move covertly over the clause boundary. Because clause boundaries matter, `Merge` nodes that dominate C-heads get projected also. The resulting tier projection has `Merge` intervene between `S-move` and NPI, which is a banned configuration (Figure 8.24); both `S-move` dominating `Merge` and `Merge` dominating NPI are banned subtrees on the `S-move` tier.

The derivation is thus correctly ruled out.

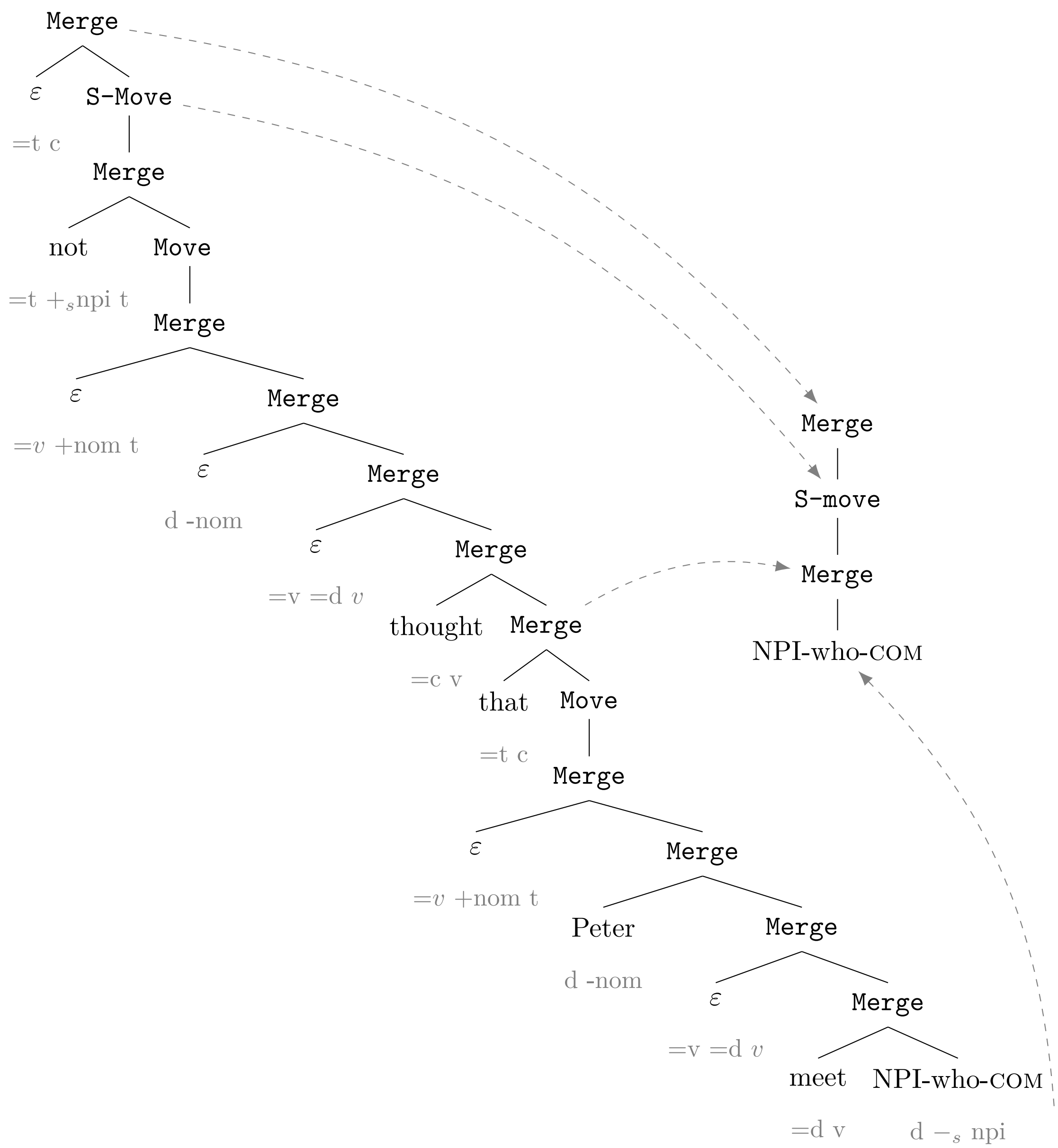


Figure 8.27: Tier projection for (7)

In this section I have shown how to restate the movement and locality restrictions in MITSL terms. In the next section, I move on to clustering, which will have a different set of constraints from the Move constraints introduced here.

8.2.2.2 `Cluster` constraints are MITSL

In this section, I show how `Cluster` can be handled with I-TSL constraints. Again, I do not include any locality constraints here, as the data regarding this is unclear.

Clustering poses challenges due to its difference to phrasal movement on two points: 1) the relation between a LI and its `Cluster`-occurrence, and 2) the feature make-up of LI's that license clustering and also undergo cluster-movement themselves. The first part affects the tier-projection function, and the second part affects the SL constraints over the tiers.

As I discussed when giving the MSO-formula for derivation tree constraints, a `Cluster` node m can be an occurrence of an LI l if it *slice-contains* the 0th occurrence of l. And, m slice-contains the 0th occurrence of l, iff the 0th occurrence of the LI that hosts m properly dominates the 0th occurrence of l. Figure 8.28 illustrates this relationship: the `Cluster` node is hosted by an LI whose 0th occurrence properly dominates the LI the `Cluster` node is associated with.

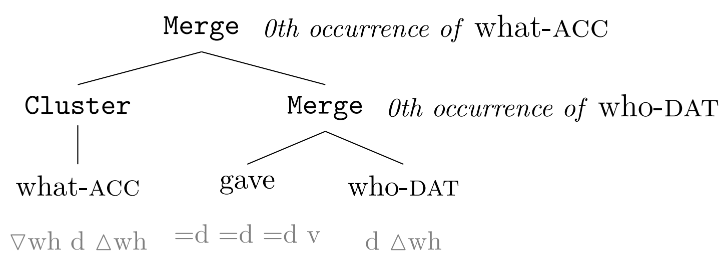
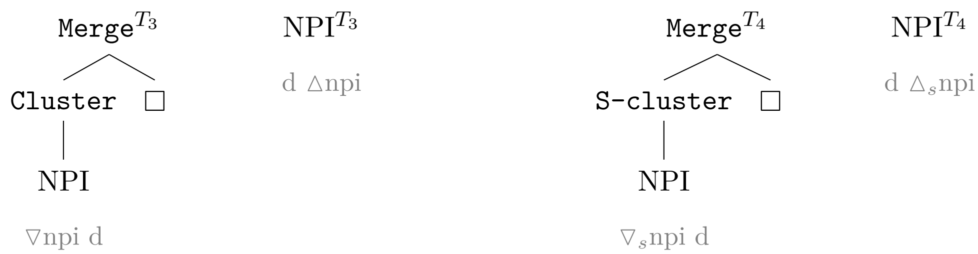


Figure 8.28: Example showing slice containment for clustering

Thus, if we projected only the `Cluster` node and the LI associated with it to a tier, neither would dominate the other, and they both would be dominated by the added $\top$ node that ensures the tier-tree has a root. The tier would not capture the requirement that the LI must be dominated by a `Merge` node that directly dominates the `Cluster` node. There would be no way of checking whether the `Cluster` node is a legal occurrence of the LI. Instead, to define `Cluster` constraints with I-TSL tools, we will have to project the `Merge` node that dominates the `Cluster` node: that way, on the tier this `Merge` node would dominate the LI that the `Cluster` node is associated with.[3]

As with movement, clustering can also be overt or covert, and so we will project two separate tiers for `Cluster` and `S-cluster`. On the `Cluster` tier we project any `Merge` node whose child is a `Cluster` node that was associated with a $\bigtriangledown$npi feature and any NPI nodes that have a $\triangle$npi feature on them. For the `S-cluster` tier, we similarly project `S-cluster` nodes triggered by the $\bigtriangledown_s$npi feature and NPI nodes that have $\triangle_s$npi feature. Figure 8.29 shows the 3,2-tree-contexts that define these tier projections.



(a) Contexts for `Cluster` tier

(b) Contexts for `S-cluster` tier

Figure 8.29: Contexts for the ISL tier-projections for the `Cluster` and `S-cluster` tiers in Hungarian

Clustering is also different from movement in that an LI can have both a cluster licensor and a cluster licensee feature on it that share names. For example if there are three NPIs in the sentence, as in (10), the middle NPI will have both $\bigtriangledown_s$npi and $\triangle_s$npi features, as seen in Figure 8.30. This results in a tree tier where `Merge` dominates two NPIs – recall that a tree of similar form was not acceptable on the `Move` or `S-move` tiers. Yet, this should only be acceptable if we can ensure that the second NPI is dominated by a second `Merge` node higher up in the tier-tree. To capture this constraint, we will

[3] Technically, we should project the `Merge` node that is the 0th occurrence of the LI hosting the `Cluster` node. In any case, this can be done with an ISL function, assuming that all LIs have a bound number of positive features. For the case of Hungarian NPI-licensing, projecting the `Merge` node dominating the `Cluster` node is sufficient, as all cluster-licensing NPIs only have $\bigtriangledown$npi as their sole positive feature.

have to take the *context* of `Merge` nodes into account when regulating their daughter-strings.

(10) *Sen-ki* *sen-ki-nek* *sem-mi-t* *nem ad-ott* .
NPI-who NPI-who-DAT NPI-what-ACC NEG give-PST.3SG
'Nobody gave anything to anybody.'

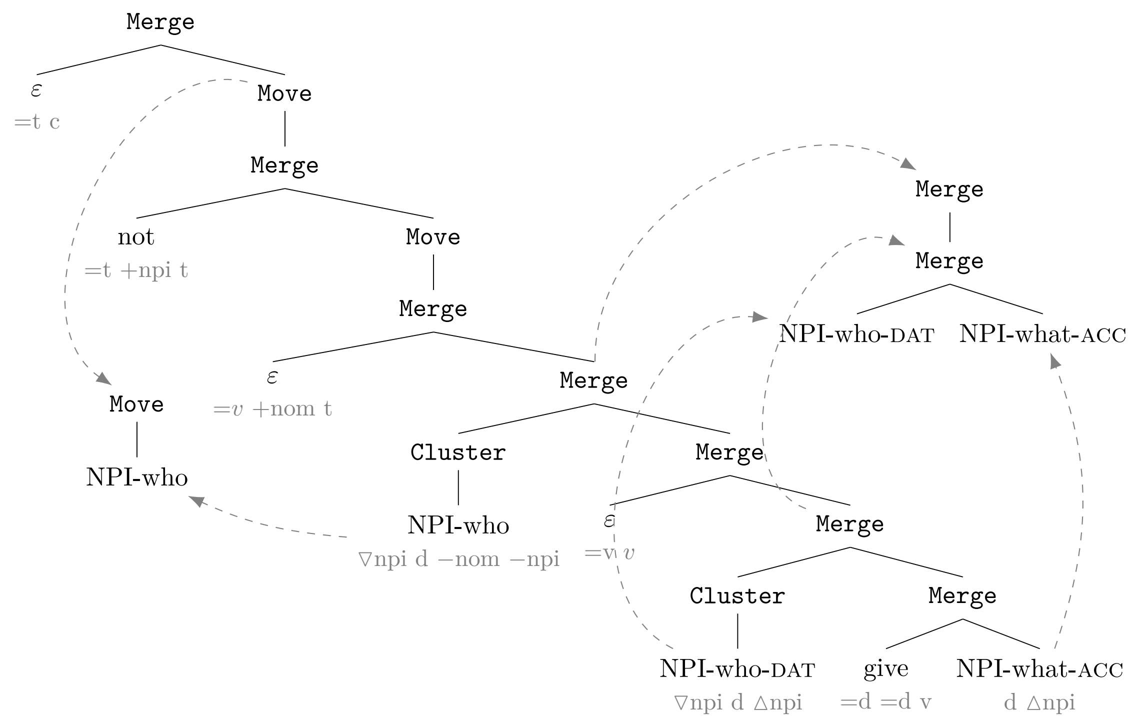


Figure 8.30: Tier projection for (10) on the right

To allow a tier-tree as in Figure 8.30, the local constraints will be then as follows. If a `Merge` node's parent is ⊤, then its daughter-string cannot be 'NPI NPI', as it was the case for `Move` nodes on `Move` tiers. However, if a `Merge` node's parent is `Merge`, then its children must be exactly two NPI nodes; we do so by mapping it to the daughter-string language that satisfies '$\neg \rtimes$ NPI $\ltimes \wedge \neg$NPI NPI NPI $\wedge\ \neg$`Merge Merge`'. Finally, under no circumstances can a `Merge` node be childless, or can an NPI node be parentless. Covert clustering is governed by the same restrictions, and thus the same constraints apply on the `S-cluster` tier. Figure 8.31 illustrates these constraints.

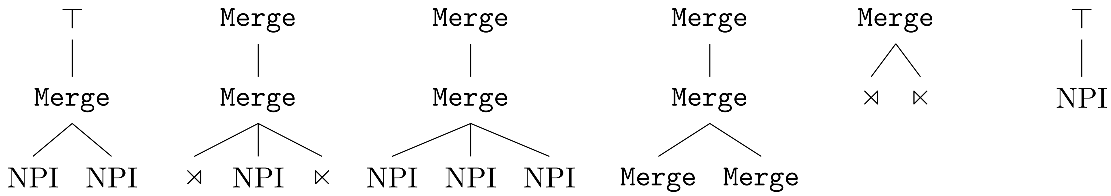


Figure 8.31: Banned subtrees for the `Cluster` and `S-cluster` tiers

Going back to the tier projection in Figure 8.30, it can be verified that the `Cluster` tier-tree does not violate any of the constraints laid out here: the `Merge` node has another `Merge` node for parent, and has exactly two NPI children.

In sentence (11), there is only one `Cluster` operation. The corresponding derivation tree and tier projection is depicted in Figure 8.32. The `Cluster` tier does not violate any of the constraints defined above, as the `Merge` node has no `Merge` parent, and has exactly one NPI child.

(11) *Sen-ki-nek sem-mi-t nem ad-t-am.*
NPI-who-DAT NPI-what-ACC NEG give-PST-1SG
'I did not give anything to anybody.'

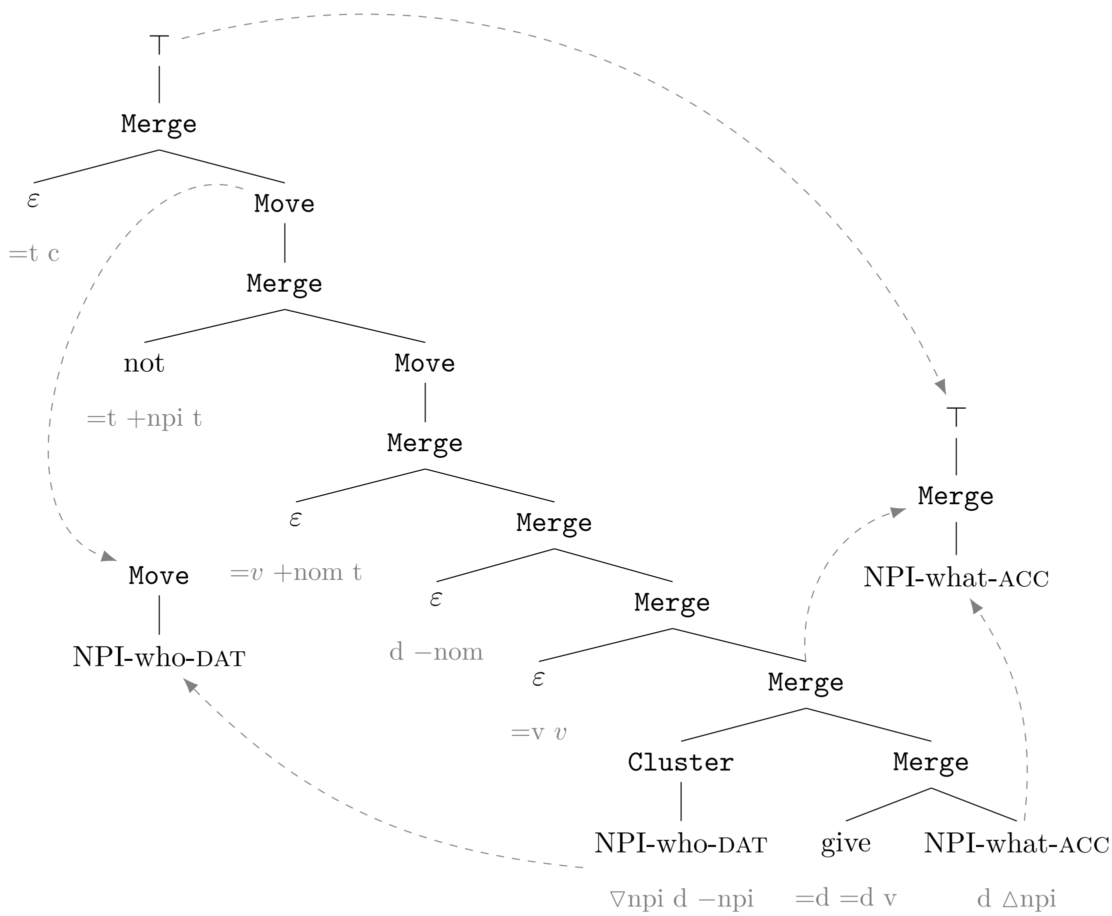


Figure 8.32: Tier projection for (11)

The same idea works for covert clustering too. Sentence (12) shows such a sentence, with the derivation tree and tier projection shown in Figure 8.33. Again, the structure is licit, because on the `S-cluster` tier, `Merge` has no parent, and has only a single NPI child.

(12)	*Nem*	*ad-ott*	*sen-ki*	*Andris-nak*	*sem-mi-t.*
	NEG	give-PST.3SG	NPI-who	Andris-DAT	NPI-what-ACC

‘Nobody gave anything to Andris.’

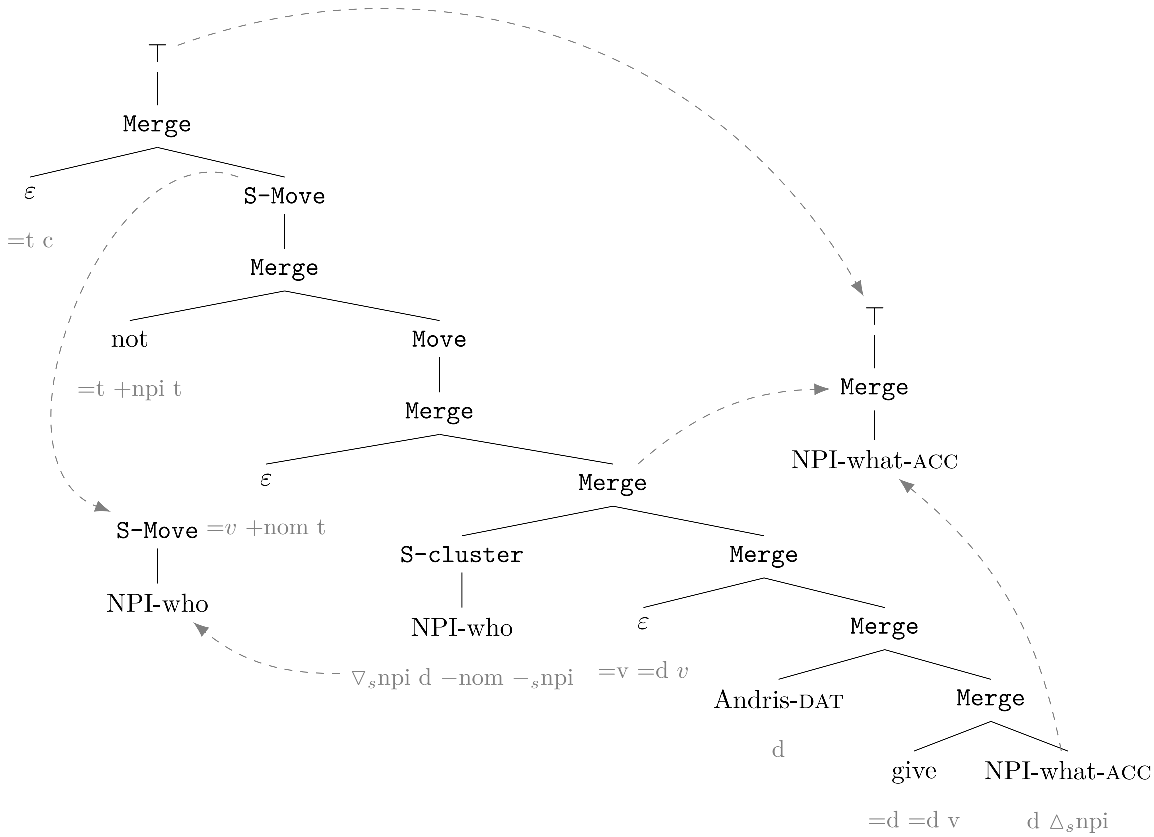


Figure 8.33: Tier projection for (12)

At this point, one might wonder about the kind of sentences that would violate the constraints introduced in this section. Unfortunately, this is not as simple as showing sentences that are ungrammatical in the language. Both a successful derivation, which violates none of the `Cluster` constraints here, and an unsuccessful derivation, which violates the constraints, could derive identical looking strings.

The `Cluster` constraints discussed in this section ensure that all LIs in a given derivation have the appropriate ordered feature strings and all their features are checked off. If at any point, the relevant LIs do not have the correct features, the derivation would fail. For example, in (11), if NPI-who-DAT had △npi as its licensee feature instead of −npi, then it would fail to be licensed. It would project to the `Cluster` tier instead of the `Move` tier, resulting in `Move` being childless on the `Move` tier, and a parentless `Merge` dominating two NPIs on the `Cluster` tier, which is a banned subtree. In other words, these `Cluster` constraints ensure a legitimate derivation within the MGs framework, rather than directly ensuring NPI-licensing in Hungarian.

8.3 Summary

Following the hypothesis put forth in Graf and Heinz (2015), and developed further in Graf et al. (2018) that syntactic constraints are I-TSL, my goal was to see if quantifer-based NPI-licensing constraints can be stated in terms of this class. To do so, in this chapter I have formally defined I-TSL tree grammars and have shown that most NPI-licensing constraints indeed can be restated with I-TSL constraints.

For indefinites, I found that base-command relationships can be handled with the tools of I-TSL languages: these are cases where neither the NPI, nor its licensor moves, so the c-command relation is simply checked over their base positions. For derived c-command, where either or both moves, I-TSL is not adequate anymore. I discussed possible modifications to I-TSL that might be able to cover derived c-command – one possibility would be using an OSL function as the projection function. Another possibility would be looking at an even more powerful class of tree-languages, the ones recognizable by Sensing Tree Automata (STA) (Graf and De Santo, 2019).

For universally quantified NPIs, NPI-licensing was done through movement and clustering. Thus, by assuming a given set of possible feature strings that NPIs and negation can have, NPI-licensing constraints could be restated simply as movement and clustering constraints. I have shown how movement and locality constraints on covert movement can be handled with MITSL constraints, based on previous work in Graf (2018). Additionally, I also have shown that ensuring well-formed clustering can also be handled in MITSL. To my knowledge, this is a new contribution to current complexity theoretic study of MGs, as there is no existing MITSL treatment on any movement type other than common phrasal movements.

In conclusion, many aspects of the quantifier-based NPI-licensing framework could be handled within the fairly restrictive class of MITSL tree-languages. Some aspects, on the other hand, need further study, such as derived c-command restrictions.

Chapter 9

CONCLUSIONS

In this thesis I have empirically and computationally examined the quantifier-based approach to NPI-licensing typology, following the proposals made in Giannakidou (2000). The main results of the study are as follows.

Empirically, I have argued that English *any*-NPIs are existentially quantified, Hungarian *se*-NPIs are universally quantified, and this difference explains a number of syntactic and semantic differences between their behaviors. I presented novel semantic scope judgment data to corroborate these findings. I furthermore have shown that this division is applicable to a number of other languages too; in particular, I demonstrated that Mandarin Chinese *renhe*-NPIs are existentials, while Slavic *ni*-pronouns and Turkish *hiç*-constructions are universals. I also gave a preliminary analysis of Romance NPIs, and concluded that currently due to new experimental data, the analysis for Romance is by necessity in-flux.

Future research should continue testing the quantifier-based approach on other languages, and examine the nature of universally quantified NPIs in more detail. What I have found is that these types of NPIs are not identical to positive universal quantifiers; they are required to scope over negation unlike positive universal quantifiers, and the two are not interchangeable in all the same contexts, such as in fragment answers and sentences that test presuppositional meaning. Thus it would be an interesting avenue to further look into the semantic-pragmatic nature of universally quantified NPIs.

Computationally, I gave a formal definition for a new version of MGss derivation tree languages that include clustering along with LF- and PF-movements. In doing so, I showed that these tree languages are still regular. Moreover, I stated quantifier-based NPI-licensing constraints in MSO-logic, which means that tree-languages that satisfy NPI-licensing are also regular. I then gave a formal definition for I-TSL and MITSL tree-languages, which are subregular, and showed that with the exception of constraints that rely on derived c-command, all other NPI-licensing constraints can be restated with I-TSL or MITSL constraints. This means that for the most part, tree languages that satisfy these NPI-licensing constraints are MITSL.

These computational results further the current research program that seeks to define the complexity class of tree and string languages that yield all well-formed linguistic patterns while excluding ill-formed ones in the vein of Heinz and Idsardi (2013); Graf and Heinz (2015); Graf et al. (2018). The significance of these results is that more syntactic constraints are subregular when we change the representation of syntax from strings to trees. This gives us tools to more accurately predict the types of linguistic patterns that should be unexpected cross-linguistically, and further specifies the nature of the learning and processing algorithms needed for syntax.

Future research on the computational side would be to continue looking at other types of syntactic constraints and dependencies and similarly analyze them for computational complexity. There is already a lot of work that approaches c-command restrictions using other types of data structures; for example, Graf and Shafiei (2019) describe base c-command dependencies on *strings* that they derive from derivation trees and Graf and De Santo (2019) propose the use of dependency trees instead of derivation trees. Another avenue for research is to describe new subregular classes of tree- and string-languages that capture more necessary constraints such as the ones that rely on derived c-command. At the latest, Graf and De Santo (2019) propose that tree-languages recognizable by Sensing Tree Automata (STA) belong to such a class.

Finally, it is important to highlight the fact that the theoretical assumptions I adopted helped *reduce* the complexity of NPI-licensing requirements. In particular, the licensing of universally quantified NPIs could have been stated as a c-command restriction, that these items must c-command negation at LF. This would not have been an I-TSL or even MITSL constraint. However, the added assumption that universally quantified NPIs always *move* to NegP at LF in order to take scope over negation resulted in the possibility to simply state this constraint as a movement and locality constraint, which are MITSL. In sum, an important take-away of the thesis is that theoretical analysis can significantly inform computational results, and we need both to further our understanding of syntactic phenomena.

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Appendix

IRB STATUS

The IRB at the University of Delaware has determined the linguistic surveys used in the dissertation to have Exempt status on November 12, 2018. The project submission number and title are [1342569-1] Studies in syntactic structure of different languages using Google Forms. All surveys began with a standard disclaimer and all information was optionally given and kept anonymous.