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Tree adjoining grammar at the interfaces

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Presented to the Department of Linguistics and to the Department of Computer Science in partial fulfillment of the requirements for an A.B. degree with Honors

Harvard College
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Abstract

This thesis constitutes an exploration of the applications of tree adjoining grammar (TAG) to natural language syntax. Perhaps more than any of its major competitors such as HPSG and LFG, however, TAG has never strayed too far from the guiding principles of generative syntax. Indeed, following the pioneering work of Frank (2004), TAG has been successfully incorporated into Chomsky's (1995) Minimalist Program (MP). In large part, however, Frank (2004) leaves unexplored the issue of how TAG applies at the PF and LF interfaces. Given the fundamental importance of interfaces within the MP, no minimalist syntactic theory is complete without at least some notion of the means by which syntactic structure relates to pronunciation and interpretation. In this thesis we attempt to provide insight on this very issue: we address how TAG interfaces with the articulatory and interpretive components of the language faculty, and what insights it provides to minimalist conceptions of these interfaces. Ultimately, our aim is both to reaffirm the viability of TAG as a minimalist syntactic theory as well as to demonstrate that TAG makes clear otherwise arcane facts in natural language syntax.

The central proposal of this thesis is twofold. First, TAG may be naturally extended to interface with the articulatory and interpretive components of the language faculty by making recourse to synchronous TAG (STAG). Second, once such a framework has been adopted, minimalist ideas regarding the interaction between syntax and linear order can be applied to deal with certain problematic examples in the TAG framework. TAG thus offers confirmation that in at least some cases, certain aspects of linear order are dependent on post-syntactic operations, so that syntax does not always wholly determine linear order. As a corollary of our proposal, we also demonstrate, through a case study in Niuean raising, that the TAG system makes clear predictions on phenomena that are difficult to describe in mainstream minimalist theories.

Our argumentation for these proposals proceeds in three major stages. First, we formalize the synchronous TAG system that has to date been applied in a mostly piecemeal way by various researchers (see Shieber & Nesson 2006, Frank & Storoshenko 2012 for some examples). As a part of this formalization, we argue that the derivation of the LF object, but not the PF object, should make recourse to a more expressive version of the TAG system: multicomponent TAG, a variant that relaxes some constraints on the primitive units in the TAG system to yield greater expressive power. Second, we argue that the STAG system lends credence to the view that at least some word order is determined post-syntactically. In the past, researchers have presented ad hoc extensions of the expressive power of TAG to handle various difficult examples such as subject-to-subject raising in English questions and Irish and Welsh main clauses. We demonstrate that these extensions are both theoretically suspect and ultimately unnecessary given minimalist notions of the derivation: for many of the data motivating these extensions, there is independent evidence that their derivation in fact relies on post-syntactic rearrangements of certain verbal heads. Such examples are therefore well within the generative capacity of a framework with a TAG-based syntactic component that allows certain specific and well motivated post-syntactic rearrangements. Third, we demonstrate that not only is our particular system well motivated within the theoretical bounds of the MP, but also that it makes surprising and accurate empirical predications in cases that have otherwise defied analysis. Specifically, the Austronesian language Niuean features a peculiar instance of raising that has defied a satisfactory analysis since its discovery by Seiter (1980, 1983). We show that TAG makes the clear prediction that there is no raising in Niuean, then argue that this prediction is borne out under a careful examination of the facts. Given that the framework was developed almost exclusively based on the Indo-European language family, its ability to capture confounding behavior in a typologically dissimilar Austronesian language is a strong confirmation of its status as a reasonable alternative to mainstream minimalist syntactic theories.

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Chapter 1

Introduction

1.1 Introduction

This thesis constitutes an exploration of the applications of tree adjoining grammar (TAG) to natural language syntax. Perhaps more than any of its major competitors such as HPSG and LFG, however, TAG has never strayed too far from the guiding principles of generative syntax. Indeed, following the pioneering work of Frank (2004), TAG has been successfully incorporated into Chomsky's (1995) Minimalist Program (MP). In large part, however, Frank (2004) leaves unexplored the issue of how TAG applies at the PF and LF interfaces. Given the fundamental importance of interfaces within the MP, no minimalist syntactic theory is complete without at least some notion of the means by which syntactic structure relates to pronunciation and interpretation. In this thesis we attempt to provide insight on this very issue: we address how TAG interfaces with the articulatory and interpretive components of the language faculty, and what insights it provides to minimalist conceptions of these interfaces. Ultimately, our aim is both to reaffirm the viability of TAG as a minimalist syntactic theory as well as to demonstrate that TAG makes clear otherwise arcane facts in natural language syntax.

The central proposal of this thesis is twofold. First, TAG may be naturally extended to interface with the articulatory and interpretive components of the language faculty by making recourse to synchronous TAG (STAG). Second, once such a framework has been adopted, minimalist ideas regarding the interaction between syntax and linear order can be applied to deal with certain problematic examples in the TAG framework. TAG thus offers confirmation that in at least some cases, certain aspects of linear order are dependent on post-syntactic operations, so that syntax does not always wholly determine linear order. As a corollary of our proposal, we also demonstrate, through a case study in Niuean raising, that the TAG system makes clear predictions on phenomena that are difficult to describe in mainstream minimalist theories.

Our argumentation for these proposals proceeds in three major stages. First, we formalize the synchronous TAG system that has to date been applied in a mostly piecemeal way by various researchers (see Shieber & Nesson 2006, Frank & Storoshenko 2012 for some examples). As a part of this formalization, we argue that the derivation of the LF object, but not the PF object, should make recourse to a more expressive version of the TAG system: multicomponent TAG, a variant that relaxes some constraints on the primitive units in the TAG system to yield greater expressive power. Second, we argue that the STAG system lends credence to the view that at least some word order is determined post-syntactically. In the past, researchers have presented ad hoc extensions of the expressive power of TAG to handle various difficult examples such as subject-to-subject raising in English questions and Irish and Welsh main clauses. We demonstrate that these extensions are both theoretically suspect and ultimately unnecessary given minimalist notions of the derivation: for many of the data motivating these extensions, there is independent evidence that their derivation in fact relies on post-syntactic rearrangements of certain verbal heads. Such examples are therefore well within the generative capacity of a framework with a TAG-based syntactic component that allows certain specific and well motivated post-syntactic rearrangements. Third, we demonstrate that not only is our particular system well motivated within the theoretical bounds of the MP, but also that it makes surprising and accurate empirical predications in cases that have otherwise defied analysis. Specifically, the Austronesian language Niuean features a peculiar instance of raising that has defied a satisfactory analysis since its discovery by Seiter (1980, 1983). We

show that TAG makes the clear prediction that there is no raising in Niuean, then argue that this prediction is borne out under a careful examination of the facts. Given that the framework was developed almost exclusively based on the Indo-European language family, its ability to capture confounding behavior in a typologically dissimilar Austronesian language is a strong confirmation of its status as a reasonable alternative to mainstream minimalist syntactic theories.

The remainder of this thesis is broadly structured to give one chapter each to the three major steps outlined above: the formalization of a STAG-based approach to the interfaces, the argumentation in favor of post-syntactic movement, and an exploration of Niuean raising. In the remainder of this introductory chapter, we will introduce the MP and explain how Frank's (2004) TAG-based syntactic formalism fits within it.

1.2 The Minimalist Program

As mentioned above, we will be working with a flavor of TAG that is firmly rooted in the methodological program that traces its origins to the pioneering work of Chomsky (1993, 1995). Accordingly, before we begin any discussion of TAG, its behavior at the interfaces, or its application to the study of Niuean syntax, we need to understand the objectives and tools that the Minimalist Program (MP) offers to guide syntactic theory. In what follows, we will overview in broad terms the central ideas of the MP and how TAG fits into this theoretical landscape.¹ For reasons of space we necessarily omit details that are not relevant to our later work.

We turn our attention first to a very basic question: what is a syntactic theory and what should it attempt to do? Underlying almost seventy years of research in generative grammar is the simple and elegant idea that a syntactic theory is a means of explaining what Chomsky (1986) termed *Plato's problem*. Specifically, the grammatical information available to children learning a language is insufficient to explain the level of linguistic sophistication exhibited by adult speakers. A syntactic theory, then, should explain this incredible disparity between the *primary linguistic data* available to children and the attained linguistic capacity of adults. In the MP and all of its progenitors in generative syntax, this puzzle is explained via the postulation that children are born with an innate language capacity which is fine-tuned or programmed by the primary linguistic data they receive. This innate capacity, the so-called *Universal Grammar* (UG), is nicely analogized as a function that takes as its input primary linguistic data and returns as its output an adult grammar for a particular language (Hornstein et al., 2005). Returning to our original questions, then, syntactic theory can be framed as an attempt to describe the principles and parameters of this universal grammar. Viewed in the context of a particular language, we can view the study of syntax as the effort to provide a means of describing or generating the grammatical strings of that language via a set of core principles that are universal to the human language faculty.

Now that we have a rudimentary view of what a syntactic theory should accomplish, we can begin to answer our questions regarding the objectives and tools of the MP. Chomsky (1995) outlines a set of core assumptions and goals that offer a starting place for research and discussion, a sort of common ground on which theories may be based. Our goal in this thesis is to build a theory that relies on these central assumptions and aims for these common goals. In (1), we outline some of the main facts that the MP establishes as primitive and that any syntactic theory must be consistent with.

- (1) a. Sentences are the basic linguistic units.
- b. Sentences are pairings of form (sound) and meaning.
- c. Sentences are composed of smaller expressions (words and morphemes).
- d. These smaller units are composed into units with hierarchical structure, i.e., phrases, larger than words and smaller than sentences.
- e. Sentences show displacement properties in the sense that expressions that appear in one position can be interpreted in another.
- f. Language is recursive, that is, there is no upper bound on the length of sentences in any given natural language.
 (Hornstein et al., 2005)

With these core facts in mind, let's focus our discussion first on the objectives of the MP: what should a successful syntactic theory based in the MP seek to accomplish? Following our discussion above, we want

¹Readers familiar with the MP are encouraged to skip the following section, and those familiar with Frank's (2004) work to skip to Chapter 1.

a theory that can, for a particular language, predict which sentences (which following (1-a) are the basic linguistic units which we may judge as grammatical or ungrammatical) are grammatical and which are not, and moreover that can do this with recourse only to universal principles, allowing of course for some variation in how we apply these principles. We will rely on the fact, stated in (1-d), that syntactic constituencies, relationships, and dependencies are best expressed via an appeal to hierarchical structure. In our case, we assume a binary branching tree structure and the notions of hierarchical dominance that it provides.² A theory within the MP, then, should provide a model wherein we can accept and rule out syntactic structures in such a way as to exactly specify which sentences of a given language are grammatical and which are not.

There is a spectrum of approaches to this problem, with *representational* and *derivational* methods delineating the two ends of the scale. Representational approaches attempt to capture grammatical relations and behaviors through a series of well-formedness constraints. The grammaticality of a particular sentence, then, is determined, at least in part, by whether or not the syntactic structure for that sentence adheres to the well-formedness constraints or not. Under representational approaches, the means by which the tree structures actually arise are not so important; the theory really only cares about the structures themselves. Alternatively, derivational approaches focus on establishing a set of rules whereby grammatical sentences are derived. That is, a sentence is grammatical if and only if there are a series of applications of the relevant rules that results in that particular sentence. These are not the only means of investigating natural language syntax, but in large part most successful theories have adopted at least some aspects of the representational or the derivational perspective.

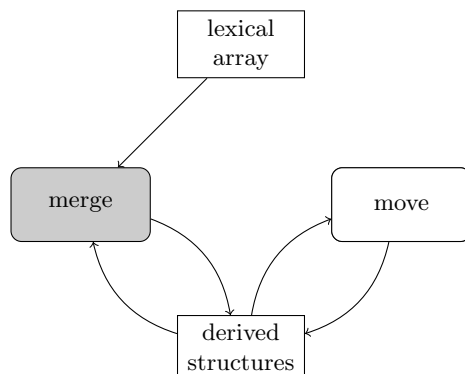
The MP, it turns out, stakes out a position that is very much on the derivational side of the spectrum, in noted contrast to some of its progenitors. It provides a set of rules for building and modifying syntactic structures, and ungrammaticality arises when a sentence cannot be derived via these rules. Now, just as when we seek to define a function we must specify its domain and co-domain, if we are to adopt a derivational approach to syntax, we must establish the inputs to and outputs of the derivation process. In particular, we must know what objects the rules apply to, and what we hope to see as the end result. The end result of the derivation seems to be quite obvious: we want our application of rules to ultimately result in a sentence of some form (again harking back to (1-a)). When we say “sentence,” though, exactly what does this mean? Recall that in (1-b) we made the assertion that sentences represent a form-meaning pair: the form, that is the individual sounds that we utter when speaking the sentence, is fundamentally linked to the meaning of the sentence, the idea that is being conveyed. Building on this observation, the MP asserts the existence of two separate systems within the language faculty, one responsible for pronouncing sentences, the articulatory system, and one responsible for interpreting sentences, the semantic system. The output of the syntactic derivation, we therefore argue, should be a pair (π, λ) , where π represents a phonological form (PF) object, and λ a logical form (LF) object. The PF object is an input to the articulatory system, while the LF object is an input to the semantic system. The role of the syntactic derivation is to build these two objects in such a way that these two systems can successfully interpret them, thus resulting in a grammatical sentence.

We turn now to the issue of what the input to the syntactic derivation should be. To answer this question, we need to define a further aspect of the language faculty: the lexicon. The lexicon is essentially a dictionary that encodes the fundamental form-meaning map of individual words. Moreover, it encodes information regarding various peculiar properties of individual words, e.g., what types of complements verbs take. The answer to our question, then, is that the syntactic derivation takes entries from the lexicon –lexical items– as its input. This captures the fact, given in (1-c,d), that sentences are made up of words combined together into hierarchical units, or phrases.

To summarize the situation so far, the syntactic derivation takes as its input an array of lexical items. It then combines and manipulates these items into a syntactic structure which is then somehow mapped to a pair of objects, (π, λ) , which constitute the inputs to the articulatory and semantic components of the language faculty. For the time being we’ll abstract away from the mapping from syntactic structure to pairs of objects and focus on the derivation of syntactic structure alone. We can therefore conclude that the objective of the MP is to provide a language-universal derivation process that, absent the tweaking of a few parameters, can produce from the input of an array of lexical items the range of PF and LF objects attested throughout the world’s languages. We have therefore demonstrated how the MP incorporates four of the six essential facts given in (1) into central tenets that should underly any syntactic theory. We turn our attention now to specifics of the derivation process and how the last two unmentioned facts figure into the MP.

²See Kayne (1984, 1994) and Larson (1988) for arguments in favor of binary branching.

So what tools and restrictions does the MP provide for deriving PF and LF objects? As we have mentioned, the MP holds that each derivation begins with a *numeration*, a set of lexical entries enriched with *features* that represent various properties of those entries. Given that the output of the derivation process is a pair of syntactic structures, we need a way to combine these lexical entries into structures. In response to this need, the MP postulates that the derivation process in any particular theory should have access to an operation for structure building: MERGE. This operation, which is the minimal operation required for building binary branching structures, takes as its input two syntactic objects (trees or lexical items) and returns a set of syntactic objects, which is itself a syntactic object: $\text{MERGE}(A, B) = (A, B)$.³ MERGE, then, is the encapsulation of (1-f), one of the fundamental property of human language: MERGE allows us to combine smaller syntactic components into larger ones *ad infinitum*, thus permitting the derivation of sentences of unbounded length. However, MERGE alone cannot be the only structure building operation, for recall that as stated in (1-e), syntactic theory needs to provide a mechanism whereby an element may be displaced within the structure. As stated, MERGE on its own cannot affect displacement of this sort. The MP therefore provides a slight variation of the merge operation, known as INTERNAL-MERGE or MOVE. This operation allows the copying of a syntactic object already merged in the structure and the subsequent merger of this object in a hierarchically higher position. In so doing, we provide a means of displacing an element within the structure, and thus a means of according with the observation in (1-e). This situation is represented schematically below (Frank, 2004).⁴



1.3 Tree adjoining grammar

Now that we have seen the fundamentals of the MP, we examine the essential details of the framework we will employ: Frank’s (2004) tree adjoining grammar based syntactic theory. The theory resides entirely within the confines of the MP and makes use of all of the central ideas we have presented thus far. In many ways the theory can be viewed as a means of restricting the operations MERGE and MOVE provided by the MP in such a way as to prevent over-generation. The core idea behind our TAG-based theory bears a striking resemblance to the work of Uriagereka (1997) and Chomsky (2001) on phases. These authors propose that within the syntactic derivation we have discussed, there are independent units, smaller than sentences, that in effect localize all syntactic relationships and dependencies. The authors term these units *phases* and argue that the different phases of a sentence are derived independently, and, once derived, treated as an atomic unit to the rest of the derivation process. To see how this idea is represented in the TAG framework, it helps to have a definition of tree adjoining grammars, which we now provide.

Formally, a tree adjoining grammar is defined as follows:

- (2) A TAG is a quintuple (Σ, NT, I, A, S) , where:

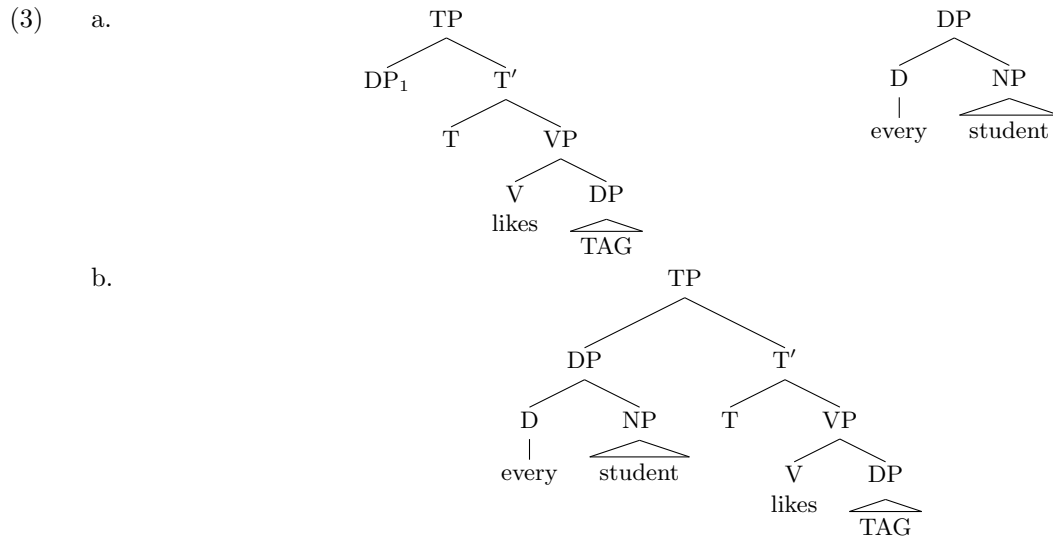
³The standard line holds that $\text{MERGE}(A, B) = \{A, B\}$, so that the tree structures thus constructed are only partially ordered and the linear order of the terminals is not definitively specified. Following Kayne (1994), the order, which is obviously required for pronunciation, is said to be determined at PF via a mechanism based on a-symmetries in the tree structure. We will not adopt this view here, instead arguing that MERGE determines a total order which can be modified at later stages of the derivation.

⁴Conspicuously absent from this discussion is any mention of how the single structure built from MERGE and MOVE is transformed into a pair of LF and PF objects. We’ll leave this issue aside for now, returning to it in much greater detail in the ensuing two chapters.

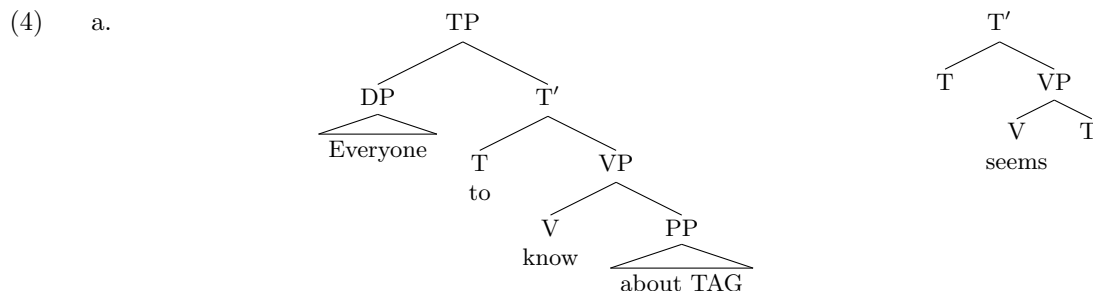
- a. Σ is a finite set of terminal symbols;
- b. NT is a finite set of non-terminal symbols, and $\Sigma \cap NT = \emptyset$;
- c. S is a distinguished non-terminal symbol $S \in NT$;
- d. I is a finite set of finite trees, called *initial trees*, where:
 - interior nodes are labeled by non-terminal symbols;
 - frontier nodes are labeled by non-terminal or terminal symbols;
- e. A is a finite set of finite trees, called *auxiliary trees*, where:
 - interior nodes are labeled by non-terminal symbols;
 - frontier nodes are labeled by non-terminal or terminal symbols; the label of one of the frontier nodes much match the label of the root node of the tree (we call this the foot note).

(Joshi & Schabes, 1997)

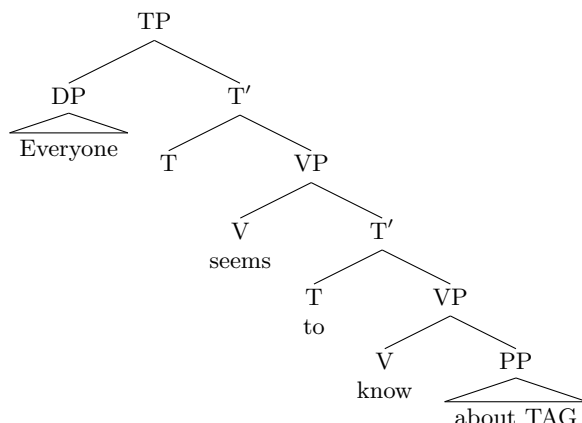
We denote the set $I \cup A$ as *elementary trees*. The definition of TAG also provides two rules for combining and modifying elementary trees: *substitution* and *adjoining*. A TAG derivation is defined to be the process of combining and re-writing elementary trees through substitution and adjoining to form one final tree, the *derived tree*. The first operation, *substitution*, re-writes a non-terminal node X along an elementary tree τ 's frontier with another tree τ' rooted in X . In this case we say τ' was substituted into τ at X . In (3), we substitute the second tree in (3-a) into the first at node DP_1 , resulting in the tree in (3-b):



As mentioned above, substitution is limited to non-terminals along the frontier of the tree. There is no such restriction for *adjoining*, which may be used to re-write any node in a tree. The adjoining operation takes auxiliary tree τ' rooted in node X (and therefore also containing a foot node X) and an elementary tree τ containing X as an interior or frontier node. The operation re-writes the node X in τ with τ' . In this case we say that tree τ' adjoined to tree τ at node X . In (4), we adjoin the second tree in (4-a) to the first at node T' , resulting in the tree in (4-b):



b.



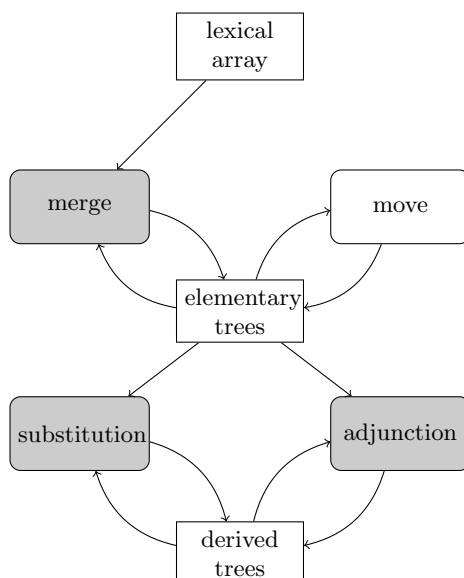
In the subsequent discussion, we will effectively drop the distinction between auxiliary and initial trees. From this point, we will assume that any tree with a matching frontier-root node pair may be substituted into any other tree. There is one caveat here before we move on, however. If we wish to ignore the distinction between initial and auxiliary trees, there is a restriction that we must impose on the TAG derivation process. Specifically, the derivation must be Markovian in nature, i.e., the derived tree must be obtainable independent of the order in which the substitution and adjoining operations are applied. In effect, this restriction means that we cannot use substitution to “build” trees intended for adjoining with a foot in one tree and the root in another.

Returning now to our discussion of locality and the derivation process, we can begin to see how to phrase the innovations of Uriagereka (1997) and Chomsky (2001) in terms of TAG. Specifically, elementary trees provide us with the analogue of phases in their system. Under this view, we can treat the derivation as a two step process: first the operations MERGE and MOVE build up a set of elementary trees; second, these trees are “passed on” to the TAG machinery, where they are combined and re-written via applications of the substitution and adjoining operations. The diagram below captures this new take on the derivation process. Note that we do not allow MOVE to displace elements from one elementary tree to another.

Critically, limiting the applications of MERGE and MOVE to elementary trees and treating these as the units of our derivation provides us with a natural way of restricting movement and syntactic dependencies. We simply assert that they are limited to occurring within elementary trees. This notion is summarized below.

(5) **The fundamental TAG hypothesis**

Every syntactic dependency is expressed locally within a single elementary tree. (Frank, 2004)



(Frank, 2004)

1.4 Elementary trees

Localizing syntactic dependencies to elementary trees is a nice idea, but without a principled account of what exactly the domain of an elementary trees consists of, it is of little theoretical value. We turn our attention now to this topic. Due to reasons of space, we are unable to present all of the motivation behind the choices we will make for elementary tree domain. If the argumentation seems sparse at times, refer to (Frank, 2004) original work.

Before we begin, we elucidate the fundamental domain in which our elementary trees are defined. Specifically, we work within the confines of the standard X'-theory. The essential idea is that each grammatical object, be it a lexical item like a noun, verb, adjective, etc., or a non-lexical –functional– item like negation, tense, aspect, mood, etc., *projects* a binary branching tree structure around it. We call this projecting element the *head* and say that it projects a *phrase*. The sister of the head is its *complement*, and the phrasal child of the root node of the phrase is the *specifier* of that phrase. We call the entire phrase projected by a head the *maximal projection* of that head. The following context-free re-writing rules succinctly summarize the structure we permit a head to project:

- (6) a. $XP \rightarrow YP X' \parallel X' YP$
b. $X' \rightarrow X' ZP \parallel ZP X' \parallel X WP \parallel WP X$

In this case, XP is the maximal projection of X, YP is in the specifier position, and WP is the complement of the head X (see, for example, Kayne (1994) and Carnie (2012) for a more thorough introduction). Either of YP or WP can be empty.

Moving on, our most basic claim will be that every elementary tree is rooted in a single lexical predicate.⁵ As we alluded to previously when we offered a definition the lexicon, lexical predicates are associated, in the lexicon, with a so-called θ -grid that details their essential semantic properties and those of their arguments.⁶ The syntactic structure associated with this θ -grid is called the *thematic domain* of the predicate. This thematic domain is made up of a structure containing the lexical predicate as well as all of the arguments it takes. As such, we might reasonably propose that elementary trees are limited to this thematic structure associated with lexical predicates.

Following the work of Fukui & Speas (1986) and Koopman & Sportiche (1991), we know that thematic domain is restricted, in the case of verbs, to the maximal projection of that verb, the VP: subjects are generated in so-called predicate internal position. Critically, this position is hierarchically lower than the standard position of such functional notions of tense, mood, aspect, negation, etc. Given that these items are non-lexical, they cannot head their own elementary trees. However, they are certainly realized overtly (we pronounce them after all), and they must head their own projections in the structure (see, for example, Abney (1987), Pollock (1989), Cinque (1999), among others) so that we are at an impasse: functional items must find their way into elementary trees, yet they lie outside the thematic domain of lexical predicates.

We run into similar problems with nouns under the assumption that determiners are functional items outside the thematic domain of the noun they embed. Our solution will be to extend the domain of elementary trees to what is called the *extended projection* of a lexical item.

(7) **Extended projection**

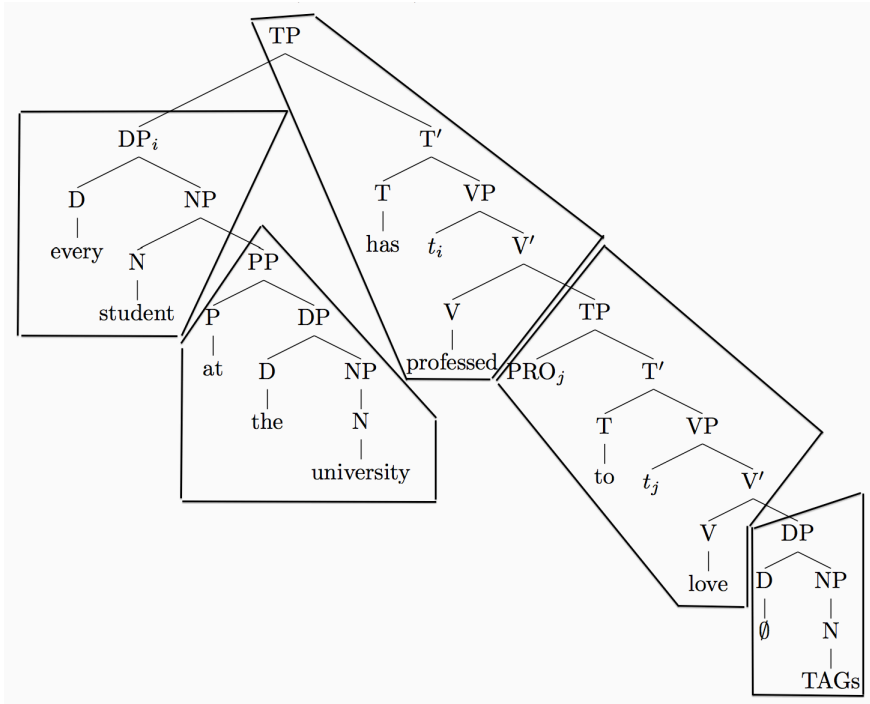
The extended projection of a lexical item is the maximal projection of that item along with the maximal projections of all functional heads that embed it.

We provide an example below of the extended projections that make up a fairly complicated biclausal structure (Frank, 2004). There are exactly five extended projections corresponding to the five lexical heads of the sentence: *student*, *university*, *profess*, *love*, *TAG*.

⁵We will hold this claim as the primitive out of which we develop our theory of elementary trees. It is a mostly uncontroversial claim, although see Frank (1992) and Hegarty (1993) for a thorough discussion of its merits and issues.

⁶Briefly, for those unfamiliar with this terminology, the θ -grid associated with each lexical predicate contains information regarding the number, type, and structure of the arguments of that particular predicate. Argument types are specified by their syntactic category, i.e., what type of phrase they are, and by their semantic role, e.g., agent, patient, theme, etc.. This semantic role is denoted as the θ -role assigned by the predicate to that argument. See Carnie (2012) for a more thorough introduction.

(8)



The choice of limiting elementary trees to extended projections of lexical heads, taken in conjunction with the fundamental TAG hypothesis, predicts that all grammatical dependencies must be localized to extended projections. This idea is well supported by empirical data. Grimshaw (2000) has presented strong evidence that selection/subcategorization, agreement, case assignment/checking, head movement, and many other other syntactic relations all take place within the domain of extended projection.⁷

We solidify our claim regarding elementary trees and extended projections below.

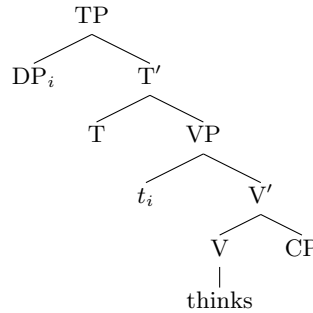
(9) **Condition on elementary tree minimality (CETM)**

The syntactic heads in an elementary tree and their projections must form an extended projection of a single lexical head.

Note that the definition of extended projection we provided does not make reference to the arguments of the relevant lexical head. In fact, technically speaking these items are *not* a part of the extended projection. This is an undesirable result, as we want to capture the thematic structure of our predicates within the elementary trees. For example, if we are to capture the notion of subcategorization/selection, we need for a verb to be able to specify the syntactic type of its complement within its extended projection. The CETM provides the flexibility we need to do exactly this. While this condition limits elementary trees to the extended projection of a single lexical head, it says nothing about the distribution of nodes that are not the projection of a syntactic head. This allows us, for example, to capture the fact that a verb subcategorizes for a clausal complement by inserting a CP node as sister to V. Since this node is not the projection of a lexical head, it is invisible to the CETM and thus allowed in the elementary tree. Likewise, we can insert maximal projection nodes representing subject and indirect object arguments of the verb. Such nodes can then serve as substitution or adjoining sites for the combination of elementary trees in the TAG derivation. The example below demonstrates how we might capture the selectional requirements of a verb like *think* that selects for a DP subject and CP object while adhering to the CETM.

⁷As we will see in chapter 2, the restriction of head movement to extended projections is a dubious claim.

(10)



Our condition on elementary trees thus allows for the accommodation of a predicate’s thematic structure. However, we want a stronger result: elementary trees headed by a lexical item should *require* the presence of all of the predicate’s arguments. In other words, we need to ensure that [Chomsky’s \(1981\)](#) θ -criterion is satisfied in our framework. As such, we formulate the following TAG versions of the θ -criterion:

(11) **θ -criterion (TAG version)**

- a. If H is the lexical head of elementary tree T, H assigns all of its θ -roles within T.
- b. If A is a frontier non-terminal node of elementary tree T, A must be assigned a θ -role in T.

The condition in (11-a) ensures that all of a predicate’s arguments appear in the elementary tree it heads, and the condition in (11-b) ensures that there are no vacuous non-terminal nodes in elementary trees.

To summarize, we hold that our elementary trees be extended projections of lexical heads. Furthermore, the first half of the θ -criterion requires that a lexical predicate discharge each of its θ -roles within its elementary tree, so that we must have a non-projected non-terminal node for each of a predicates particular arguments. Since the CETM does not make a statement about non-projected nodes, this configuration is permitted. Finally, the second half of the θ -criterion requires that all frontier non-terminal nodes in a tree receive a θ -role, thus ensuring that there are no vacuous non-terminals in our elementary trees.

1.5 The EPP, feature checking, and the TAG derivation

Now that we have outlined the well-formedness constraints on our elementary trees, we turn to the question of how such trees are derived, as well as the means by which the TAG operations, *substitution* and *adjoining*, drive the second half of the derivation process. The content summarized in this section forms the core of [Frank’s \(2004\)](#) framework, although for reasons of space we can do little more than sketch a skeleton of his argumentation. Our goal will be to succinctly outline the major proposals that underlie the system, and to this end we omit most of the examples and arguments supporting [Frank’s \(2004\)](#) claims. We do however provide several example derivations where we work through all of the relevant details in the next section.

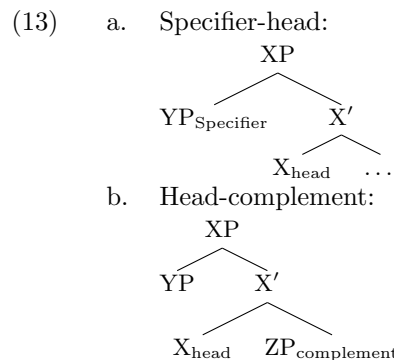
TAG makes use of [Chomsky’s \(1995\)](#) conception of features. The essential idea is that the lexical items that feed the derivation are composed of bundles of so-called *features*, which may be broadly classified into three categories: phonological, semantic, and formal. Phonological features contain information regarding how a particular lexical item is pronounced, i.e., what is the combination of phonemes that must be uttered to pronounce the item. Semantic features contain information related to the interpretation or meaning of lexical items. They can include, for example, the φ -features: person, number, and gender information which is relevant in some situations to interpretation. Finally, the formal, or syntactic, features are abstract notions related to the structural and selectional properties of a particular item. An example of a formal feature is case, i.e. nominative, accusative, etc., which has no real semantic content but rather serves to delimit syntactic relationships among items. Given that formal features are defined by their lack any phonological or semantic reflex, [Chomsky \(1995\)](#) argues that the articulatory and semantic systems are unable to process these features. As such, we term them *uninterpretable*, and claim that they must be somehow eliminated in the course of the derivation.

(12) **Full interpretation**

- Both of the PF and LF objects produced by the syntactic derivation must only contain features interpretable by the two components, respectively.

In light of this principle, we might view the entire derivation process as an attempt to eliminate the uninterpretable features on the lexical items in the numeration, in keeping of course with the CETM and θ -criterion.

So just how do we eliminate uninterpretable features? The claim is that elimination occurs through a process known as *checking*: two matching features on lexical items in a particular structural configuration may be said to check with each other, and if they are uninterpretable, delete. Crucially, such a checking operation is limited to very specific structural configurations: the *specifier-head* configuration and the *head-complement* configuration.



The derivation of elementary trees is driven, then, by an attempt to reconcile and delete uninterpretable features via achieving the above structural relations. Given that every lexical item with an uninterpretable feature may not be merged into a position where it can check that feature, we will rely on applications of the MOVE operation to deform the structure in such a way as to permit the necessary feature checking. In fact this is the only use we permit for the MOVE operation, a condition we call the *Last resort* principle.

(14) **Last resort**

An application of MOVE may take place only if it results in the elimination of uninterpretable features.

To summarize, the derivation of elementary trees begins with a numeration of feature-endowed lexical items, as well as non-projected non-terminals and functional heads, both of which may also have features. Next, in keeping with the CETM and the θ -criterion, applications of the MERGE operation build binary branching structure. Additionally, applications of MOVE deform this structure in order to eliminate the uninterpretable features associated with the various items in the numeration.⁸

The second half of the derivation process –the application of substitution and adjoining to combine our elementary trees thus constructed– will also be driven by the need to eliminate uninterpretable features. As such, we want to ensure that the elementary trees we feed into this stage of the derivation are optimal in that they do not have any uninterpretable features that might have been eliminated in the first stage of the derivation. We therefore impose an additional restriction on our elementary trees that acts as a sort of derivational complement to the last resort principle. Specifically, we claim that if movement is possible according to the last resort principle, then it is obligatory.

(15) **Maximal checking principle (MCP)**

The output of an elementary tree derivation must contain as few uninterpretable features as possible. (Frank, 2004)

We turn now to the second half of the derivation, where we use substitution and adjoining to combine elementary trees. Observe that the operations of MOVE and adjoining share many formal properties. Both operations are structure deforming rather than structure building: MOVE moves subtrees to new locations and adjoining replaces non-terminal nodes with trees. Moreover, both of these operations have the effect of displacing subtrees to hierarchically higher positions. MOVE does this overtly, while adjoining has the effect of “raising” the structure above the node it targets in the tree being adjoining into.⁹ Given this similarity, it

⁸Our system varies from the one proposed by Chomsky (1995) in two critical ways. First, MERGE is limited in the sorts of structures it may build by the CETM and the θ -criterion, and second, our numeration is allowed to contain non-projected non-terminals that may serve as future sites of substitution and adjoining.

⁹Technically there is nothing in the definition we have provided for MOVE that rules out “downward” movement to a hierarchically lower position. However, in keeping with standard assumptions, we hold that movement can never displace elements in

should not come as a surprise that we restrict adjoining in much the same way as the principle of last resort restricts MOVE. Specifically, our central claim will be that applications of adjoining are limited to situations where such an application leads to the removal of uninterpretable features.

(16) **Greed**

Adjoining may apply at some node of an elementary tree T only if it results in the elimination of uninterpretable features in T.

In effect, this condition states that just as there can be no vacuous movement, there can be no vacuous adjoining. The operations are specifically limited to allowing the establishment of checking configurations that lead to feature deletion (see the next section for some examples of how this plays out in actual derivations).

Substitution is similarly driven by features, although in this case the motivation is slightly different. Recall that we allow our numeration to contain non-projected non-terminals that represent the argument slots of the predicates that head our elementary trees. We mentioned in the above discussion that these nodes were essentially placeholders, sites for future substitution. These non-projected non-terminals are free to be associated with various characteristic formal or semantic features. For example, DP node that is intended as a subject must be associated with an uninterpretable nominative feature to indicate that it is intended as a subject. However, because these nodes are not associated with a lexical or functional head, they lack phonological features. As such, the articulatory system cannot see them, and thus they cannot be pronounced. In a language such as English that does not allow for null arguments, this is an unacceptable state of affairs: the articulatory system does not permit a predicate to be pronounced without its arguments, and hence we arrive at ungrammaticality. Substitution provides us with a way to avoid this pitfall. Phrases projected from a lexical or functional head with phonological features can substitute into our non-projected non-terminals, providing the necessary phonological feature to this position.¹⁰

While we leave explicit examples of how these derivational principles conspire to allow us to produce grammatical sentences to the next section, there is one example of feature driven movement that is important enough to warrant discussion here, the extended projection principle.

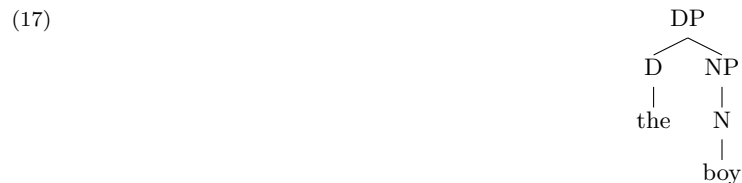
(18) **Extended projection principle (EPP)**

A TP projection in an elementary tree τ must have a specifier if and only if there is some otherwise licensed element within τ that can be moved to the specifier of TP.

This principle was originally proposed by Chomsky (1982) as a stipulation to capture the fact that, in a large majority of the world’s languages sentences are required to have a subject. It is meant to express the intuition that subjects are both *external* in some way to the verb/object/indirect-object complex and mandatory, in that there are intransitive verbs but never verbs without subjects. Given that a wide variety of behaviors in many languages are explained via an appeal to the EPP, it is something that our theory should incorporate. Fortunately we can easily explain the above condition with the feature based framework we are working in. Specifically, we will associate every T head with an uninterpretable feature, called [EPP] for simplicity’s sake, that must be checked and deleted. Likewise, we posit the existence of a complementary feature, denoted [D],

a downward fashion (see Kayne (1994) for an argument in favor of this claim).

¹⁰There is a technical detail regarding the percolation of features following an application of MERGE. Specifically, if we only allow features to be present on the items in the numeration, then MERGE will essentially bury these features under layers of projection, thus rendering the features inaccessible. To take a simple example, image the following D(eterminer)P(hrase) projected from a noun below.



Under our assumptions thus far, all of the features present in this elementary tree should be associated with *the* and *boy*. However, if we want to substitute this tree into another elementary tree, we need for at least the phonological features and perhaps other formal or semantic features to be visible. To resolve this issue, we assume that when two elements are merged, there is an implicit selection requirement that selects the features from an element and projects them to the newly created root node. In this way, features can be seen to percolate to the maximal projection of each phrase.

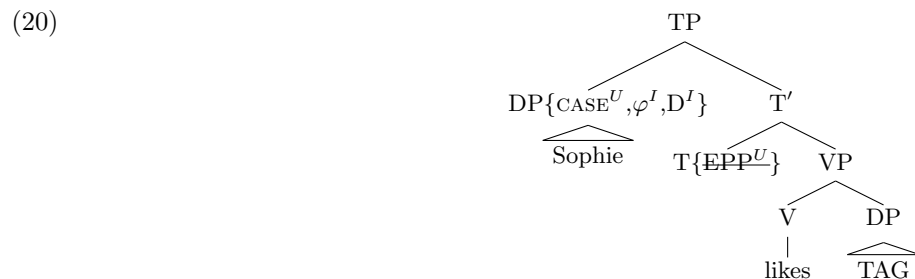
on certain DPs and CPs. It follows from the MCP that if a DP or CP with a [D] feature—essentially a DP or CP with satisfying the formal characteristics of a subject—appears in the numeration, it *must* move to the specifier of TP, enter a checking relation, and delete the uninterpretable [EPP] feature on the T head.

1.6 Raising and TAG

Given that raising plays a fundamental role in the ensuing chapters of this thesis, we will now take the chance to go through the derivation of a few raising examples. First, let’s derive a simple English subject-to-subject raising example like in (19).¹¹

(19) Sophie seems to like TAG.

Let’s consider the elementary tree projected from *like* first. In accordance with the θ -criterion, the DP position into which *Sophie* will eventually be substituted must be a part of the elementary tree projected from *like*. The EPP feature on the T head of this tree then draws the subject DP from its base-merged VP internal position to the specifier of TP, where the interpretable D(efinite) feature on the DP checks the uninterpretable EPP feature on the T head. However, as is standardly assumed, the T head in this tree, being non-finite, lacks the ability to check the case feature of subject DP. This situation is represented below, where we have substituted in the subject DP *Sophie* for clarity. Relevant features are marked with superscript *I* if they are interpretable and *U* if they are uninterpretable.



Moving on to the elementary tree projected from *seems*, we immediately see that since *seems* does not assign an external θ -role, there is no external DP argument. Accordingly, the TAG version of the EPP tells us that *seems* does not project beyond T'. It follows that the EPP feature associated with the T head in this tree remains unchecked, as do the uninterpretable φ -features associated with finite tense heads.¹²

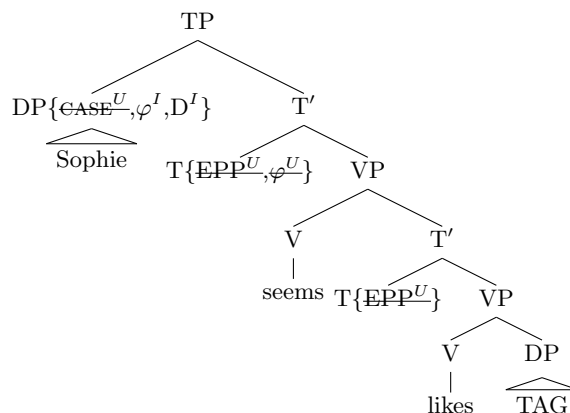


At this point it is clear that adjoining (21) into (20) at the T' will result in the elimination of uninterpretable features and hence is licensed in terms of the greed principle. Following such a move, the subject DP and the finite T head are in a specifier-head agreement relation and hence the D^I feature on the subject DP is free to eliminate the uninterpretable EPP and φ -features on the T head. Likewise, T is free to check the uninterpretable case feature on the subject DP. It follows that adjoining of this sort results in the elimination of all uninterpretable features so that the derivation is acceptable.

¹¹The dynamics of feature percolation and checking in Frank’s (2004) TAG framework are considerably more complicated than what we will present here. For the sake of the argumentation in this thesis, this additional complexity is irrelevant and hence we present a watered down version of Frank’s (2004) system. This simplification is in no way a comment on the original work.

¹²Note that we have *seems* subcategorizing for a T' complement, which is a somewhat unorthodox move. See Frank (2004) for more discussion.

(22)

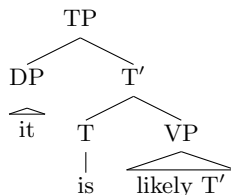


Let's see how we can block the following illicit raising examples using our feature checking system.

- (23) a. *Gabriel seems adores TAG.
 b. *Sophie seems it is likely to adore TAG

In (23-a), note that the tree projected from *adores* does not contain any uninterpretable features. The finite tense head associated with *adores* is in a specifier head configuration with *Gabriel*, and hence every relevant feature has been checked. It follows that the adjoining of the tree projected from the raising verb does not result in the elimination of any uninterpretable features and thus is precluded. In (23-b), the intermediate raising verb projects a tree with a TP specifier, given below. It follows that this tree may not undergo the sort of adjoining that is necessary to derive subject-to-subject raising.¹³

(25)



1.7 Conclusion

In this chapter, we have outlined the fundamental objectives and tools of the Minimalist Program. Making use of the six central facts about the language faculty given in (1), we argued that syntax can be thought of as a derivation process whereby lexical items enriched with features are combined according to the operations MERGE, MOVE into larger hierarchical structures. Moreover, we made the case that the output of this derivation process should be a pair of objects that are then passed on to articulatory and semantic modules for pronunciation and interpretation, respectively.

Within this general framework, we introduced a syntactic theory based on tree adjoining grammar. The central insight underlying this theory is the idea that all grammatical dependencies can be localized to atomic pieces of structure: elementary trees. We then argued that elementary trees are best viewed as the extended projection of lexical predicates, and we outlined several conditions on the well-formedness of these extended projections. To make full use of the TAG machinery, we postulated that the derivation process be split into two steps. In the first stage, we derive the elementary trees based on a feature drive system after Chomsky (1995). In the second stage, the TAG operations of substitution and adjoining combine elementary trees into a final structure. Once again we motivated this stage of the derivation with features and feature checking.

¹³Note that in order to derive super-raising examples of the sort in (24), we need a more complicated feature system. While it is beyond the scope of this work to delve into the details, it should be clear that the adjoining of the intermediate raising tree is precluded under our current analysis, given that it does not result in the elimination of uninterpretable features in the tree being adjoined into. See Frank (2004) for a solution to this problem.

- (24) Sophie seems to be likely to hate TAG.

Finally, we demonstrated that the extended projection principle can be stated nicely in our system as the reflex of an feature-checking operation.

With the central tenets of the MP now clear, it should be immediately obvious that the TAG formalism is lacking in that it says nothing regarding the fundamental notion of interfaces: notably absent from this discussion, and also from Frank's (2004) original work, is any mention of how we arrive at the pair of objects that we posited the derivation should produce. We have rules for building syntactic structure, but no way, as of yet, to map this structure to objects that can serve as inputs to the interpretive and articulatory systems. As mentioned in the introduction, the primary aim of this thesis is to address this very shortcoming, as well as to handle the broader implications of doing so. In the subsequent chapter, we turn our attention to exactly how to separate the pronunciation and the interpretation of a syntactic object. It turns out that a variety of TAG is naturally suited to this very task.

Chapter 2

TAG at the interfaces

In the first chapter, we recounted the observation that sentences are fundamentally form-meaning pairings. This idea has been known since ancient times (Aristotle, but find the citation), and was captured by Saussure’s notions of *signifier* and *signified*. The MP continues this venerable tradition by asserting that the syntactic derivation should feed both the articulatory and semantic systems. Indeed in the theory we have presented, the entire syntactic derivation is driven by a need to resolve features so as to render the elements provided in the numeration interpretable to both these systems. Recall that we denoted the output of the syntactic derivation as a pair, (π, λ) , of PF and LF objects that serve as the inputs to the articulatory and semantic systems, respectively. We can think of these objects as being the “interfaces” between the syntactic derivation and the two aforementioned systems. Given the indispensable role of interfaces in the MP, any syntactic theory grounded in this theoretical program must provide some means of deriving, or at least of referring to, the PF and LF interfaces. On this topic, Frank (2004) offers only a few parting words in the last section of his last chapter. Aside from this, there is little guidance as to how we might address this crucial issue within a TAG framework.

It is to this topic that we turn our attention in this chapter. Specifically, we discuss one method of deriving PF and LF objects with a TAG-based syntactic model. Under the standard assumption that syntactic structure maps more or less straightforwardly to the PF object following some sort of linearization, the major question we are faced with is how to derive the LF object. Given that the standard appeal to covert movement is not compatible with the TAG framework, we are forced to adopt a different mechanism to capture the form-meaning divide that the Y model achieves via bifurcation. To this end, there are two major approaches to compositional semantics with TAG. The first method, developed and advocated for primarily by Aravind Joshi, Laura Kallmeyer, and Maribel Romero, is based on feature enhanced derivation trees on Lexicalized TAG (LTAG) (Kallmeyer & Romero 2004, Kallmeyer & Scheffler 2004, Joshi et al. 2007, Kallmeyer & Romero 2008). The second method, introduced by Stuart Shieber and Yves Schabes, simultaneously derives isomorphic syntactic and semantic representations through the use of so-called Synchronous TAG (STAG) (Shieber & Schabes 1990, 1994). Further refinements of this method have been pursued by a variety of authors, of which some highlights are the work of Shieber & Nesson (2006) and Frank & Storoshenko (2012). As pointed out by Frank & Storoshenko (2012), the LTAG method extends the computational power of the TAG formalism, rendering it Turing complete. In hopes of maintaining the computational restrictiveness of the TAG framework, we will advocate for the adoption of the STAG model, which permits no such extension of formal expressivity. Moreover, the STAG framework is simple, elegant, and relatively easy to incorporate into our MP based TAG framework.

2.1 Covert movement, STAG and the LF interface

In this section, we develop an account of how our TAG formalism interfaces with the semantic system. Specifically, we consider the traditional MP account of this interface, then discuss both why the TAG framework is not amenable to this sort of analysis and how we can capture the core intuitions in a purely TAG formalism.

In standard theories within the MP, the essential form-meaning pairing for which we are striving is accomplished via the concept of SPELL OUT. In these theories, the syntactic derivation proceeds as we have

detailed, with MERGE and MOVE building and deforming a structure whose terminals are the feature-bundles provided by the numeration. In order to affect the output of a pair of objects from this derivation, these theories posit that there is a point in the structure building process, denoted SPELL OUT, where the derivation bifurcates. On one branch, the structure present at the bifurcation point is linearized, its feature bundles are assigned phonological content, and the resulting string becomes the desired PF object. On the other branch, the derivation process continues unhindered, with various movements deforming the structure in such a way as to affect the necessary hierarchical relations for a proper semantic interpretation. Movements after this bifurcation are said to be *covert*, as opposed to *overt* movements that occur before SPELL OUT, as they are not realized in the pronounced string. To see an example, let's consider the derivation of a sentence like (1).

- (1) Every boy loves a girl.
- a. Numeration: {every, a, loves, boy, girl}
 - b. Spell Out: [TP [DP every boy] [VP loves [DP a girl]]]
 - c. LF:
 - (i) [[DP every boy]_i [DP a girl]_j [TP t_i [VP loves t_j]]]
 - (ii) [[DP a girl]_j [DP every boy]_i [TP t_i [VP loves t_j]]]

Proceeding from the numeration in (1-a), applications of MERGE and MOVE derive the structure in (1-b), which is the structure at bifurcation point, SPELL OUT, and hence the place where overt word order is determined. The exact mechanism for how the binary branching syntactic structure is linearized to a string need not concern us here; we'll simply assume that there is some unambiguous, language independent linearization technique that transforms (1-b) into (1).¹ On the LF side of the bifurcation, the derivation continues with applications of MOVE driven by feature interpretability requirements and, critically, interpretation requirements. Before we can examine the factors motivating the LF structures proposed above, we need to clarify the exact assumptions we will be making regarding semantic interpretation, both in our explication of the traditional story and in the ensuing discussion of alternative semantic derivations. The single most fundamental assumption is that semantics should be compositional, so that the meanings associated with each of the individual lexical entries combines to form the meaning of the sentence. Because the primary focus of this work is not semantics, we will not offer a defense of this notion, but merely assert its status as a primitive in our system (see Frege (1892) and Heim & Kratzer (1998) for some discussion). Adhering to the standard nomenclature, we'll denote the "meaning" of a lexical item to be its *denotation*, and we'll let $\llbracket \ \rrbracket$ be the function mapping words, phrases, sentences, and as we will see later, trees, to their denotations.

(2) **Denotation**

Let D be the set of all entities that exist in the real world. Then we define denotations recursively as follows. A denotation is:

- a. An element of the set D (a type $\langle e \rangle$ denotation);
 - b. An element of the set $\{0, 1\}$ (a type $\langle t \rangle$ denotation)²;
 - c. A function from denotations of a given type x to denotations of a given type y (a type $\langle x, y \rangle$ denotation).
- (Heim & Kratzer, 1998)

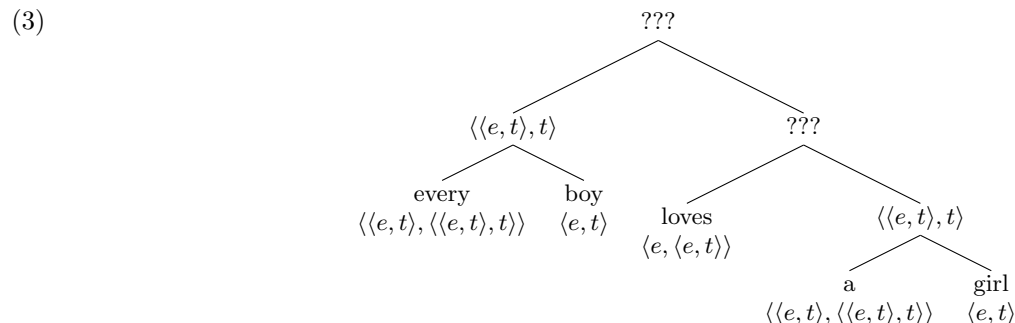
With the principle of compositionality and the definition of a denotation in place, the next questions that arise are how to determine the way in which the meaning of the parts combine to form the meaning of the whole, and exactly what such meaning should look like. To answer the latter question, we will assume that every sentence should ultimately evaluate to a type t denotation. In response to the former question, the order in which we combine the denotations of lexical items should be dictated by the structure of the syntactic representation. Once again, we posit these assumptions without justification, although see the same sources as above for some discussion. In general, the argument to a particular lexical item is its sister node in the structure, although we'll leave this guideline purposefully vague for now to avoid unnecessary complication.

Returning now to the LF forms given in (1-c), we can motivate the form of the structure based on the need for a well typed interpretation. In particular, let us assume that the denotation of quantifiers like *every*, *a* are two place generalized quantifiers of type $\langle\langle e, t \rangle, \langle\langle e, t \rangle, t \rangle\rangle$. Under the assumption that the order of application

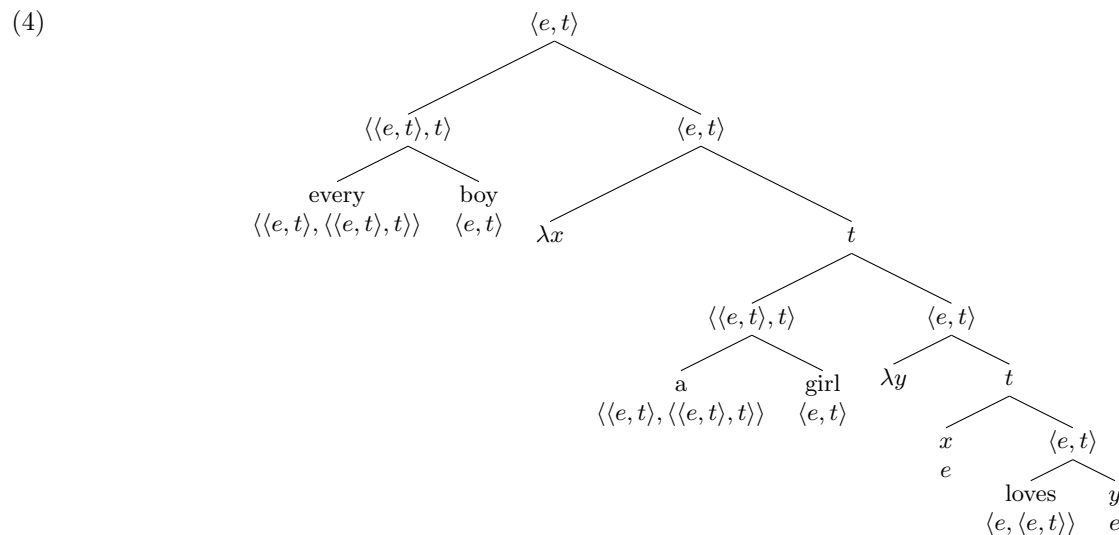
¹See Kayne (1994) for one proposed technique.

²For simplicity, we will write e and t instead of $\langle e \rangle$ and $\langle t \rangle$

of the denotations attached to each lexical entry is linked to hierarchical position, we can immediately see that quantificational determiners of type $\langle\langle e, t \rangle, \langle\langle e, t \rangle, t \rangle\rangle$ cannot be interpreted *in situ* in object position: if the general maxim that an entry’s sister constitutes its argument, then there is simply no way to avoid a type mismatch with an object position quantifier. In the figure below, we have enriched a traditional syntactic structure with types, where each node is represented by the type of its denotation.



Even without specifying anything about the semantic content of the denotations of the entries, there is no way to get the types to align with this representation. The types of the extensions of *love* and *a girl* cannot be matched regardless of the order of application. It follows that with the types we have provided, there is no way to interpret object quantifiers *in situ*. While some authors have pursued allowing for flexible types, or even allowing different denotations for subject and object quantifiers, we will not attempt such maneuvers here. Our solution will be rather to use to tools available, i.e., MOVE, to displace the object (and subject) quantifier to a position where it can be interpreted. Consider now the structures depicted in (1-c), where movement proceeds via a standard lambda abstraction operation, leaving behind a bound variable trace of type e .³



Assuming there is some way to assign an interpretation to this structure, an issue we return to shortly, the types here can be easily verified to match as desired. Moreover, such a movement based analysis provides us with the additional benefit of dealing with the inherent ambiguity in (1). In particular, such a sentence is consistent with two interpretations, one where the assertion is that for each boy, there exists a girl that he loves, and the other where the assertion is that there exists a girl that every boy loves. If we assume that the denotations of our lexical items are as below, then the two readings may be generated via scoping either the universal or the existential quantifier higher in the structure, respectively, thus deriving the LFs given in (1-c). These two LFs can be derived simply by varying the order in which the quantified DPs extract. No additional theoretical mechanism is required.

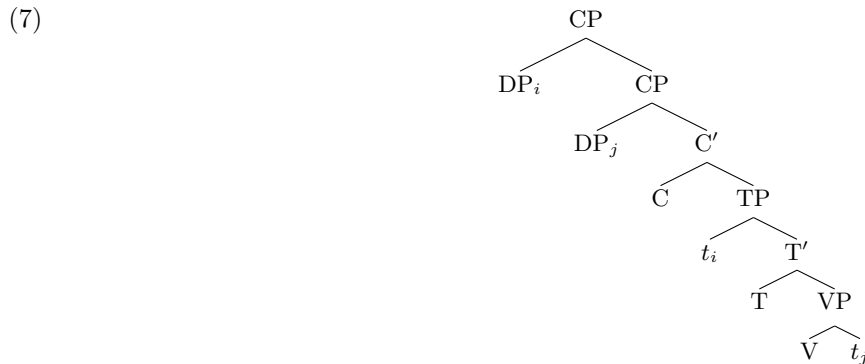
³While we do not need to displace the subject quantifier to avoid a type mismatch, such displacement allows a clean and easy explanation for quantifier scope ambiguities. For a more thorough defense of this move, see May (1985).

- (5) a. $\llbracket \text{every} \rrbracket = \lambda P_{\langle e,t \rangle} . \lambda Q_{\langle e,t \rangle} . \forall x \in D, P(x) = 1 \Rightarrow Q(x) = 1$
 b. $\llbracket \text{a} \rrbracket = \lambda P_{\langle e,t \rangle} . \lambda Q_{\langle e,t \rangle} . \exists x \in D, P(x) = 1 \wedge Q(x) = 1$
 c. $\llbracket \text{boy} \rrbracket = \lambda x. x \text{ is a boy}$
 d. $\llbracket \text{girl} \rrbracket = \lambda x. x \text{ is a girl}$
 e. $\llbracket \text{loves} \rrbracket = \lambda x. \lambda y. x \text{ loves } y$
- (6) a. $\forall >> \exists: \llbracket \text{every} \rrbracket (\llbracket \text{boy} \rrbracket) (\lambda x_i. (\llbracket \text{a} \rrbracket (\llbracket \text{girl} \rrbracket) (\lambda x_j. (\llbracket \text{loves} \rrbracket (x_i) (x_j))))))$
 b. $\exists >> \forall: \llbracket \text{a} \rrbracket (\llbracket \text{girl} \rrbracket) (\lambda x_j. (\llbracket \text{every} \rrbracket (\llbracket \text{boy} \rrbracket) (\lambda x_i. (\llbracket \text{loves} \rrbracket (x_i) (x_j))))))$

This strategy of so-called quantifier raising (QR) has been employed successfully to handle a wide variety of scope related phenomena (May 1985, Fox 2003), and it fits nicely into standard minimalist conceptions of LF, the scopal behavior of *wh*-elements, and the principle of Relativized Minimality (Rizzi, 1990). While there is no intrinsic reason why a similar bifurcation would be forbidden in our TAG framework, we will now argue that the notion of *covert* movement simply does not fit. It follows that QR is not a viable technique in the theory we have presented, thus necessitating the introduction of an alternative method for deriving the structures that interface with LF.

To see why QR, and indeed any covert movement, is precluded, recall that we argued for the division of the derivation into two discrete steps. In the first step, elementary trees are derived via applications of MERGE and MOVE. Then, these trees are assembled into a final phrase structure with the TAG machinery. Critically, once we have begun the TAG step of the derivation, where we substitute and adjoin, deformations of the elementary trees via MOVE are unequivocally precluded. Allowing such movement is tantamount to violating the fundamental TAG hypothesis that all syntactic dependencies are expressed in the confines of elementary trees. It is apparent, then, that certainly once the TAG machinery, i.e., the second step of the derivation, has assembled a structure that represents the hierarchical organization of the surface string we are deriving, there can be no further movement.

To see an explicit example, let us consider how we might go about deriving the structure in (4), for example. In light of the requirement that all movement must occur before the elementary trees are combined via the TAG machinery, we would need an elementary tree of the form in (7).⁴ We could then substitute our quantificational DPs into the DP slots to derive the desired structure. While this elementary tree is arguably acceptable in terms of the well-formedness conditions of the previous chapter, it does not, under reasonable assumptions, linearize to the surface string associated with (1). In particular, any movement within our framework is visible in the surface string.

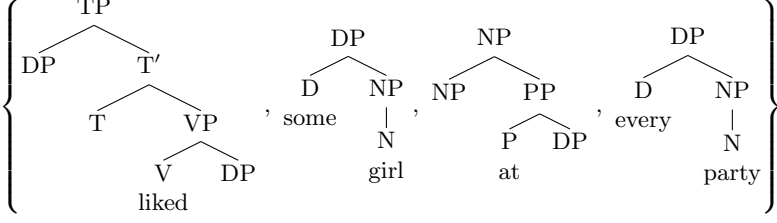


We conclude that QR, and covert movement in general, is not permitted with our TAG framework.

An even more troubling set of examples arises in sentences with one quantifier embedded in the restriction of another quantifier. For example, in (8), the PP *at every party* attaches to the elementary tree projected by *girl*. If we maintain that semantic interpretation is in any way linked to syntactic structure, it seems impossible that the hierarchically lower quantifier would be able to outscope the hierarchically greater one. Assuming the elementary trees for the relevant components are as in (8-b), we can immediately see that in order to derive such a scope, where $\forall >> \exists$, we would need some kind of non-elementary-tree-local movement of the universal quantifier: the universal and existential quantifiers are not even in the same elementary trees. Thus even if we could solve the covert movement problem, we would still be at a loss in terms of deriving the correct

⁴We have assumed that quantifiers raise to the specifier of CP, although nothing depends on this.

scope for a sentence like (8), where the $\forall >> \exists$ reading is freely available. We provide some different levels of representation for the inverse-scope reading below.⁵

- (8) John liked some girl at every party.
- a. Spell Out: [TP [DP John] [VP liked [DP some [NP girl [PP at [DP every party]]]]]]]
- b. Selected elementary trees:
- 
- c. LF: $[[_{\text{DP}} \text{ every party}]_i [_{\text{DP}} \text{ some } [_{\text{NP}} \text{ girl } [_{\text{PP}} \text{ at } t_i]]]_j [_{\text{TP}} \text{ John } [_{\text{VP}} \text{ liked } t_j]]]$

Assuming that the denotation of *at* is something like what’s given below, the interpretation leading to the inverse scope reading is given in (10).

- (9) $[[\text{at}]] = \lambda x. \lambda P. \lambda y. y \text{ is at } x \text{ and } P(y) = 1$
- (10) $[[\text{every}]]([[\text{party}]])(\lambda x. [[\text{some}]]([[\text{at}]]([[\text{girl}]])(x))(\lambda y. [[\text{likes}]]([[\text{John}]])(y)))$

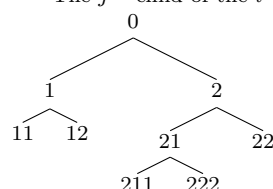
Given that ultimately we need to compute a semantic interpretation something like the one in (10), we need some way of capturing the requirements both that the two quantificational DPs outscope the rest of the sentence, and that *every* outscores *some*. Without covert movement, and more critically, without non-local displacement, we cannot hope to derive the required LFs that lead to (10) by deforming the phrase structure derived in the syntax. We do not, however, want to totally dissociate syntax and semantics, since clearly there is a fundamental link between the two.

Fortunately, as mentioned in the introduction, there has been a wealth of research devoted to capturing the syntax-semantics link with TAG-based theories. There are two major research trends, the first of which focuses overtly on the relationships encoded in the TAG derivation tree. The derivation tree is a device for encoding the steps taken in a TAG derivation. Its nodes are taken to represent elementary trees, and its edges connect nodes in such a way as to express which nodes were substituted or adjoined where, and are labeled by the Gorn address of the node being substituted or adjoined into.⁶ The most recent version of this approach, summarized nicely by Kallmeyer & Romero (2008), has a few drawbacks. First, it requires an extension of the TAG formalism (unification over unbounded feature structures) that renders it Turing complete (Frank & Storoshenko, 2012). Given that one of the benefits of using TAG in the first place is that they are formally restricted in such a way as to capture only the mildly context-sensitive class of languages, which is thought to be the minimal complexity class containing human language, this is an undesirable outcome. When restiveness has been sacrificed in this way, it is not clear (at least to the author) exactly what is gained from choosing the TAG framework over some of its phase-based minimalist brethren. Second, this strategy lacks the simplicity and elegance afforded by the formalism we will now discuss, the Synchronous TAG. While there are certainly some analyses within Kallmeyer & Romero’s (2008) system that are elegant and (somewhat) simple, in the author’s opinion many linguistic intuitions are easier to capture and express within the STAG system.

Like the LTAG approach, STAG also rely on the derivation tree, although in this case the reliance is implicit rather than overt. Formally, a Synchronous TAG is defined as below.

⁵The difficulty of capturing the inverse scope reading here has in fact lead several authors to propose abandoning the TAG framework altogether (Shieber & Nesson, 2008). As we will see, however, such a move is unwarranted.

⁶The j^{th} child of the i^{th} node is given address ij , e.g.,



(11) **Synchronous Tree Adjoining Grammar (STAG)**

A STAG G is a set of triples $(L_i, R_i, \sphericalangle)$, where L_i, R_i are elementary trees forming TAG $G_L = \{L_i\}$ and $G_R = \{R_i\}$, and \sphericalangle_i is a linking relation between nodes in L_i and R_i . (Shieber, 1994)

The derivation in a STAG proceeds as outlined below.⁷

(12) **STAG Derivation**

Choose an initial tree pair $(I_L, I_R, \sphericalangle)$ to be the *current derived tree pair* and repeatedly perform the following steps:

- a. Choose a link $t_L \sphericalangle t_R$ between two nodes in the current derived tree pair.
- b. Choose an elementary tree pair $(A_L, A_R, \sphericalangle')$ from the grammar such that A_L can adjoin at t_L in I_L and A_R can adjoin at t_R in I_R .
- c. Perform the adjoining of A_L into I_L at t_L and A_R into I_R at t_R , yielding the new current derived tree pair $(I'_L, I'_R, \sphericalangle'')$, where \sphericalangle'' contains all links in \sphericalangle and \sphericalangle' except the chosen link in \sphericalangle where the adjoining occurred.

(Shieber, 1994)

STAG offer a natural and intuitive way of relating semantic interpretation to the composition and derivation of syntactic structure. Instead of bifurcating a single structure that yields both the PF and LF objects, we begin the derivation with two disjoint collections of items that we then assemble into two distinct objects, one PF and one LF. The linking relation guarantees that notions of argument structure, dominance relations, and other syntax-semantics overlaps are captured in the system. Moreover, the STAG formalism inherently captures the form-meaning divide that we are trying to affect in our derived sentences. By shifting the burden of capturing syntactic and semantic dependencies and hierarchies off of a single structure and onto two separate but linked derivations, we can solve, for example, our problems deriving the LF objects of (1) and (8) with TAG. In the rest of the chapter, we will refer to the trees involved in the derivation of the PF object as “PF-trees” and the trees involved in the derivation of the LF object as “LF-trees.”

Let us now examine in depth a few examples, including the problematic (1) and (8), in order to demonstrate how the STAG model works. These data demonstrate one of the fundamental problems in semantics: elements, such as quantifiers, can be interpreted, or take scope, in a position that is different from where they overtly appear in the sentence.⁸ As we have seen, in standard Minimalist accounts, this disconnect between overt position and semantic scope is accomplished via an appeal to covert movement, where elements are actually displaced even though we cannot “see” such movement. The way that we will handle this disconnect is by associating each elementary PF-tree, which must be projected from a single lexical predicate, with two LF-trees. One tree will represent the actual denotation of the lexical predicate, complete with argument positions filled by unbound variables. The second tree will represent the scope part of the predicate, and will adjoin or substitute into the structure in the position that the element is interpreted. But how can we have two elementary LF-trees associated with a single elementary PF-tree? This certainly doesn’t accord with the definition of STAG we have provided thus far. In fact, what we are describing on the semantics side is a multicomponent TAG (MCTAG). A MCTAG differs from a standard TAG in that primitive objects in the derivation are not elementary trees but sets of elementary trees, denoted multicomponent sets (note that such sets may be singleton). At every step of the MCTAG derivation, all of the component trees in the multicomponent set being adjoined or substituted must simultaneously adjoin or substitute into one single elementary tree component. That is, given two multicomponent sets $\Sigma = \{\tau_1, \tau_2\}$ and $S = \{t_1, t_2\}$, if the components of Σ are to undergo adjoining or substitution with the components of S , τ_1 and τ_2 must simultaneously adjoin or substitute into t_1 or into t_2 . Adjoining or substitution of one of τ_1, τ_2 into t_1 and the other into t_2 is not permitted. Likewise, it is not permitted to adjoin or substitute one of τ_1, τ_2 into a tree τ' that has been adjoined or substituted into t_1 and the other into t_1 itself. Put succinctly, substitution or adjoining of a multicomponent set must target a single, non-constructed elementary tree. When constrained

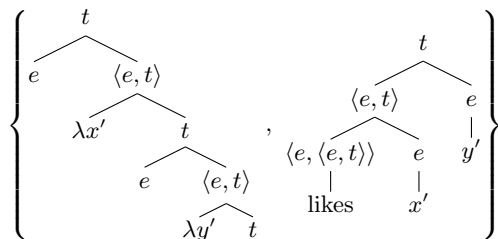
⁷This conception of the derivation process has some issues, as pointed out by Shieber (1994). In particular situations, such a derivation process can yield string languages not within the generative capacity of standard TAG. Moreover, the standard parsing algorithms are not always applicable to STAG derived in this way. Both of these issues can be overcome via a modification of the derivation process, although the new rules make some requirements that we’d rather not deal with here. We therefore set them aside. Interested readers are referred to Shieber’s (1994) discussion.

⁸Barbara Partee (p.c.) has in fact attributed the birth of the entire field of semantics at least in part to an attempt to comprehend the behavior of quantifiers, including behavior with respect to scope.

in this way, MCTAG are formally no more powerful than TAG. It follows that along as we follow these rules, we can successfully associate each lexically grounded elementary PF-tree with a set of LF-trees. We will see later in this chapter that allowing MCTAG in the LF derivation but not the PF derivation is in fact a well motivated and theoretically desirable move.

Returning now to our examples, we will claim that all higher typed operators can be associated with a scope and denotation tree. Thus, for a verb like *likes*, we will have the following two LF-trees.

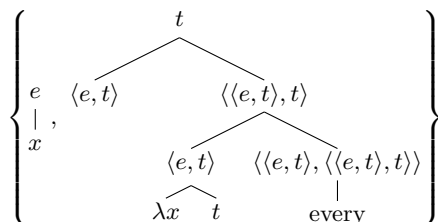
(13) likes: {scope part, denotation part}



The *e* positions in the scope tree are where the arguments of the predicate are substituted into the semantic structure. Likewise, the *t*-recursive structure of the scope tree permits its adjoining at all type *t*, or sentential, nodes. This reflects the uncontroversial claim that verbs can scope over a sentence. Finally, the denotation tree contains the denotation of the actual lexical predicate and two variable arguments that are bound by the scope portion of the tree.

In a similar manner, quantifiers can be split into their corresponding scope and denotation parts, as below.⁹

(14) every: {scope part, denotation part}



In this case, the $\langle e, t \rangle$ frontier node acts as a substitution site for the restriction of the quantifier, while the rightmost frontier *t* ensures the tree is *t* recursive and therefore capable of scoping over a sentence. The denotation part allows the substitution of the variable bound by the quantifier into a corresponding position of type *e*.

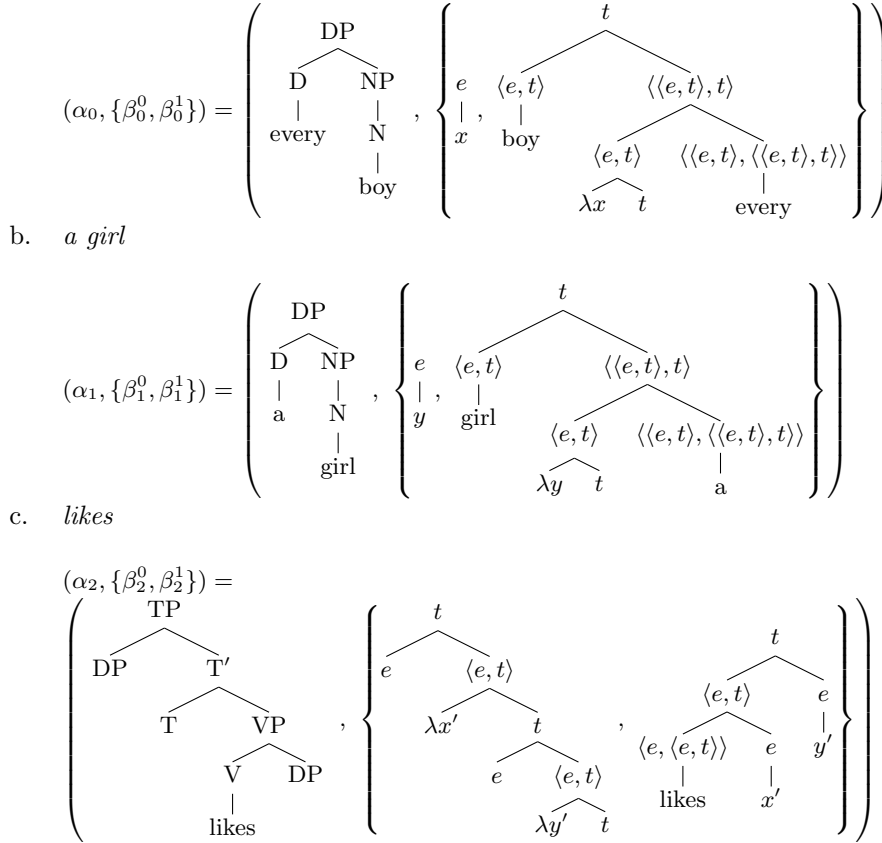
Setting aside the issue of how such LF-tree sets are derived, we will now detail the TAG portion of the derivation of (1) and (8). For (1), the elementary tree tuples are as follows. We label the trees for convenience of reference, and omit the linking relation. Suffice it to say that all of the trees we use can be trivially linked in a sufficient manner, we just don't want to complicate the representation.

(1) Every boy likes a girl.

(15) STAG elementary tree tuples

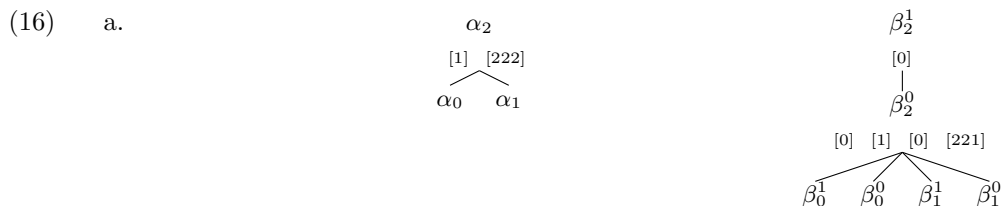
a. *every boy*

⁹Note that with the tree geometry depicted below, we need to flip the order of arguments to *every*, i.e., to redefine $\llbracket \text{every} \rrbracket = \lambda Q. \lambda P. \forall x [P(x) \Rightarrow Q(x)]$.

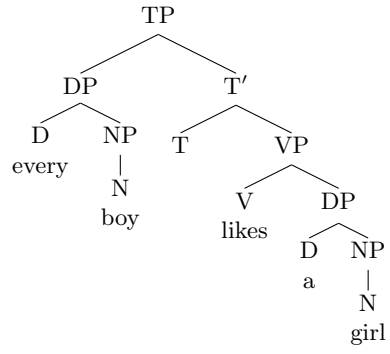


Labeling nodes by their Gorn addresses on the PF side the derivation proceeds via substitution of α_0 into α_2 at node 1, and substitution of α_1 into α_2 at node 222, yielding the tree in (16-b).

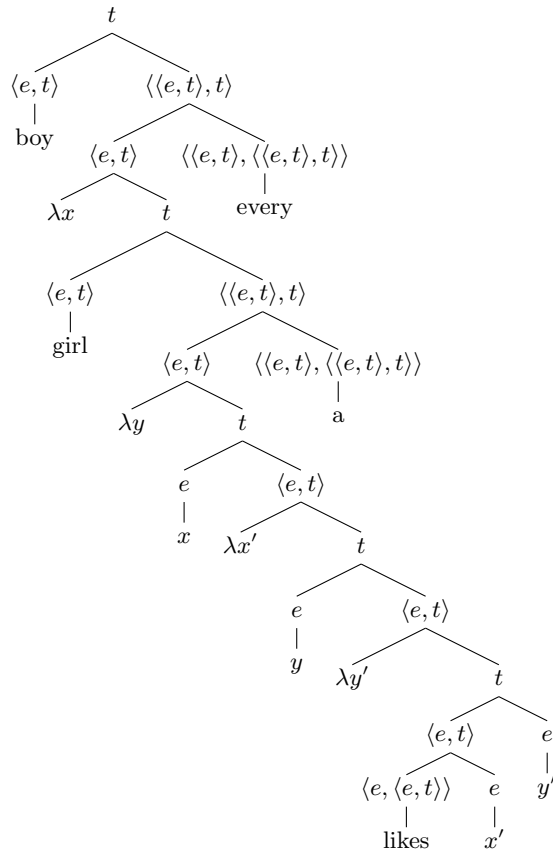
On the semantics side, the substitution of α_0 into α_2 is accompanied by a substitution of β_0^0 into β_2^0 at node 1 and an adjoining of β_0^1 into β_2^0 at node 0. Likewise, the substitution of α_1 into α_2 is accompanied by a corresponding substitution of β_1^0 into β_2^0 at node 221 and adjoining of β_1^1 into β_2^0 at node 0. Finally, tree β_2^0 adjoins to β_2^1 at node 0. To derive the multiple scope options, we note that the scope parts of both quantifiers adjoin at the same node in the scope part of the verb. Multiple adjoinings of this sort, as pointed out by Shieber & Schabes (1990), are inherently ambiguous and permit any permutation of “order of adjoining,” so to speak. Thus we can choose to have the scope part of *every boy* appear above the scope part of *a girl*, or vice versa. It follows that the ambiguity arises as a reflex of the ambiguity of multiple adjoining that is built into STAG. We represent these derivations in (16-c) and (16-d), and give the derivation tree in (16-a).



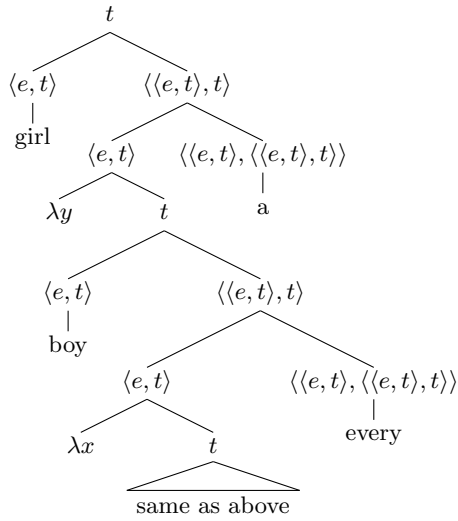
b.



c. $\forall >> \exists$



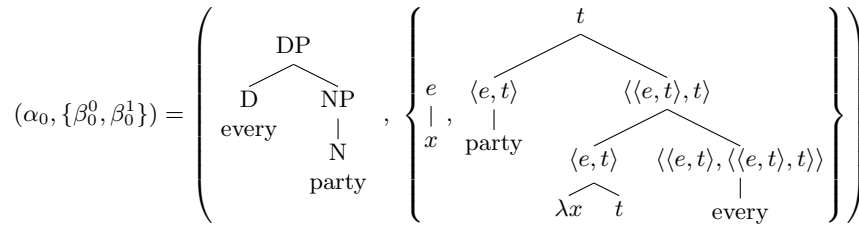
d. $\exists >> \forall$



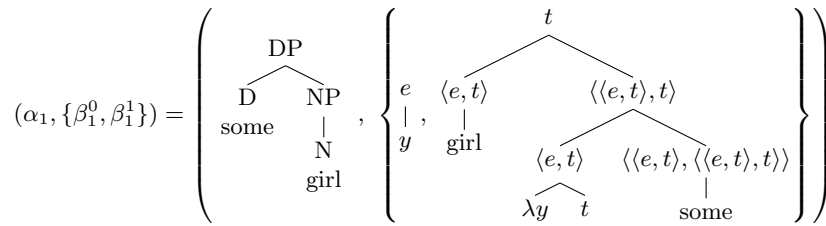
Moving on, the elementary tree tuples for (8) are given below.¹⁰

(8) John liked some girl at every party.

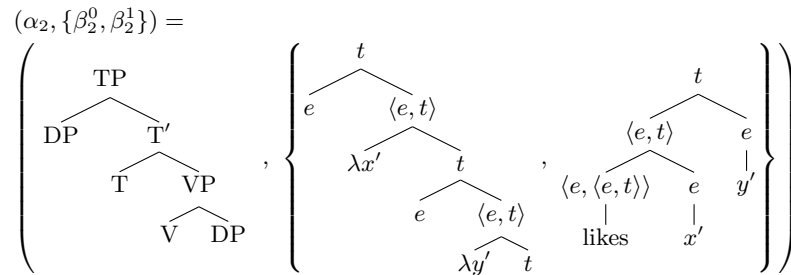
(17) a. *every party*



b. *some girl*



c. *likes*



d. *John*

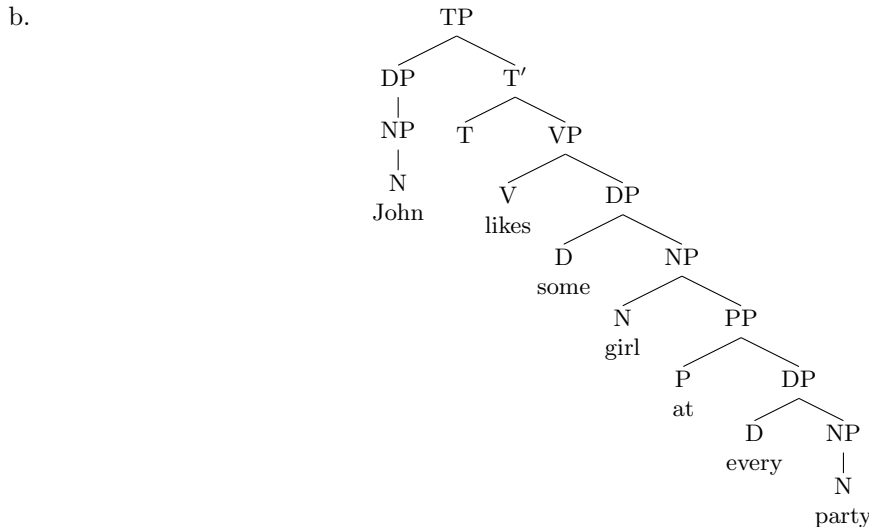
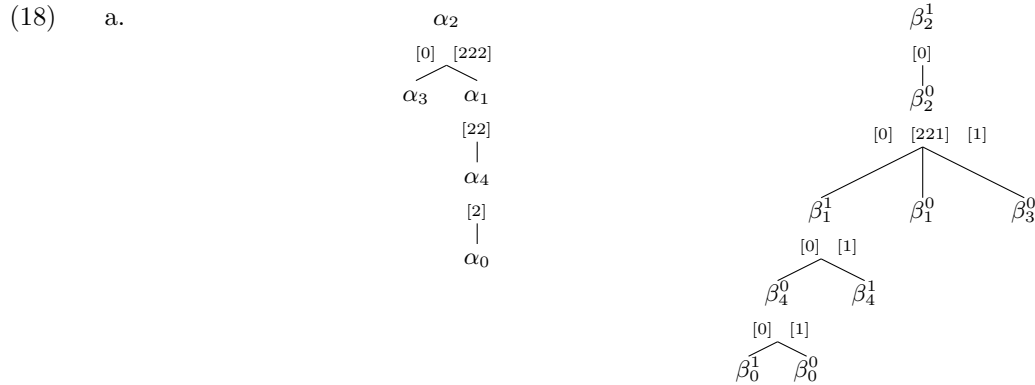
¹⁰Technically, according to the theory outlined in the previous chapter prepositions cannot project elementary trees. We cannot derive the desired data, as far as the author can tell, without recourse to trees headed by prepositions, however. As such, we relax the restriction that functional elements cannot project trees for this example.

$$(\alpha_3, \{\beta_2^0\}) = \left(\begin{array}{c} \text{DP} \\ | \\ \text{NP} \\ | \\ \text{N} \\ \text{John} \end{array}, \left\{ \begin{array}{c} e \\ | \\ \text{John} \end{array} \right\} \right)$$

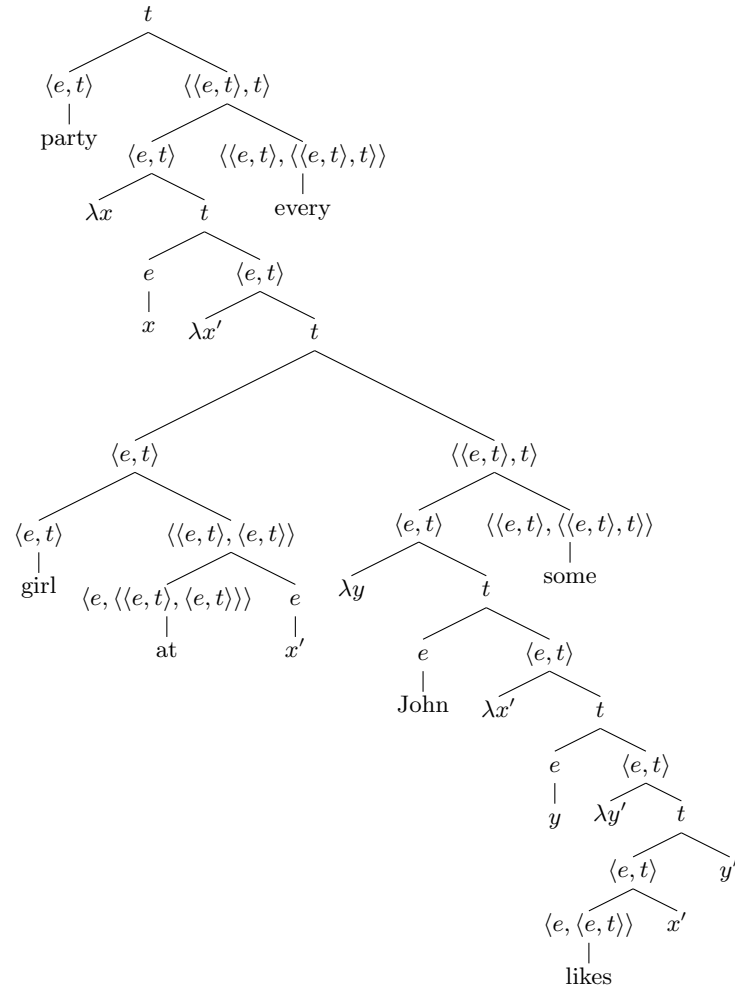
e. *at*

$$(\alpha_4, \{\beta_4^0, \beta_4^1\}) = \left(\begin{array}{c} \text{NP} \\ / \quad \backslash \\ \text{NP} \quad \text{PP} \\ \quad \quad / \quad \backslash \\ \quad \quad \text{P} \quad \text{DP} \\ \quad \quad \text{at} \end{array}, \left\{ \begin{array}{c} t \\ / \quad \backslash \\ e \quad \langle e, t \rangle \\ \quad \quad \lambda x' t \\ \langle e, t \rangle \end{array}, \left\{ \begin{array}{c} \langle e, t \rangle \\ / \quad \backslash \\ \langle e, t \rangle \quad \langle \langle e, t \rangle, \langle e, t \rangle \rangle \\ \quad \quad \langle e, \langle \langle e, t \rangle, \langle e, t \rangle \rangle \rangle \quad e \\ \quad \quad | \quad | \\ \quad \quad \text{at} \quad x' \end{array} \right\} \right)$$

On the PF side, α_0 substitutes into α_4 at node 2. α_4 substitutes into α_1 at node 22, and α_1 substitutes into α_2 at node 222. Finally, α_3 substitutes into α_2 at node 1. The resulting structure is depicted in (18-b). On the semantics side, the substitution of α_0 into α_4 is accompanied by a substitution of β_0^0 into β_4^0 at node 1 and an adjoining of β_0^0 into β_4^0 at node 0. The substitution of α_4 into α_1 is accompanied by an adjoining of β_4^1 to β_1^1 at node 1 and an adjoining of β_4^0 to β_1^1 at node 0. Note that this adjoining effectively scopes *at*, and therefore *every*, which has adjoined to the scope part of *at*, above *some*, as desired. Next, the substitution of α_1 into α_2 is accompanied by a substitution of β_1^0 into β_2^0 at node 221 and an adjoining of β_1^1 into β_2^0 at node 0. The substitution of α_3 into α_2 is accompanied by a substitution of β_3^0 into β_2^0 at node 1. Additionally, we collapse the LF-trees for *likes*, as before, by adjoining β_2^0 to β_2^1 at node 0. The resulting LF-tree is given in (18-b). We also give the derivation tree in (18-a).



c.



Our association of two elementary LF-trees to each elementary PF-tree therefore allows us to capture at least some quantifier scope phenomena without recourse to either covert or non-local movement. Moreover, the formal computational power of the new system is no greater than that of a standard TAG system. To be clear, we have only explored a tiny fraction of the issues surrounding quantifier scope, and indeed an even smaller fraction of the intricacies of the syntax-semantics interface. Our goal was merely to demonstrate the viability of a STAG system in describing a situation that at first glance appears intractable in any TAG system. In fact, a STAG account of many of the complexities of the syntax-semantics interface, including some issues that can be explained with covert movement and some that cannot, is the subject of ongoing research within the computer science and linguistics communities. We turn our attention now to the derivation of the elementary trees involved in the LF side of the derivation.

2.2 The derivation of elementary trees

Having established that the STAG model is a viable option for affecting the derivation of PF and LF objects with TAG, we now turn to the derivation of the elementary trees on the LF side of the derivation. What we offer here is a purposefully sketchy outline piggybacked on the syntactic derivation, but it should give some idea as to what a more developed proposal might look like. In the ensuing section we will describe the trees that participate in the derivation of the LF object “semantic” trees for simplicity.

One of the core features of our elementary LF-trees is that they are composed of a scope and a dentotation part. This separation harkens back to the previous chapter’s note that “expressions that appear in one position can be interpreted in another.” Recall that we explained how syntactic movement offers one way of capturing this fundamental insight: elements can be dislocated from their “thematic” position, that is from the position

where they are interpreted. In many ways, our splitting of LF-trees into scope and denotation parts is simply the other side of this same coin. Sometimes elements that have not been affected by overt syntactic movement are interpreted in a non-canonical position, and we need a way of capturing this. For quantifiers, this is a fairly natural division that is captured in traditional accounts with covert movement. It is much less obvious that such a division is warranted for verbs or prepositions, however, at least if we roughly equate the presence of a scope component to the availability of covert movement. For example, while VP movement is a well-established technique in traditional minimalist grammars, it is not usually posited for semantic reasons, nor is it usually covert. As such, we need some motivation for why verbs and prepositions should be associated with scope components.

Returning to the derivation of (8), let's examine why we need a scope and denotation component for prepositions. Suppose that instead of splitting the semantic components for *at* into two trees, we maintained a single LF-tree of the form below:



In order to derive a structure representing the desired scope, we need the scope part of the LF-tree for *every party*, the saturated variable x of type e , to substitute into the type e position of the tree for *at*. Because of our tree-locality constraint, we also then need the denotation component of this quantifier to adjoin or substitute into this same tree, but there is no node that permits such an operation. Following Shieber & Nesson (2008), we might try and avoid this problem by positing a degenerate scope tree with a single t node to host the quantifier denotation component. However, such a choice would lead to a violation of tree locality: the scope part of the quantifier would adjoin to the degenerate t , but the denotation part would have to substitute into the denotation part of *at*. It follows that we have no way of deriving the correct scoping. A similar argument can be made for splitting the semantic components of the elementary tree projected from a verb into a scope and denotation part based on sentences with control verbs, as in (20) (Frank & Storoshenko, 2012).

- (20) Some student remembered to draw every TAG for class.
 $(\exists \gg \forall \gg \text{remember})$

Moreover, such a splitting of scope and denotation components of verbs can likewise be used to derive scope-rigidity effects in Japanese, where quantifier scope is determined by linear order (Frank & Storoshenko, 2012).

Extending the basic reasoning from the previous chapter that elements can be interpreted in non-canonical positions, we argued for a split between denotation and scope components for quantifiers. We have now seen evidence that such a split is useful for prepositional and verbal projections as well. Taking this reasoning one step further, we claim that every syntactic object provided in the numeration must have a scope and denotation component which are then derived in conjunction. This principle not only carries our reasoning from the previous chapter to its natural fruition, but in many ways provides us with a uniform theoretical device that exactly parallels covert movement. Just as minimalists do not place any *a priori* restrictions on what may be moved, instead limiting movement by associating it with feature checking, we do not want any *a priori* restrictions on the positions in which elements may be interpreted. Such restrictions should arise as a result of and be motivated by other factors. We therefore adopt the scope-denotation separation as a primitive in our system.

- (21) **Scope-denotation separation principle (SDSP)**
 Every syntactic object provided in a numeration must be associated with a scope and denotation component.

This division, beyond its specific ramifications in deriving the ability of quantifiers to scope out of prepositional phrases and embedded clauses, reflects the broader intuition that interpretation is less sensitive to islands than is A'-movement. For example, A'-elements can absolutely not extract out of PPs that modify subjects, although

we just saw quantifiers have no trouble with such extractions.

- (22) a. The boy at the party liked Sophie.
 b. *Where did the boy at like Sophie?

Likewise, strong *wh*-islands do not allow any kind of A'-extraction.

- (23) a. I wonder what John fixed with the wrench.
 b. *Who did I wonder what fixed with the wrench.

However, universal quantifiers, for example, can easily scope out of such situations. To see this, note that in the sentence below both $\forall \gg \exists$ and $\exists \gg \forall$ readings are attested.

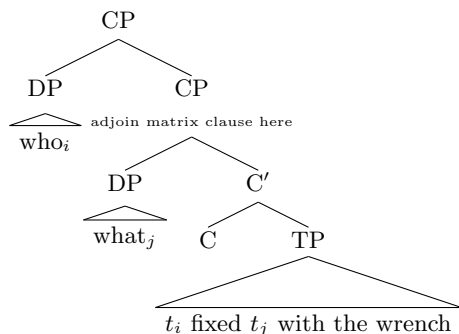
- (24) Some girl wondered what every boy fixed with the wrench.

Quantifiers can thus be seen to be less limited in terms of the constructions they may scope out of. This is certainly not to say their scope taking is unbounded, however. For example relative clauses are islands to quantifier interpretation, much as they are for A'-extraction.

- (25) a. The girl who went to the conference liked Rolando.
 b. *Where did the girl who went like Rolando?
 c. Some girl who went to every conference liked Rolando. ($\exists \gg \forall$), ($*\forall \gg \exists$)

As Frank (2004) demonstrates in Chapter 5 of his book, syntactic islands are in most cases a direct consequence of either the restrictiveness of the TAG operations of substitution and adjoining or the conditions of well-formedness conditions on elementary trees. That is to say that they follow from the framework itself without stipulation. For example, the strong *wh*-islands in (23) follow from the fact that English C^0 elements do not allow multiple *wh*-elements in the specifiers they project. Thus the elementary tree projected from *fixed* cannot host two *wh*-elements in its CP specifier, so there is no way to enact the fronting of two *wh*-elements.

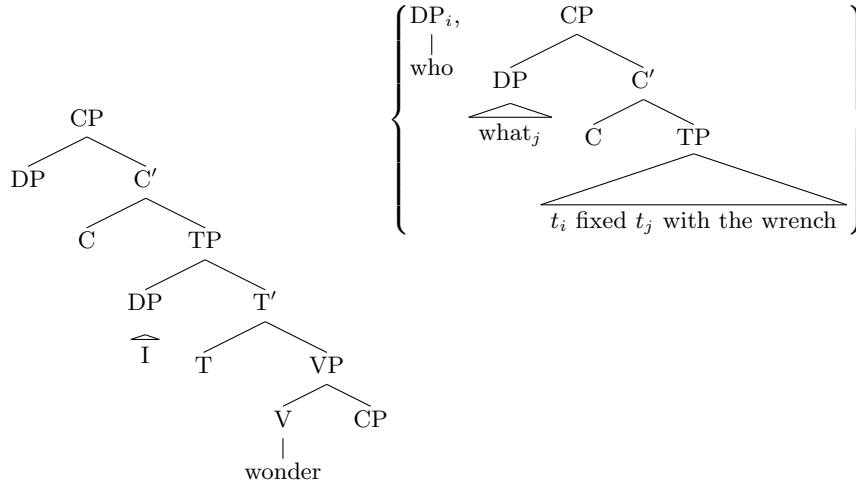
- (26) Who did I wonder what fixed with the wrench.



Such examples, however, may be derived with tree-local MCTAG: we simply posit that the elementary tree for the embedded clause features a degenerate DP node that will represent the long-moved argument, in this case *who*, as well as the standard tree projected from *fixed*. These two trees can then combine with a matrix clause tree of the form below.¹¹

¹¹In fact Frank (2004) proposes an analysis of exactly this sort to handle long *wh*-movement out of weak islands.

(27)



It follows that the dichotomy enforced by the SDSP matches well with the facts: syntactic islands are enforced by the unavailability of MCTAG in the derivation of the PF object; in the derivation of the LF object, on the other hand, the use of MCTAG permits certain elements such as quantifiers to scope out of some islands. The SDSP is thus best thought of as a reflection of the fact that A'-movement is subject to stricter constraints than is the scope taking of various elements.

With the scope-denotation split made precise, we turn to the derivation, including the processes and well-formedness conditions on LF-trees that are required. In keeping with the SDSP, we at least need our derivation to maintain the scope-denotation separating as it combines elements from the numeration, so that we have at least one “boundary condition,” so to speak. Before moving on, we note that the proposals that follow are not intended to be much more than broad sketches.

Our first topic will be LF-tree well-formedness. Essentially, we need our LF-trees to be well-formed in the vague sense that the types of two sister nodes should be able to combine in some meaningful way. If they cannot, these type mismatches will be passed on to the semantic system and cause the derivation to crash. We formulate this explicitly below:

(28) **Semantic well-formedness condition (SWC) (*preliminary*)**

Every elementary LF-tree must not contain type-mismatched sister nodes.

Such a rule presupposes the existence of some set of rules or procedures for determining what types of sister node combinations are allowed, so we need to explore the form such rules might take. However, the form of the rules itself depends on what we take to be the definition of a “LF-tree” in the first place. In our derivations above, we have implicitly—and somewhat haphazardly—taken our LF-trees to comprise structures that could be assigned an interpretation without offering any real interpretation algorithm or even any clear definition of what the nodes of the tree should look like. To begin to remedy this shortcoming, let’s define an LF-tree as follows:

(29) **Semantic Trees**

An LF-tree τ is a binary branching tree where each node is a denotation or a λ -operator.¹²

For simplicity, we label all nodes by their type, although implicitly each node (except λ -nodes) is a denotation—a function—with a specific behavior. Thus far we have also implicitly taken there to be a semantic relationship between the children of an LF-tree node and the node itself. Making precise this relationship is tantamount to enforcing well-formedness, as we now see.

Borrowing from the work of Heim & Kratzer (1998), we extend the interpretation function $\llbracket \cdot \rrbracket$ to allow it to take trees as arguments. We define the extension of this function in a top-down recursive way, thus establishing the set of acceptable relationships between parent and child nodes. Well-formed trees, then, are those in the domain of the interpretation function. The basic definition of the function appears below, where

¹²Probably we should be more careful about this and not allow λ -operators as nodes in the tree, but rather define binding by updating an assignment function when we abstract arguments. For the purposes of the ensuing discussion, however, putting the λ -operators in the tree and representing abstraction in this way is far clearer and hence we’ll bend the rules here.

τ_T denotes the type of denotation τ .¹³

$$(30) \quad \llbracket \cdot \rrbracket_\tau : \text{LF-trees} \mapsto \text{denotations}$$

$$\text{a. } \llbracket \begin{array}{c} \alpha \\ \beta \quad \gamma \end{array} \rrbracket_\tau = \begin{cases} \llbracket \beta \rrbracket_\tau (\llbracket \gamma \rrbracket_\tau) & \text{if } \beta_T = \langle \sigma, \tau \rangle \text{ and } \gamma_T = \langle \sigma \rangle \\ \llbracket \gamma \rrbracket_\tau (\llbracket \beta \rrbracket_\tau) & \text{if } \beta_T = \langle \sigma \rangle \text{ and } \gamma_T = \langle \sigma, \tau \rangle \\ \lambda P. \llbracket \beta \rrbracket_\tau(P) \wedge \llbracket \gamma \rrbracket_\tau(P) & \text{if } \beta_T = \gamma_T = \langle \sigma, \tau \rangle \\ \lambda x. \llbracket \gamma \rrbracket_\tau & \text{if } \beta \text{ is a } \lambda\text{-operator binding } x \\ & \text{and } \gamma \neq \lambda y \text{ for some variable } y \\ \lambda x. \llbracket \beta \rrbracket_\tau & \text{if } \gamma \text{ is a } \lambda\text{-operator binding } x \\ & \text{and } \beta \neq \lambda y \text{ for some variable } y \\ \text{undefined} & \text{otherwise} \end{cases}$$

$$\text{b. } \llbracket \alpha \rrbracket_\tau = \llbracket \alpha \rrbracket \text{ if } \alpha \text{ is a non-branching node}$$

It follows that the denotation of a parent node follows directly from the denotation of its children in a predictable and limited way: one child can apply to its sister, children of the same type can be joined into a complex denotation representing the conjunction of the children, or one child can indicate an act of λ -abstraction over its sister. Beyond this, there are two important facts to take away from the definition. First, LF-trees are inherently unordered in that the method of combining the children to yield a parent is indifferent to which argument occurs on the left or right. This provides considerable freedom in structuring and deriving these trees. Second, we can now offer a more precise definition of well-formedness, as below.

$$(31) \quad \textbf{Semantic well-formedness condition (SWC) (*final*)}$$

All elementary LF-trees must be in the domain of $\llbracket \cdot \rrbracket_\tau$.

The SWC allows the ruling out of obviously nonsensical constructions and vastly reduces the space of allowable trees. Beyond this we will not posit any other well-formedness constraints, opting instead to limit our trees by exploiting the formal link between syntax and semantics provided by STAG. The basic idea will be that each item introduced in the numeration will have a syntactic component and a scope-denotation semantic component set. As operations of MERGE and MOVE deform the structure on the PF side of the derivation, corresponding operations likewise build up and deform the structure on the LF side of the derivation in predictable ways.

The chief technique we will adopt for affecting this bipartite derivation will be to modify the definitions of MERGE and MOVE. Let us denote the set of all PF-trees as τ_{PF} and the set of all LF-trees as τ_{LF} . Then the standard MERGE and MOVE have the domain and range depicted in (32-a). In our new derivation process, we will extend this domain and range so as to handle to added syntax-semantics pairing afforded by STAG. Such an extension is depicted in (32-b).¹⁴

$$(32) \quad \text{Let } \tau_{\text{PF}} \text{ denote the set of all PF-trees and } \tau_{\text{LF}} \text{ denote the set of all LF-trees.}$$

$$\text{a. MERGE, MOVE: } \tau_{\text{PF}} \times \tau_{\text{PF}} \mapsto \tau_{\text{PF}}$$

$$\text{b. MERGE, MOVE:}$$

$$(\tau_{\text{PF}} \times (\tau_{\text{LF}} \times \tau_{\text{LF}})) \times (\tau_{\text{PF}} \times (\tau_{\text{LF}} \times \tau_{\text{LF}})) \mapsto (\tau_{\text{PF}} \times (\tau_{\text{LF}} \times \tau_{\text{LF}}))$$

Setting aside the behavior of the syntactic component of MERGE, we'll discuss some of the core properties of the semantic component through an examination of the examples we have already discussed. We begin with our simplest example, (1), repeated below.

(1) Every boy likes a girl.

Recall that on the PF side, there are three elementary trees: one each for the two quantified DPs, and one for the clause projected by the verb. We begin with the latter of these three, the extended verbal projection.

¹³The additional conditions on the λ -abstraction rules is to rule out denotations of the form $\lambda x. \lambda y.$ which are not well defined in the lambda calculus.

¹⁴The MCTAG formalism we rely on on the semantic side requires that the trees we are using form a set, not an ordered pair. Below, however, we have depicted MERGE as acting on pairs of LF-trees. This is because we need for MERGE to know the difference between scope and denotation trees. However, once MERGE has built the structures, we can essentially unorder them before the TAG machinery completes the derivation.

Following our discussion above, we will assume that each item enters the numeration with a syntactic part and a pair of semantic parts.

(33) Numeration N for verbal extended projection of (1):

$$N = \left\{ \left(\text{DP}, \left(\begin{array}{c} e \\ e_{[+x']}, | \\ x' \end{array} \right) \right), \left(\text{DP}, \left(\begin{array}{c} e \\ e_{[+y']}, | \\ y' \end{array} \right) \right), \left(\begin{array}{c} \text{V} \\ | \\ \text{likes} \end{array}, \left(\begin{array}{c} \langle e, \langle e, t \rangle \rangle \\ t, | \\ \text{likes} \end{array} \right) \right), (\text{T}, (I, I)) \right\}$$

Note that we will not consider tense in our derivation, taking it to be semantically vacuous. As such we will associate it with the polymorphic identity function in both the semantic components. For representational simplicity, we do not include these functions in our derivation. We have associated the non-projected DPs with a denotation part contain an arbitrary unbound variable, and a scope part containing a substitution site. These choices are both natural and consistent with our discussion. The denotation of a non-projected DP that has yet to be associated with lexical content is intuitively similar to an arbitrary unbound variable: both are place holders in a verbal argument structure, “waiting” for lexical content, so to speak, either in the form of substituted syntactic material or a semantic binder. On the scope side, the open type e argument reflects the syntactic status of non-projected DPs as requiring substitution of an argument. Moving on to the semantic component associated with the verb, the denotation component is simply a non-branching node containing the denotation of the verb. On the scope side there is a degenerate t node reflecting the requirement that verbal projections scope alongside other type t denotations.

Our task, then, is to describe how these separate pieces are merged together to form the desired scope and denotation trees. Certainly we want our merging operation to only derive well-typed trees, so that we are restricted to structure building operations that are invertible by the interpretation function. Accordingly, the first behavior that our structure building function should have is one of application. First let’s see what the rules of the LF-tree version of MERGE should look like in terms of constructing a single scope or denotation tree. Once we have this function determined, we can simply duplicate it to derive scope and denotation pairs in conjunction. To simplify our representation, let’s call the LF-tree component of the MERGE function, namely the function from pairs of LF-trees to LF-trees, MERGE_{LF} .

(34) **Merge application rule**

Let S and T be LF-trees rooted in denotations of type $\langle \sigma \rangle$ and $\langle \sigma, \tau \rangle$, respectively. Then:

$$\text{MERGE}_{\text{LF}}(S, T) = \text{MERGE}_{\text{LF}}(T, S) = \begin{array}{c} \langle \tau \rangle \\ \wedge \\ S \quad T \end{array}$$

This allows us to derive, for example, the denotation component associated with the verb *likes*. We simply compute the following:

$$(35) \quad \begin{array}{l} \text{a. } \text{MERGE}_{\text{LF}} \left(\begin{array}{c} e \\ | \\ y' \end{array}, \text{MERGE}_{\text{LF}} \left(\begin{array}{c} e \quad \langle e, \langle e, t \rangle \rangle \\ | \quad | \\ x' \quad \text{likes} \end{array} \right) \right) \\ \\ \text{b. } \text{MERGE}_{\text{LF}} \left(\begin{array}{c} e \\ | \\ y' \end{array}, \begin{array}{c} \langle e, t \rangle \\ \wedge \\ \langle e, \langle e, t \rangle \rangle \quad e \\ | \quad | \\ \text{likes} \quad x' \end{array} \right) \\ \\ \text{c. } \begin{array}{c} t \\ \wedge \\ \langle e, t \rangle \quad e \\ \wedge \quad | \\ \langle e, \langle e, t \rangle \rangle \quad e \quad y' \\ | \quad | \\ \text{likes} \quad x' \end{array} \end{array}$$

However, it is clear that the application rule cannot generate the desired scope tree, which features λ -operators intended to bind the variables in the structure above. In order to derive this tree, we associate the degenerate e component of the DP scope tree with a feature $[+x']$, that indicates that the MERGE_{LF} operation must introduce a λ -operator binding variable x' when it adds the corresponding degenerate type e node to the structure. This

type e node should then serve as the argument to the function created by adding the λ -operator. We can enact this by adding the λ -operator, effectively introducing a λ -abstraction over the denotation the rest of the tree represents. Then, we can merge the type e argument as sister to the λ -abstracted denotation. Again, this rule corresponds to the interpretation function's λ -abstraction component.

(36) **Merge λ -abstraction rule**

Let S and T be LF-trees rooted in nodes of type $\langle\sigma\rangle$ and $\langle\tau\rangle$, respectively, where $\langle\tau\rangle \neq \langle\sigma, \gamma\rangle$ for some type γ , and S contains a variable binding feature $[+x']$. Then:

$$\text{MERGE}_{\text{LF}}(S_{[+x']}, T) = \text{MERGE}_{\text{LF}}(T, S_{[+x']}) = S \begin{array}{l} \langle\tau\rangle \\ \swarrow \quad \searrow \\ \langle\sigma, \tau\rangle \\ \swarrow \quad \searrow \\ \lambda x' \quad T \end{array}$$

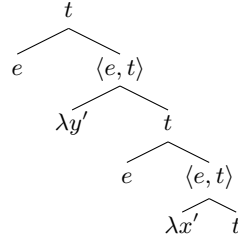
The rule in (36) captures the fact that since the non-projected DPs come from the lexicon with a saturated variable argument necessitates some sort of binding to specify the intended referent of the variable. Consequently, we need some way of categorically associating the scope component of the DP with some sort of λ -operator. In particular, our use of a variable feature on the degenerate scope type e node, combined with the rules in (36), ensures that the denotation component, in this case the bound variable x' , will be appropriately bound in the same step that its scope correlate is added to the structure.

With the merge λ -abstraction rule in place, we can successfully derive the scope tree for our example:

(37) a. $\text{MERGE}_{\text{LF}}(e_{[+y']}, \text{MERGE}_{\text{LF}}(e_{[x']}, t))$

b. $\text{MERGE}_{\text{LF}} \left(e_{[+y']}, e \begin{array}{l} t \\ \swarrow \quad \searrow \\ \langle e, t \rangle \\ \swarrow \quad \searrow \\ \lambda x' \quad t \end{array} \right)$

c.

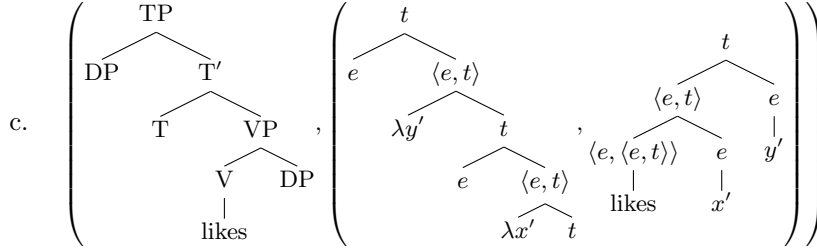


To bring the individual steps together, we can now take our global MERGE function which combines the PF-tree merge and two copies of the LF-tree merge into a single function with a domain and range as specified above. We'll assume that any merger which occurs in the PF-tree must be replicated in the scope and denotation components of the LF-tree set by a corresponding application of the MERGE_{LF} function. In this way the PF-tree and both the components of the LF-tree set are constructed in unison. Below we outline the derivation of the elementary tree set for the verbal extended projection in (1).¹⁵

(38) a. $\text{MERGE} \left(\left(\text{DP}, \left(e_{[+y']}, \left| \begin{array}{l} e \\ y' \end{array} \right. \right) \right), \text{MERGE} \left(\left(\text{DP}, \left(e_{[+x']}, \left| \begin{array}{l} e \\ x' \end{array} \right. \right) \right), \left(\text{V}, \left(\begin{array}{l} \langle e, \langle e, t \rangle \rangle \\ \text{likes} \end{array} \right), \left(\begin{array}{l} t \\ \text{likes} \end{array} \right) \right) \right) \right)$

b. $\text{MERGE} \left(\left(\text{DP}, \left(e_{[+y']}, \left| \begin{array}{l} e \\ y' \end{array} \right. \right) \right), \left(\begin{array}{l} \text{VP} \\ \text{likes} \end{array} \right) \text{DP}, \left(\begin{array}{l} t \\ \langle e, t \rangle \end{array} \right), \left(\begin{array}{l} \langle e, t \rangle \\ \langle e, \langle e, t \rangle \rangle \\ e \\ \lambda x' \quad t \quad \text{likes} \quad x' \end{array} \right) \right)$

¹⁵We leave out the merging of the T node for simplicity.



The derivation of the quantifier DP LF-trees proceeds likewise according to the rules above. The only difference is in the elements included in the numeration, which we list below:

(39) Numeration N for quantified DP:

$$N = \left\{ \left(\left(\begin{array}{l} \langle \langle e, t \rangle, t \rangle \\ e \quad \langle e, t \rangle \quad \langle \langle e, t \rangle, \langle e, t \rangle, t \rangle \\ \quad \lambda y \quad t \quad \quad \quad \text{every} \end{array} \right) \right), \left(\begin{array}{l} \langle e, t \rangle \\ N, \quad I, \quad \text{boy} \end{array} \right) \right\}$$

In the denotation component of *every*, we rely on a fairly complex tree which asserts the status of *every* as an inherent variable binder: the λ -operator binding the variable in the scope component comes precoded from the lexicon.¹⁶ Note that the noun *boy* is associated with an identity function in its scope component. This decision is a reflex of a topic we discussed earlier: while we do not want to preclude scope trees *a priori* for any elements, sometimes they are not necessary and hence will be represented as a polymorphic identity function that we leave out of our representation of the derivation. The desired trees then arise as a result of a simple execution of the merge application rule. Once the DP trees have been derived, the resulting semantic and syntactic structures follow in the manner depicted in the previous section, and we successfully derive the trees for (1).

Turning now to (8), repeated below, we need to explain the derivation of the elementary tree projected by *at*. The numeration for this trees is as follows.

(8) John liked some girl at every party.

(40) Numeration N for prepositional phrase projected from *at*:

$$N = \left\{ \left(\begin{array}{l} \text{P} \\ \quad \langle e, \langle \langle e, t \rangle, \langle e, t \rangle \rangle \rangle \\ \text{at} \quad \quad \quad \text{at} \end{array} \right) \right\}, \left(\begin{array}{l} \text{DP}, \left(\begin{array}{l} e \\ e_{[+x']}, \quad \text{I} \\ x' \end{array} \right) \right), \left(\begin{array}{l} \text{NP}, (I, \langle e, t \rangle) \end{array} \right) \right\}$$

The only new content here is the inclusion of a non-projected NP node, which is associated with an identity scope element and a type $\langle e, t \rangle$ denotation element. This is in keeping with both the use of the degenerate NP within the structure and the type of NPs that are projected from nouns (see, for example, (39)). The derivation of the desired elementary tree proceeds first via the merge application rule, which joins the denotation components of the *at* and the non-projected DP. This is accompanied by an application of the merge λ -abstraction on the scope side. The resulting trees are then joined with the non-projected NP via the merge application rule, which leaves us with the tree below, as desired. The other elementary trees involved in the derivation of (8) are identical to their counterparts in (1), so we do not detail their derivation.

¹⁶The exact reason why *every* comes with a fairly complicated tree directly from the lexicon is a difficult one to address. It may be that in fact that determiners should project their own elementary trees, in which case the above LF-tree associated with *every* could be associated with a derivation process instead of pulled from the lexicon. At this time, it is not clear to the author how to proceed with this sort of argument, so we simply place the burden squarely on the lexicon.

$$(41) \left(\left(\begin{array}{c} \text{NP} \\ \text{NP} \quad \text{PP} \\ \quad \quad \text{P} \quad \text{DP} \\ \quad \quad \text{at} \end{array} \right), \left(\begin{array}{c} \langle e, t \rangle \\ \text{e} \quad \langle e, t \rangle \\ \quad \quad \lambda x' \quad t \\ \langle e, t \rangle \quad \langle \langle e, t \rangle, \langle e, t \rangle \rangle \\ \quad \quad \langle e, \langle \langle e, t \rangle, \langle e, t \rangle \rangle \quad \text{e} \\ \quad \quad \quad \quad \quad \quad \lambda x. \lambda P. \lambda y. \\ \quad \quad \quad \quad \quad \quad \text{y is at x and } P(y) = 1 \\ \quad \quad \quad \quad \quad \quad \quad \quad x' \end{array} \right) \right)$$

There is one final aspect of MERGE that warrants discussion. Recall that we required our merge application and λ -abstraction rules to lead to structures that are exactly of the form required for the interpretation function we defined in (30). However, thus far we have no way of building a structure where the two sister nodes are of the same type although the interpretation function is defined on such configurations. Correspondingly, we will introduce a final merge rule to handle this deficiency.

(42) **Merge conjunction rule**

Let T and T' be LF-trees rooted in nodes of type $\langle \sigma, \tau \rangle$. Then:

$$\text{MERGE}_{\text{LF}}(T, T') = \text{MERGE}_{\text{LF}}(T', T) = \langle \sigma, \tau \rangle$$

Having thus defined the LF-tree version of the MERGE function, we can likewise offer an LF-tree version of MOVE. In keeping with the intuition that MOVE is primarily an operation driven by syntactic feature requirements, we do not want it to affect in any major way the denotation of the tree that it operates on. Moreover, we do not need movement to satisfy any interpretability requirements, so we'll simply assume, following Heim & Kratzer (1998), that the semantic component of MOVE is essentially an operation of λ -extraction that is limited to scope trees. Accordingly, MOVE has the same domain and range as MERGE, except that we require that one of the two inputs be a subtree of the other input. The behavior of MOVE will be to replace the target subtree with a variable, then merge the subtree with the root of the main tree. We associate a variable feature with the target subtree to ensure that the merger introduces the appropriate λ -operator.

(43) Let MOVE_{LF} be the semantic component of the MOVE function. Then given an LF-tree T with subtree S , we can define the following:

$$\text{MOVE}_{\text{LF}} = \text{MERGE}_{\text{LF}}(S_{[+x']}, T')$$

where T' is T with subtree S replaced by variable x' .

2.3 Deriving PF and LF objects from syntactic structure

We have said very little thus far on how the output of the STAG derivation is converted to the PF and LF objects that the MP posits as the output of the derivation. As we have made explicit above, the two components of the STAG derivation represent intermediate steps along the way to the derivation of the PF and LF objects, with the PF-trees and LF-trees, respectively, the entities that must eventually be transformed into PF and LF objects. Let's loom first at the LF object and its derivation. We'll make the perhaps naive and simplistic assumption that ultimately the LF object should be a proposition that the interpretive component of the language faculty can simply evaluate to true or false. Accordingly, our interpretation function $[\!]_{\tau}$ offers a natural way of transforming our LF-trees into LF objects. This has in fact been the implicit assumption we've made all along, but now it's explicit. As far as this author is concerned, there is no problem with simply postulating that the interpretation function linearizes the LF-tree into a proposition that then becomes the LF object. In this way, the syntax totally determines the character and form of the corresponding LF object it derives.

Turning now to the PF object, we'll focus here on the linearization of the PF-tree into a string and abstract away from issues of pronunciation. In all of the TAG literature to date, it is taken for granted that syntactic structure maps straightforwardly onto linear order, namely via a left-biased depth first search of the

syntactic structure that spells out terminals as it visits them. However, now that we have extended TAG to the interfaces, we essentially have access to all minimalist conceptions of the syntactic and post-syntactic components of the (PF) derivation. SPELL OUT is a well defined concept in our new STAG framework: it represents the point at which the TAG operations of adjoining and substitution cease to deform the structures relevant to the derivation. Accordingly, there is nothing preventing us from applying notions of post-syntactic movement, in particular, to our TAG formalism. After SPELL OUT, our framework is no different from any other minimalist theory. As such, we need not adopt the simplistic, but also elegant, view that syntax wholly determines word order. Indeed as we will show in the next chapter, TAG, in its inability to derive certain data, offers evidence that at least some types of head movement are post-syntactic.

2.4 Conclusion

We began this chapter with a reminder that interfaces are inextricable from the MP. As such, no theory that claims to be grounded in the framework can forever avoid having to deal with them. In this chapter, we faced this inevitable reckoning and outlined a means by which the TAG framework introduced in the last chapter may be made to interface with PF and LF. Instead of the traditional idea of a single derivation that bifurcates at SPELL OUT, we chose to divide our derivation at the very beginning into syntactic and semantic components. Using the STAG machinery, we detailed how elementary PF- and LF-trees may be combined in unison, ultimately yielding a pair of trees that may then be linearized to produce the PF and LF objects the MP demands. By exploiting multi-component elementary LF-tree sets, we then demonstrated, after [Frank & Storoshenko \(2012\)](#), that the STAG model can handle a variety of issues surrounding the syntax-semantics interface. In fact, we argued that the SDSP captures in an elegant way the confounding fact that A'-movement and scope taking, despite sharing many properties (including the means by which they are enacted in standard minimalist theories), differ in terms of the types of islands conditions they respect. We then argued in favor of a handling of quantifiers through a modification of [Shieber & Nesson's \(2008\)](#) particularly elegant treatment. Finally, we turned to the issue of how PF- and LF-elementary trees might be derived. We presented a sketch of a theory that exploits the syntax-semantics link afforded by STAG and allows us to straightforwardly derive all of the trees needed for our examples. In this area in particular, however, our discussion was a sketch with many details yet to be filled in. Ultimately, from the sum total of this discussion there emerges an outline of how TAG interact with the interfaces. From this discussion, we have opened the TAG framework up to the wide body of minimalist work on the topic of the interaction between syntax and word order, in particular. It is to this broad issue that we now turn our attention.

Chapter 3

Post-syntactic movement and TAG

As we discussed in great detail in the previous section, traditional notions of covert movement and the Y-derivational model are in many ways irreconcilable with the TAG-framework. Such incompatibility necessitates a different approach to capturing the essential form-meaning mismatch of natural language, and ultimately we argued that STAG is a reasonable framework for this task. With the STAG model, the derivation of the LF object is fundamentally different from corresponding derivations in more mainstream minimalist theories. The derivation of the PF object is, contrastively, almost identical to mainstream analogues. While the mechanisms responsible for the syntactic component of the derivation differ in that we apply the TAG rules for tree re-writing to build syntactic structure, the notion of SPELL OUT is both well-defined and relevant in our framework. In fact, after SPELL OUT, the TAG derivation and a standard minimalist derivation converge and are identical in form and function. This fact has some essential consequences for the investigation we will undertake in this chapter. Essentially, it allows us to apply verbatim a large body of work in the minimalist program directly to our framework. Likewise, we can expect that TAG will, due to its peculiarities, be able to inform certain aspects of minimalist ideas on post-syntactic phenomena.

Accordingly, our main task in this chapter has two complementary components. First, we will discuss the ramifications in our framework of various recent arguments regarding exactly which operations are properly syntactic and which belong to the post-syntactic component of the derivation.¹ Specifically, we will identify cases where minimalist ideas regarding the interaction of and distinction between syntactic behavior and post-syntactic behavior can help us to find solutions to puzzles in the TAG-framework that otherwise require somewhat arcane analyses. In many cases, these analyses sacrifice the elegance and predicate power inherent to TAG, so we would like to find alternatives. This leads to the second component of our task: instead of viewing the existence of phenomena that are difficult to describe with TAG as problems that necessitate complex and otherwise unmotivated changes to the framework, in this chapter we will argue that the difficulty of capturing certain behaviors in fact constitutes a prediction that the phenomena in question are not essentially syntactic. In this way, TAG may be seen to actually inform minimalist syntactic theory.

That said, we will narrow the discussion down to few discrete phenomena, the chief of which is head movement. Though traditionally assumed to be a syntactic phenomenon restricted by the same kinds of locality constraints as phrase movement, in recent years there have been attempts of varying success to argue that head movement is best viewed as a post-syntactic phenomenon. Chomsky (2001) lends credence to the idea by noting the various ways in which head movement fails to conform to generalizations that nicely capture the essential details and constraints on phrasal movement. The claim we will make is that many of the examples that are particularly troubling for TAG-based syntax can in fact be explained simply and elegantly if head movement is relegated to the post-syntactic component of the derivation. This will serve, on the one hand, to eliminate much of the need for MCTAG in the derivation of the PF object, and on the other to corroborate the notion that head movement is a post-syntactic behavior.

The remainder of the chapter is structured as follows. First, we very briefly explore the theoretical motivation for treating head movement as a post-syntactic operation. Next, we will examine two classes of examples that have prompted Frank (2004) and others to introduce MCTAG into the PF derivation. We will then argue that if head movement is a post-syntactic operation, these examples are derivable via familiar and unenhanced

¹I take the “post-syntactic” operations to include the effects traditionally attributed to the linearization process or to phonology. We’ll assume that the post-syntactic component of the derivation begins directly after SPELL OUT.

mechanisms. Extending beyond the purely theoretical issues with head movement, we will then present evidence based on the work of Bruening (2013) that some of the head movement that is problematic from a TAG perspective is in fact post-syntactic. We end with an aside that demonstrates that a class of examples that has been claimed to be troubling for TAG is actually derivable in a straightforward way under closer examination. In contrast, we show that the data is inexplicable from the perspective of mainstream minimalist syntax.

3.1 Head movement within the MP

In this section we will review Chomsky’s (2001) arguments for excluding head movement from the syntactic component of the derivation.² Note that these arguments, while not originally formulated with a TAG-based system in mind, are nonetheless applicable within our formalism with very minor revisions.

The first major argument is that head movement does not seem to have semantic effects in the same way that phrasal movement does. For example, it might be expected that since French verbs undergo V-T movement, they would differ in terms of certain scope effects from their non-raised English counterparts. No such effects have been observed.³

The second argument relates to the means by which head movement is motivated. All movement within the MP is attributed to the necessity of checking various uninterpretable features. It follows that the system of features must be adequately expressive not only to motivate the raising of XPs and heads, but also to distinguish these types of movement. Moreover, under the plausible assumption that XPs do not move to heads and vice versa, the system must also distinguish these two objects and ensure that illicit cross-category movement of this type does not occur. If head movement is post-syntactic, the system can be considerably simpler, in keeping with the minimalist emphasis on optimality: phrases move in syntax and heads move post-syntactically, and there is no need to otherwise distinguish them.

The third argument is that head movement, independent of the motivational concerns discussed above, requires a structural operation that is precluded on independent grounds. In particular, Chomsky (1995) proposes with his Extension Condition that all movement operations, and indeed all structure building operations more generally, must extend the root of the structure they apply to. The canonical examples of XP movement, such as subject and *wh*-fronting, can be seen to adhere to this constraint: the XP targeted for movement merges with the root of the structure – in these cases T’ or C’ respectively – and the root is extended. With head movement this is not the case, at least under standard assumptions. Heads are usually understood to undergo adjunction to other heads, so that movement of head X to head Y results in the following configuration. Clearly the movement has not expanded the root YP, which remains unchanged.



As a corollary to this argument, note that a head moved via adjunction to another head does not c-command its trace. This poses numerous theoretical problems, to the point that some authors have proposed re-defining the c-command relation altogether to avoid this conclusion (Kayne, 1994). However, no redefinition of the c-command relation that eliminates this problem is definable from MERGE alone. In fact, one of the original motivations of the Extension Condition was to guarantee that c-command be wholly definable in terms of MERGE: if nodes may only MERGE at the root of the structure being derived, then we can say that any node *A* c-commands the node *B* it is merged with, along with everything dominated by *B*. Such a complication in the definition of c-command is undesirable from an optimality point of view.

²The summary provided here owes its structure and form to the very helpful discussion by Roberts (2011).

³Harley (2004) (and many others) observes that this assertion does not appear to be universally true. Note that there do appear to be interpretive differences between the below examples, which purportedly differ only in whether or not the negative marker has undergone head movement.

- (1) a. Didn’t every key work?
 b. Did every key not work?

The final argument is that head movement is never successive cyclic like phrasal movement. This notion was captured in the so-called Head Movement Constraint, which states essentially that given three heads A, B, C such that $A >_c B >_c C$, where $>_c$ roughly denotes structural hierarchy, then C cannot move to A . Rather, C may move to B and then the complex head $[_{BC} B]$ may move to A . It is unclear under a syntactic account of head movement why this should be so, given that phrasal movement freely exhibits successive cyclicity. However, if head movement is some kind of morphological operation, it would make sense that “excorporation” of the sort required for successive cyclic movement of heads would be precluded.

To summarize, head movement is theoretically suspect from the perspective of the MP. Not only does it not pattern like phrasal movement in several key respects, but in order to capture its unusual behavior, we have to introduce a number of complexities into the system which would otherwise be unnecessary. Given that the word order effects of head movement are readily observable, so that it is a necessary operation at some level, Chomsky (2001) proposes to treat it as a post-syntactic phenomenon. We will now see that such a move is supported by TAG, and, in at least some instances, by empirical evidence.

3.2 Problematic head movement in TAG

Having seen some of the arguments in favor of relegating head movement to the post-syntactic component of the derivation, we will now turn our attention to two related examples where our TAG framework has been argued to be inadequate to derive the data in question. The existence of these examples prompted Frank (1992) to argue that the derivation of PF objects necessitates MCTAG, which we employed in the previous chapter to derive LF objects. Such a move is extremely undesirable for a number of reasons. First, much of the theoretical appeal of the TAG framework is that it captures in its fundamental structure and manipulation rules many facts that are simply stipulated in other frameworks. Critically, notions of locality follow from the notion of the elementary tree. Things like the tenet of Relativized Minimality are simply unnecessary, and almost all island effects are a consequence of the structure of elementary trees and the form of the substitution and adjoining rules (Frank, 2004). When we relax this system by introducing MCTAG, these properties in many cases disappear. We saw a few examples of this in the previous chapter. In the case of the derivation of the LF object, this is a desirable trait given that quantifiers can freely scope out of some islands. However, this very same slackening eliminates the TAG explanation of syntactic islands that essentially came for free as a primitive of the system. Such effects must therefore be independently stipulated, so that it becomes uncertain, at least to this author, what exactly has been gained by switching to a TAG formalism. A second issue is that with MCTAG, it becomes unclear how to derive the elementary trees that participate in the PF object’s derivation. This uncertainty in turn affects the fundamental link we established between the tree building operations in our STAG system. Defining the behavior of MERGE and MOVE on the LF side based on its behavior on the PF side is no longer possible in the way we have outlined. We will now show that if head movement is post-syntactic, all of this can be avoided and we can maintain, for these cases, an analysis that relies only on the standard elementary trees we have worked with all along.

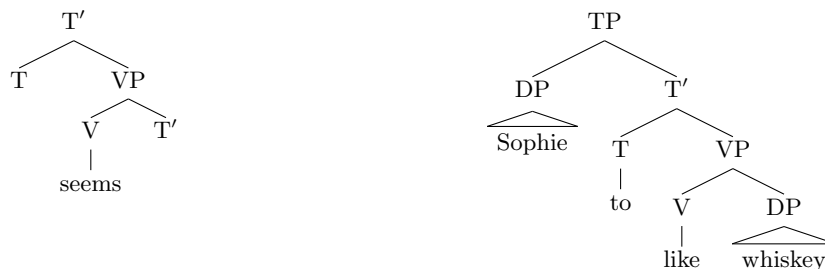
Let’s take a look at the first class of offenders, of which (3) below is one example.

- (3) Does Sophie seem to like whiskey?

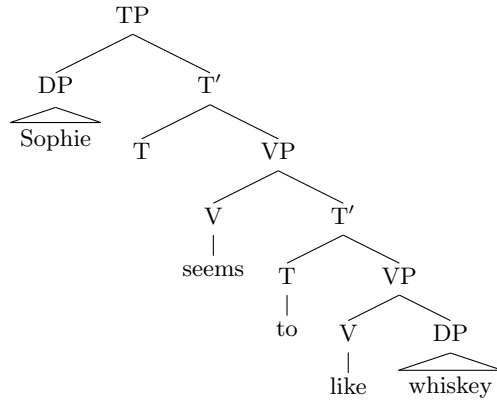
Recall that standard subject-to-subject raising examples like (4) are derived by adjoining a T' recursive elementary tree projected from *seems* into the elementary tree projected from *like* and containing the subject DP *Sophie*.

- (4) Sophie seems to like whiskey.

a. Matrix Clause: Embedded Clause:



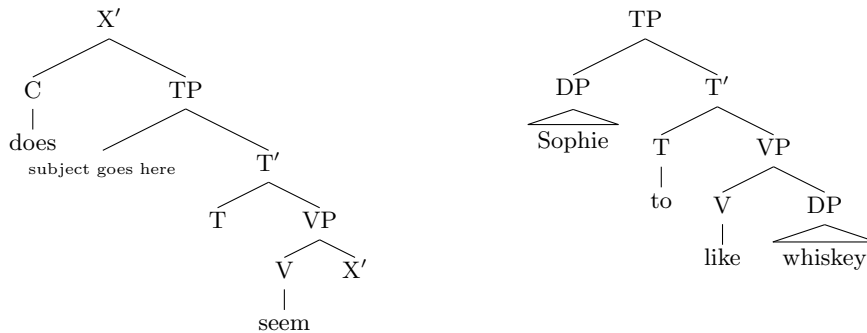
b. Result:



Essentially the raising is enacted by inserting the matrix verb between the raised subject and the embedded clause verb. In this way the raised subject receives its θ -role from and serves as underlying subject to the embedded verb, as desired.

Returning to (3), the presence of the auxiliary head *does* immediately poses problems for the analysis in (4). Given that *does* is a member of the elementary tree projected by *seems*, we run into two issues. The first is that if we want to reflect the movement of *does* from T-C and still affect adjoining, then we need our *seems* tree to be C' -recursive. Moreover, it is not clear where such a tree might adjoin in the tree projected from *like*. This is not necessarily an insurmountable problem, but we would have to somehow justify the selection of a C' complement to *seems* and posit some kind of unusual behavior in the downstairs tree. The second issue is much more troubling: even if we manage to form the elementary tree just described, with the auxiliary *does* moved to C, adjoining cannot derive the attested word order. There is simply no way, with this or any other (theoretically defensible) tree, to get interleaving of elements from the different trees that is required in (3); we need to somehow “wrap” the matrix clause elementary tree around the embedded TP specifier *Sophie*, an impossible move. We schematically represent this situation below, where we have abstracted away from the problem of the node at which adjoining occurs in order to demonstrate the structural impossibility of deriving the attested word order.

(5)



Frank’s (1992) solution to this issue, as mentioned above, is to posit that the matrix raising verb is in fact associated with a multi-component tree set of the form below.

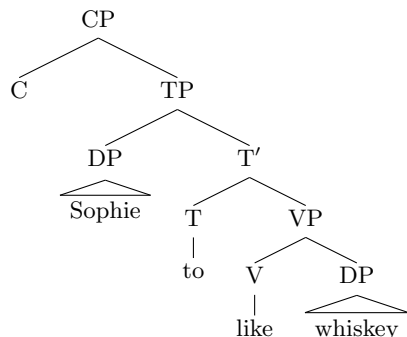
(6)



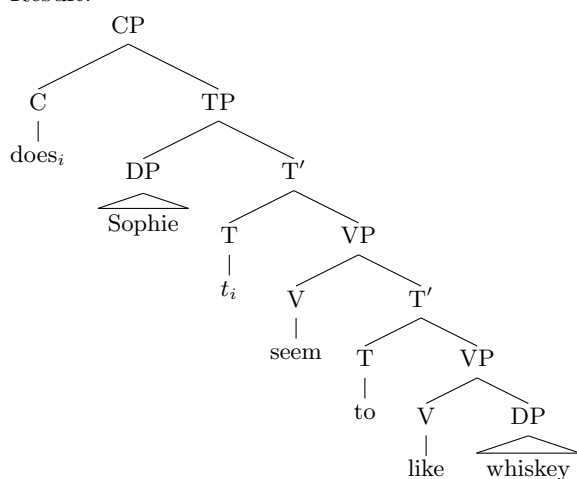
Note that this solves both the problems we mentioned above. First, we now capture the T-C movement with two separate trees, with the raised *does* heading its own degenerate C tree. This frees the tree projected from *seem* to be T' recursive in the ordinary sense. Moreover, (3) may be derived by simply adjoining the *seem*

tree into the embedded clause, then adjoining or substituting the tree headed by *does* into an appropriate C node projected from *likes*.

(7) a. Embedded clause:



b. Result:



A nearly identical situation arises with raising examples in verb-initial languages like Irish and Welsh (Harley & Kulick, 1998). In these languages, finite verbs in non-embedded contexts appear to the right of their subjects, hence the term verb-initial. Non-finite embedded verbs follow their subjects.

(8) a. Gwelodd Siôn ddraig.
saw-3.SG.PST John dragon.
“John saw a dragon.”

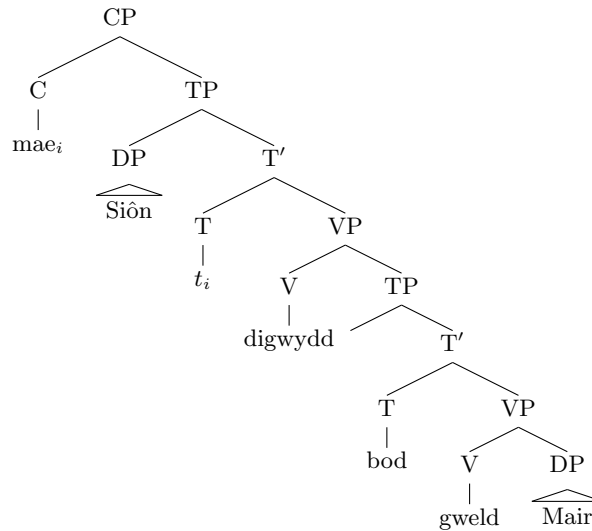
b. [CP Cyn i Siôn laddu draig] y mae rhaid iddo brynu llaeth i'r gath.
before to John kill dragon PTCL is necessity to-him buy milk for-the cat
“Before Johns kills the dragon he has to buy milk for the cat.”

On the basis of these and other data, it has been proposed that Welsh (and Irish) is underlyingly an SVO language whose phrase structure mirrors English in most important regards (Sproat, 1985). Under this assumption, verb-initial clauses are derived by moving the verbal head to a higher position by head movement. For the purposes of our discussion, let us assume that this movement is to C, after Harley & Kulick (1998).⁴ The troubling data once again come in the form of raising examples. To see an explicit example, the Welsh verb *digwydd*, “happen,” licenses subject-to-subject raising in a manner highly reminiscent to English. The verb has a non-thematic subject position that may optionally host a subject which for all intents and purposes is rightly the subject of a downstairs embedded clause (Harley & Kulick, 1998). We have represented the raising gap in (9-a) with underscores for clarity, and we give the corresponding tree in (9-b).

⁴This is a controversial assumption, to be sure, but the point of this exercise is not so much to differentiate this or that analysis of VSO syntax as it is to address a fundamental problem with our TAG framework. As such, we have simply chosen the analysis, in this case verb movement to C and not some other head, that makes the phenomenon in question easiest to talk about. The choice of describing Welsh and Irish VSO as being derived via head movement is likewise a somewhat contentious choice, but we are of the opinion that this analysis is correct. See McCloskey (2005) for a more thorough discussion.

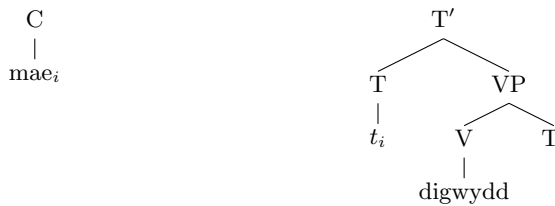
- (9) a. Mae Siôn yn digwydd -- bod yn gweld Mair.
 Is John PRT happen -- be.INF PRT see Mary
 “John happens to be seeing Mary.”
 (Harley & Kulick, 1998)

b.



Note that in the matrix clause, the finite auxiliary verb has undergone the obligatory finite clause verb fronting in place of the main verb, which is used as a participle here.⁵ Once again under the assumption that the finite auxiliary has moved to C, it should be quite clear that the data in (9-a) is identical to that in (3) modulo the lexical content. We have a non-finite embedded clause whose subject has been displaced past a matrix clause verb into a position directly following a matrix clause C⁰ element. Given that we once again need to position the matrix auxiliary verb in the elementary tree projected from the matrix verb *digwydd*, we cannot affect the interleaving necessary to derive this data. A multi-component tree set is thus necessitated via an identical argument to the one given for the English data in (3).

(10)



Analyses of the sort provided for the English and Welsh data pose not only the over-generation problems associated with the introduction of multi-component tree sets, but also they violate two fundamental principles of our framework: they allow movement to occur across elementary tree boundaries and they require a broadening of the sort of structures that count as “elementary.” Movement that is not local to an elementary tree, even if it is local to a tree set, is a violation of what is perhaps the single most essential assumption behind the TAG framework, repeated below.

(11) **The Fundamental TAG hypothesis:**

Every syntactic dependency is expressed locally within a single elementary tree.

Turning to the second problem, recall that we made the following requirement on our elementary trees:

(12) **Condition on elementary tree minimality (CETM):**

The syntactic heads in an elementary tree and their projections must form an extended projection of a single head.

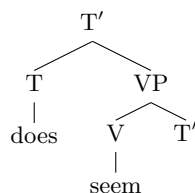
It follows that a C⁰ element should not be able to project an elementary tree: it is not a lexical head. Given

⁵Harley & Kulick (1998) uses examples of this slightly complicated form as a part of another argument; the problem we are describing shows up nicely even when the auxiliary, not the main verb, has fronted, so we saw no reason to change the example.

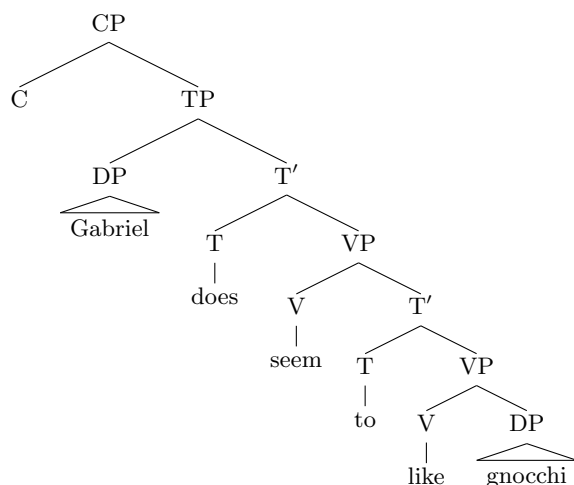
that these conditions form the backbone of the entire framework we have been discussing, such violations, if substantiated, cast serious doubt on the validity of the TAG approach. While we could perhaps relax these conditions to apply to sets of trees instead of trees themselves, we would then be faced with a host of new questions concerning what sorts of limits to impose on, as a small example, the cardinality of these sets and the structure of the trees within them. Moreover, we'd need to revisit literally the entire syntactic theory to ensure that the added flexibility of MCTAG didn't disturb our analyses – recall that we have already seen cases involving islands where we know it does. Our goal now will be to show that if we can treat subject-auxiliary inversion in English and verb raising in Welsh as a post-syntactic operation, then the examples above may be derived without recourse to multi-component tree sets or non-local syntactic dependencies.

For the sake of the argument, let us suppose that there is some post-syntactic means of enacting English and Welsh T-C movement, at least in the problematic contexts. To derive (3), we can simply adjoin the following T'-recursive elementary tree into the embedded clause tree in (7-a) to derive the result in (13-b).

(13) a. Matrix clause:



b. Result:



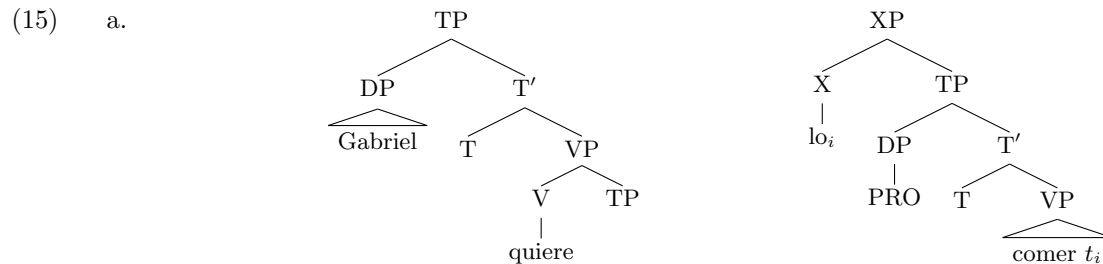
Our post-syntactic head movement mechanism can then move T-C, and the correct word order will be derived as desired. An identical argument obtains in Welsh, where we adjoin a raising-verb-headed elementary tree with an unmoved auxiliary verb into the tree projected from the embedded clause verb. Note that this analysis is identical in every respect to the case of traditional subject-to-subject raising. We do not need multi-component tree sets or non-local syntactic movement of any sort. We merely adjoin in the tree projected from a raising verb in the usual way, and presumably for the usual reasons (feature checking), deriving the correct result. Gone are all violations of the Fundamental TAG hypothesis and the CETM.

The second class of problematic examples we will entertain here is based on the Romance language phenomenon of “clitic-climbing.” These examples are in many ways even more problematic for TAG syntax, ultimately requiring *set*-local MCTAGs, which are computationally more powerful than standard TAG and tree-local MCTAG. While the details vary across the different Romance languages, in general pronominal object clitics have the ability to undergo non-local displacement from the position into which they are merged. In the Spanish example (14-a), the object pronominal clitic *lo* appears adjacent to the matrix subject. Thematically, however, it functions as the object of the embedded clause verb. Note that such displacement is forbidden if the object is not a pronominal clitic.

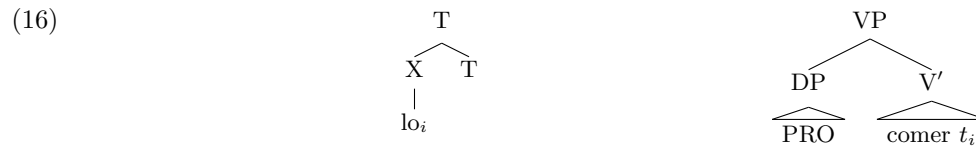
(14) a. Gabriel lo quiere ver.
 Gabriel it wants to see

- “Gabriel wants to see it.”
 (Frank, 2004)
- b. *Gabriel el plátano quiere ver.
 Gabriel the banana wants to see
 “Gabriel wants to see the banana.”

As Bleam (2000) points out, this kind of non-local movement is derivable only with tree-local MCTAG. The raised object clitic must move past the embedded clause verb, so that if we maintain our condition that head movement is tree local, the only possible way to derive a word order that looks anything like the above is to displace with clitic within the elementary tree projected from *comer*, then the do some kind of substitution or adjoining. Note however that once we have affected this displacement, the situation is nearly isomorphic to the troubling English and Welsh examples: the matrix clause must undergo a “wrapping” of sorts around an element of the embedded clause:



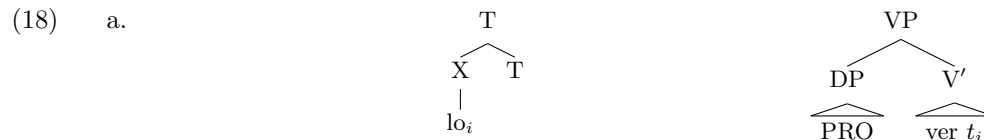
To derive this data, we detach the object clitic to its own elementary tree, so that both it and the tree projected from the verb can undergo tree-local substitution into the tree projected from the matrix verb.⁶



Unfortunately, there are examples that even this approach cannot derive. Bleam (2000) notes that in Spanish, clitics from different clauses may simultaneously climb to a single matrix clause position, just following the subject.

- (17) Mari te_i lo_j quiere permitir- t_i ver- t_j .
 Mary you it wants to permit to see
 “Mary wants to permit you to see it.”
 Bleam (2000)

To see why tree-local MCTAG cannot derive these sorts of examples, note that as in the case of (14-a), we must posit that each of the object clitics is associated with its own elementary tree in a multi-component set. For the clauses projected from *ver* and *permitir*, we thus have the following tree sets.



⁶To conform with the analysis traditionally given for clitic climbing, I have assumed that the clitic adjoins to *T*. If we are to maintain any semblance of our theory as to how elementary trees are derived, we will be forced to omit any *T* projection from the tree associated with *comer*. This in turn necessitates that we leave the *PRO* in its base generated position inside the *VP*. To make a long story short, this is a dubious analysis in many ways.

b.



To derive this data, we must combine the trees associated with the embedded-most clause with *both* the trees associated with the intermediate clause. First we need to adjoin the two clitic trees together; the result may then adjoin into the matrix clause to enact the clitic climbing. Second, we need to substitute the tree projected from *ver* into the tree projected from *permitir* to derive the clausal embedding; the result must then be substituted into the matrix clause tree. It follows that the elements of the tree set associated with the embedded-most clause must be combined with two different trees, thus violating tree-locality. The derivation is *set-local*, however: given that the trees associated with the embedded-most clause combine with trees in a single set. It turns out that this move to set-local MCTAG involves a corresponding increase in formal generative capacity that is not desirable.⁷

As with English subject-auxiliary inversion and Welsh subject-to-subject raising, the argument here is that if we can enact clitic climbing after the syntactic component of the derivation, then our TAG framework can easily derive the data in question. Indeed under the standard assumption that clitic movement is head movement, it is vulnerable to all the theoretical arguments in the previous section and thus may be treated as a post-syntactic phenomenon. It follows that to derive the clitic climbing data, the derivation can proceed just as the derivation of any multi-clausal sentence would, in a way that is well within the bounds of the TAG framework. Crucially, we leave the clitics in their canonical base merged object positions throughout the syntactic component of the derivation. Then, after SPELL OUT, the clitics are fronted according to their particular needs.

At this point, it is important to emphasize the ramifications of this result. Superficially, the inability to derive simple sentences like (3), or to describe the robust phenomenon of Romance clitic climbing, seems like a major problem for TAG. That we must relax our most basic assumptions to handle these simple cases is deeply troubling. However, as soon as it becomes apparent that the sort of purported syntactic operation that we are unable to model is theoretically and empirically suspect in a number of different ways, this data becomes immediately less threatening.⁸ Indeed as we mentioned in the introduction, the derivational incompatibility of (3) transforms from a liability into an asset. Chomsky’s (2001) objections that we pointed out in the previous section are realized in the actual structure of our framework: head movement in many instances becomes a violation of fundamental principles of locality that are in other contexts (islands, raising, etc.) strictly adhered to.⁹ TAG therefore offers yet another theoretical condemnation of syntactic head movement.

3.3 Subject-auxiliary inversion: an empirical claim

From the theoretical arguments offered by the MP to the structural inability to enact some types of head movement in TAG, we have now seen a litany of complaints against treating head movement as a syntactic phenomenon. In contrast, we have not offered much in the way of empirical evidence in favor of this claim. Part of the reason for this is simply that it is so difficult to tease apart the predictions of a syntactic versus post-syntactic account of head movement. Moreover, in the few such cases that have been identified, the data is often rather inconclusive. In this section, we seek to address, in a small way, this problem by presenting an empirical argument in favor of treating English subject-auxiliary inversion as post-syntactic. The account relies on two minimalist assumptions that are well motivated but by no means completely uncontroversial: the copy theory of movement with a post-syntactic determination of copy chain deletion and the ALIGN theory of subject-auxiliary inversion (Bruening, 2013). The idea is that subject-auxiliary inversion in English is an

⁷Recall from chapter 1 that tree-local MCTAG is computationally equivalent to standard TAG. This is not true of set-local MCTAG (Weir, 1988), which can be demonstrated to be formally more expressive.

⁸The empirical data is less clear but see Boeckx & Stjepanović (2001) and Wurmbrand (2004) for some elegant and convincing arguments.

⁹In the case of long-distance clitic movement, as we will see in the next section, the it is quite clear that even non TAG notions of locality are violated. With subject-auxiliary inversion, this is a more difficult case to make if we take a step back from our TAG theory. However, I will present data at the end of this chapter that suggests that raising verb clauses have an “island” like flavor to them.

essentially post-syntactic repair mechanism enacted to ensure that the derivation satisfies an independent phonological condition. We'll briefly argue in favor of the core points of these assumptions then proceed to detail the argument.

We adopt the copy theory of movement without fanfare since it is a minimalist staple and for the most part uncontroversial.¹⁰ The copy theory takes as its primary motivation the so-called Inclusiveness Condition (IC). The IC is the assumption, established by Chomsky (1995), that syntax should be limited to rearranging lexical items; it should not be able to create content in any meaningful way. Movement traces, which in Government and Binding are truly autonomous objects with a distinct set of regulations, are an obvious offender of this condition. As a consequence, the IC dictates that we should seek to eliminate traces from our theory if at all possible.¹¹ The copy theory of movement provides a mechanism for achieving this. When movement occurs items are duplicated, with one copy remaining in situ and the other undergoing dislocation. No new content is produced, as copies, in contrast to traces, are not distinct syntactic objects with their own set of governing rules.

Once the copy theory of movement has been adopted, the obvious question is how to determine which copy in a given copy chain is pronounced. From the perspective of the IC, copy deletion should be relegated purely to the post-syntactic component of the derivation. If the unpronounced copies in a chain are somehow specially marked as such in narrow syntax, they become little more than glorified traces, imbued with information that is extraneous to the derivation. All copies should therefore be essentially identical in narrow syntax aside from variations in the presence of checked versus unchecked features. In addition to this theoretical argument, the empirical data likewise corroborates the story of a post-syntactic determination of chain deletion. One example comes from Romanian, which is a multiple *wh*-fronting language where all *wh*-elements obligatorily appear sentence initially.

- (19) a. Cine ce precede?
 who what precedes
 “Who precedes what?”
 b. *Cine precede ce?
 (Bošković, 2002)

Notwithstanding this behavior, there is one context in which multiple *wh*-fronting is precluded: two identical *wh*-words may not appear simultaneously in sentence-initial position.

- (20) a. *Ce ce precede?
 what what precedes
 “What precedes what?”
 b. Ce precede ce?
 (Bošković, 2002)

(20-a) is ruled out by a PF constraint in Romanian contra repeated identical *wh*-words (Bošković, 2002), and the *wh*-element in such cases must remain in situ, a behavior that is ordinarily forbidden (cf. (19-b), (20-b)). If the pronunciation of a copy chain is determined in narrow syntax, this behavior is confounding. Syntactically, the copy chains formed by the fronted *wh*-phrase *ce* in (19-b) and (20-b) are indistinguishable; their elements have the same features and are in the same structural configurations.

- (21) a. [CP Cine_i ce_j [TP cine_i [VP precede ce_j]]]
 b. [CP Ce_i ce_j [TP ce_i [VP precede ce_j]]]

A syntactic determination of which copy to spell out would therefore be forced to explain why two identical chains are spelled out differently based on the phonological content of an element that is neither in the chain nor in a syntactic relationship with the chain. Presumably the syntax should not even have access to the phonological content of the subject *ce* at all, given that it is little more than an abstract feature bundle at this stage in the derivation. On the other hand, if we allow that chain pronunciation is determined post-

¹⁰The trees and diagrams that appear throughout this thesis have in large part relied on X-bar theory and traces. This is in large part because it is easier to represent trees using this notation and terminology. In the remainder of this section, we will utilize the notation consistent with the copy theory of movement we are now advocating.

¹¹In some ways the TAG account of raising, for example, is a manifestation of this condition. As Frank (2004) argues, eliminating traces in this way has explicit theoretical advantages.

syntactically, the data falls out nicely. We simply state that one copy in a chain must be spelled out, and that in (20-b) the general preference to spell out higher copies, which is independently motivated by economy principles, is overridden by the restriction against repeated identical *wh*-elements.¹² The lower copy is therefore spelled out. No arbitrary distinction needs to be made between the identical chains in (19-b), (20-b), and no theoretically suspect differentiation needs to be made between lower and higher copies in a given chain. See Nunes & Bosković (2007) for numerous other arguments of this sort in favor of a post-syntactic determination of copy chain deletion.

We address now the ALIGN theory of subject-auxiliary inversion in English. The core of this hypothesis is that there is a phonological requirement in English that dictates the order that must obtain between certain C⁰ elements and the tense bearer of the complement TP they select.¹³

- (22) **The alignment condition (AC):**
 ALIGN(Comp-C*, L, V_{tense}, L/R)
 (The left phonological edge of the complement of C* (TP) must be aligned with a phonological edge, left or right, of V_{tense})
 (Bruening, 2013)

Essentially the condition, inspired by Generalized Alignment theory (McCarthy & Prince, 1993) in phonology, encapsulates the observation that in language after language there is a general preference in the grammar for tensed verbs to delineate C⁰ elements and TP. This preference is instantiated in Germanic V2 phenomena, in Romance inversion, and in English quotative inversion and subject-auxiliary inversion (Bruening, 2013). We'll examine the examples in English pertaining to quotative inversion (QI), that motivated the postulation of the condition and then see how to derive (and predict the intricacies of) subject-auxiliary inversion.

QI is a process whereby a phrase that encapsulates a speech act, or a quote, can appear sentence initially and separated from the subject by the verb that selects the phrase as its complement.

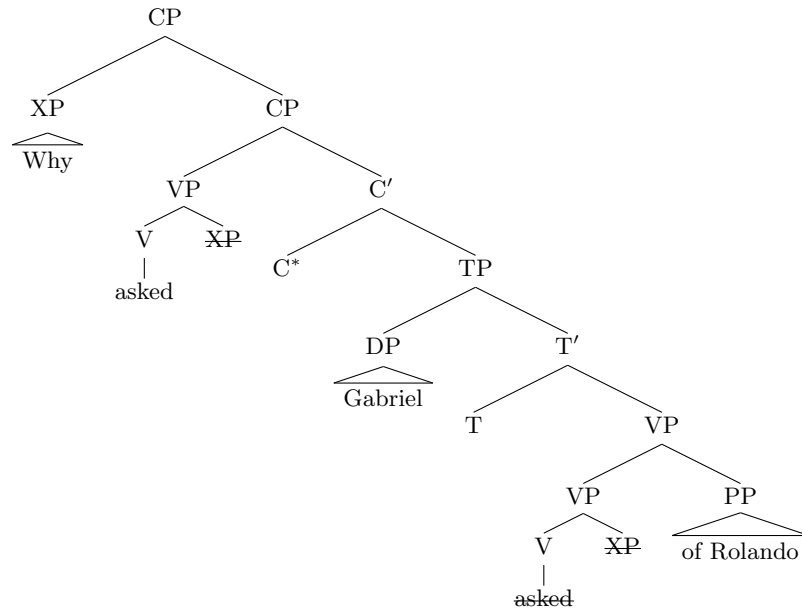
- (23) a. “Why?” asked Gabriel of Rolando.
 b. “This is the answer” said the professor to the student.

We can analyze this data by claiming that the phrase containing the quotation, as well as the verb phrase, undergo fronting to the specifier of CP. Adjuncts, which do not front (see below), are presumably merged later (Bruening, 2013).

¹²The general preference to spell out higher copies in chains may be motivated by the desire to minimize the number of “deletions” that must occur in any given derivation (Nunes & Bosković, 2007). Given that all movement is driven by feature checking needs, it follows that lower copies in a chain necessarily have more uninterpretable features. Under the assumption that these features cannot be processed by the phonological component of the grammar, if a lower copy is to be pronounced the features must be “deleted” from that copy, and all other copies must be deleted. All else being equal, then, pronunciation of a higher copy involves less deletion operations: all other copies are deleted but there is no need for an additional deletion of features from the element being pronounced.

¹³The C* element mentioned in the condition below represents the class of C⁰ elements that trigger the alignment condition in English. We'll leave this definition purposefully vague here.

(24)



There are several known constraints on QI which follow straightforwardly from the AC. We present the most salient examples below:

(25) Adjacency: the subject in QI must be adjacent to the fronted verb.

- a. [CP “Why are you here” [CP [VP asked] C* [TP Rolando asked of Gabriel]]].
- b. *[CP “Why are you here” [CP [VP asked of Gabriel] C* [TP Rolando asked of Gabriel]]].

As we see above, the presence of the adjunct PP disturbs the alignment between the fronted verb and the complement of C, TP, in violation of the AC.

(26) Auxiliaries: QI is incompatible with auxiliary verbs:

- a. *[CP “I’m hungry” [CP [AspP might say] C* [TP Rolando might say this morning]]]
- b. *[CP “What did you say” [CP [AspP was asked] C* [TP Gabriel was asked last night]]]

These examples are ruled out by the fact that the AC requires the tense bearing element to be adjacent to TP.

(27) Adverbs: the placement of adverbs in QI examples is as below:

- a. [CP (*loudly) “Time to play LoL” [CP [VP (loudly) shouted (*loudly)] C* [TP(*loudly) Rolando shouted]]]

The unacceptability of the first and final placements follows from the unavailability for *loudly* to adjoin to CP, C', or TP. The third placement is ruled out by the AC.

While these and other examples served as the original impetus for the AC, it turns out that we can also apply it to capture the intricacies of subject-auxiliary inversion. First, note that subject-auxiliary inversion obtains in questions with an extracted object *wh*-element to the exclusion of those with an extracted subject *wh*-element.¹⁴

- (28) a. [CP Who did [TP Rolando visit ~~who~~]]?
- b. *[CP Who [TP Rolando visited ~~who~~]]?
- c. *[CP Who did [TP ~~who~~ visit Rolando]]?
- (29) a. [CP Who was [TP Gabriel [VP talking to ~~who~~?]]]
- b. *[CP Who [TP Gabriel was [VP talking to ~~who~~?]]]
- c. *[CP Who was [TP ~~who~~ talking to Gabriel]]?

¹⁴We use cases here with overt do-support as a diagnostic for T-C movement, i.e., subject-auxiliary inversion.

In (28-a), T-C movement ensures that the tense bearing element appears adjacent to TP, as demanded. (28-b), where no such movement has occurred, is precluded by the AC. Alternatively, with subject extraction there is no overt subject to intervene between *visit* and TP, so the AC is satisfied; T-C movement is thus vacuous and precluded. Bruening (2013) points out that examples which are problematic for other theories of subject-auxiliary inversion follow nicely from this account. For example, fronting of *only* phrases trigger subject-auxiliary inversion. However, if the subject is also extracted, inversion becomes unacceptable.

- (30) a. [_{CP} Only in that class did [_{TP} Gabriel miss the question]].
 b. *_{[CP} Only in that class C* [_{TP} Gabriel missed the question]].
- (31) a. *Rolando is the student who I thought that [_{CP} only in that class did [_{TP} ~~who~~ said a word]].
 b. Rolando is the student who I thought that [_{CP} only in that class C* [_{TP} ~~who~~ said a word]].

The AC can therefore be seen to capture many of the complexities of subject-auxiliary inversion in a clean, elegant package.

So far we have remained silent on when the AC needs to be satisfied. That is, must elements move to conform to it in narrow syntax or can violations be “repaired” by post-syntactic operations? This issue is at the heart of argument for pushing English subject-auxiliary inversion out of narrow syntax. It turns out that the copy theory of movement, coupled with the requirement that the pronunciation of copy chains be determined outside of narrow syntax, forces the conclusion that the T-C movement responsible for subject-auxiliary inversion must be happening post-syntactically.

Let’s return to subject *wh*-extraction examples, where subject-auxiliary inversion does not take place.

- (32) [_{CP} Who C* [_{TP} ~~who~~ [_{VP} aced the test]]]?

The story here is that the lack of an overt subject allows TP and the tensed verb it embeds to be in alignment. There is no phonological material between the two, so T-C movement is not necessary and hence is precluded by economy constraints. As we discussed above, however, narrow syntax does not distinguish the two copies of *who*. Accordingly, at SPELL OUT the configuration of (32) is actually as below.

- (33) [_{CP} Who C* [_{TP} who [_{VP} aced the test?]]]

Accordingly, if the AC must be satisfied in narrow syntax and thus triggers syntactic movement, T-C movement of the sort attested in object extraction examples should be mandatory here: the presence of content in the TP specifier position is a violation of the AC and requires the dislocation of tense to a position adjacent to TP. Indeed the examples below show that *who* present in the TP specifier position does trigger subject-auxiliary inversion in other cases. This data shows that we cannot rely on some special behavior of *wh*-phrases to avoid the need to raise T-C if a copy is present in the TP specifier position. That is, *who* is not otherwise exempt from the AC.

- (34) a. Which books did who buy?
 b. Which test did who pass?

The syntactic account is therefore left to explain why the T-C movement required to satisfy the condition does not show up overtly in the final string: syntactically speaking, (32) is indistinguishable from (34) in terms of its violation of the AC, yet the latter but not the former features subject-auxiliary inversion. It is wholly mysterious why one but not another instance of an identical syntactic object in the specifier of TP should trigger T-C movement.

Alternatively, let’s assume that the AC applies post-syntactically and that violations may be repaired by (post-syntactic) subject-auxiliary inversion. In this case, the derivation of (32), for example, proceeds as above. After SPELL OUT, the determination of which copy to pronounce is enacted and the lower copy is deleted. At this point, the AC is satisfied and T-C movement is not necessary. With the derivation of examples like those in (34), we assume that after spell out the structure is as below.

- (35) [_{CP} which books C* [_{TP} who [_{VP} bought ~~which books~~]]]

Given the presence of a pronounced subject, this structure is an infringement of the AC and hence T-C movement may apply to repair the violation. The data is explained without further ado.

The insight here is that we cannot demand the phonologically motivated AC apply until the pronunciation of copies has been determined: as we see with (32), the deletion of a subject *wh*-copy must feed the AC, not vice versa. As a consequence, T-C movement induced by the condition cannot occur in narrow syntax: this movement is motivated by information that is not available at this stage in the derivation. In order to explain the data with syntactic head movement, we would need to either specially mark the subject *wh*-copy in some way in narrow syntax, or we would need to have some mechanism for undoing T-C movement when it was determined, post-syntactically, to have been unnecessary. In contrast, our account requires no special conditions, features, or operations to explain the behavior; it is in keeping with the fundamental minimalist spirit of optimality. Finally, our analysis conforms with the intuition that *do*-support (and subject-auxiliary inversion in general) has the flavor of a phonologically motivated last-resort operation.

This analysis can be straightforwardly extended to derive Irish and Welsh verb-initial word order. The adoption of the AC unchanged into these languages, combined with a broadening of the elements contained in the C* class to non-interrogative C elements, provides the necessary structure. Under these assumptions, T-C movement will be obligatory so long as there is an overt subject. There have even been proposals that the periphrastic use of *do* in English questions has its origin in Celtic (Garrett, 1998), providing a diachronic explanation for the formal link between the constructions.

As we demonstrated in the previous section, the availability of a post-syntactic means of enacting T-C movement in English questions and Irish and Welsh finite clauses brings the first class of problematic examples into the domain of sentences derivable with pure TAG. In this section we presented empirical evidence supporting the existence of just such a mechanism. As before, the conclusion is twofold. First, the class of problematic examples is rendered tractable from the perspective of TAG. Second, the corroboration of the original TAG analysis, namely that syntactic T-C movement in raising clauses is precluded, suggests that we should, at least in some instances, view the inability to derive a particular example with TAG as a prediction that such an example relies on non-syntactic operations. This leads us back to the clitic climbing examples that are in many ways even more confounding than T-C movement from a TAG perspective. In this case we do not have a direct empirical claim of the sort given for subject-auxiliary inversion to support a post-syntactic treatment of such examples. However, there are a few empirical observations suggest clitic climbing may be post-syntactic.

First, we note that clitic climbing is optional, with an object clitic permitted to appear in its base merged or climbed position interchangeably. The choice of position has no interpretive consequences.

- (36) a. Rolando quiere ver-lo.
 Rolando wants to see-it
 “Rolando wants to see it.”
 b. Rolando lo quiere ver.

A core assumption of the MP is that syntactic movement should never be vacuous; there must always be a feature checking requirement motivating any dislocation. As a corollary, then, we conclude that movement should never be optional.

Related to this optionality, when a clitic has climbed past several clauses, it may not ordinarily appear encliticized to any verb except its original host.¹⁵

- (38) a. Gabriel quiere tratar de ver-lo.
 Gabriel wants to try of to see-it
 “Gabriel wants to try to see it.”
 b. Gabriel lo quiere tratar de ver.

¹⁵To complicate matters, however, a such intermediate encliticization is permitted when the verb in question has itself selected a clitic complement.

- (37) a. Rolando quiere permitir-te ver-lo
 Rolando wants to permit-you to see-it
 “Rolando wants to permit you to see it.”
 b. Rolando quiere permitir-te-lo ver.
 c. Rolando te-lo quiere permitir ver.
 d. Rolando te quiere permitir ver-lo
 e. *Rolando te quiere permitir-lo ver.
 (Bleam, 2000)

- c. *Gabriel quiere tratar-lo de ver.
- d. *Gabriel quiere-lo tratar de ver.

If we are to maintain that head movement of this sort proceeds syntactically in a successive cyclic fashion, we need to explain why the clitic cannot be pronounced in any of the intermediate landing sites but only at the head and tail of the movement chain. A post-syntactic explanation for this fact may be that phonological forces optionally intervene to require a clitic to appear in the matrix clause. However, just as normal objects do not climb, the clitic may optionally remain in place and function much as a normal object would.

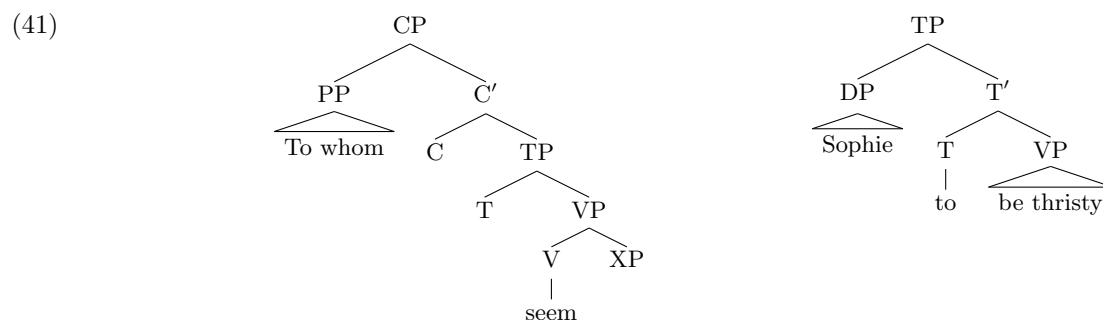
These are not meant to be anything more than speculative remarks, but they do demonstrate that, TAG motivations aside, clitic climbing is confounding from a syntactic perspective. These empirical issues, when compounded with Chomsky’s (2001) theoretical arguments, render any syntactic explanation of clitic climbing suspect, at best.

3.4 An aside: TAG and dative experiencers

Before concluding this chapter, we would like to make a brief aside to dismiss one other type of dependency that has been claimed to be beyond the domain of pure TAG. Aside from the examples rooted in head movement that we saw in the previous section, Frank (2004) establishes another case that he claims is derivable only by making recourse to MCTAG.¹⁶ The relevant examples involve extraction of dative experiencers passed raised subjects.

- (40) a. Sophie seems to Michael to be thirsty.
- b. ?To whom does Sophie seem to be thirsty.

Even with our account for the seemingly illicit T-C movement, we cannot affect the displacement of the experiencer *wh*-phrase with pure TAG. Given that this argument must be a part of the elementary tree projected from *seem*, we would have to somehow combine the trees below via adjoining. There is no way to do this that derives the attested word order, even with post-syntactic T-C movement. Interleaving of this sort is not permitted with TAG.



Indeed it turns out that if we extract a dative experiencer from a raising clause that is itself embedded under another raising verb, even tree-local MCTAG is not sufficient to derive the data (Kulick, 2000).

- (42) ?To whom was Rolando likely to appear ~~to whom~~ to have been angry?

Our argument is that despite the surface appearance, raising is not taking place in these examples. Recall that raising verbs are characterized by the fact that they do not assign external θ -roles. As such, they don’t place animacy or agency requirements on their subjects: expletives, adjuncts, meteorological *it*, and inanimate

¹⁶Frank (2004) also points out that so-called long movement is troubling for pure TAG. One group of such examples features a d-linked *wh*-phrase extracting out of an embedded clause which itself contains another *wh*-phrase (see (39-a)). The second class involves *wh*-elements that have undergone movement out of a DP (see (39-b)). Neither of these examples are derivable with pure TAG under standard assumptions.

- (39) a. Which book did Rolando wonder [_{CP} how to read ~~which book~~]?
 b. Who did Gabriel take [_{DP} a picture of ~~who~~]?

I have nothing to say about these data.

DPs may freely appear in this position. Moreover, subject idiom chunks maintain idiomatic force when they appear as the subjects of raising verbs, which again follows from the lack of assignment of an external θ -role. As we would expect, *seems* patterns as a normal raising verb, permitting *all* of the above types of subjects even when a dative experiencer is present. In contrast, if we A'-extract the dative experiencer, *none* of the above types of subjects are felicitous.

- (43) Expletive *there*:
- ?There seems to Sophie to be a riot.
 - ?*To whom does there seem to be a riot?
- (44) Non-DP subject:
- ?Under the desk seems to Sophie to be an unusual place to smoke.
 - ?*To whom does under the desk seem to be an unusual place to smoke?
- (45) Meteorological *it*:
- ?It seems to Sophie to be snowing.
 - ??To whom does it seem to be snowing?
- (46) Inanimate subject:
- ?The door seems to Sophie to be closed.
 - ?*To whom does the door seem to be closed?
- (47) Subject idiom chunk:
- The cat seems to Sophie to be out of the bag.
 - %To whom does the cat seem to be out of the bag? (no idiomatic force)

To see what is going on here, notice that (47-b) is *grammatical* to the exception of the other examples, even if idiomatic force is not maintained. Indeed examples of A'-extracted dative experiencers are marginal to acceptable with animate subjects in the matrix clause, as we saw with (40-b) and (42). It is an oft noted fact (see Potsdam & Runner 2001 for a more thorough discussion) that *seem* and other raising verbs are ambiguous between a raising (non-thematic subject position) and a control (thematic subject position) use. The data above, then, suggests that when a dative experiencer has been extracted, *seems* assigns an external θ -role and thus is unambiguously behaving as a control verb. It follows that examples like (40-b) and (42) simply involve control uses of *seem*. The “raised” element is thus merged as a part of the elementary tree projected from *seem*, in accordance with the θ -criterion, then combined via substitution with the embedded clauses, which in turn feature PRO subjects. No raising is occurring at all and thus no recourse to MCTAG is necessary.

We have chosen to discuss this analysis here for two reasons. First, it is very much in our interest to restrict the derivation of the PF object to pure TAG. The introduction of MCTAG is troubling on a number of levels, not the least of which is that the analysis we developed in the previous chapter depends on the PF derivation being limited in this way. Second, this example, perhaps even more than the head movement examples, is demonstrative of the one of the central ideas we have been advocating in this chapter: the failure of pure TAG to derive a particular example should be viewed not as a shortcoming but as a prediction. To the best of the author’s knowledge, there is no accepted analysis of the above phenomenon outside of the TAG framework, where it follows trivially from the form of the adjoining and substitution rules.

3.5 Conclusion

We began this chapter by noting that standard minimalist ideas regarding and accounts of the PF-interface are trivially extensible in our TAG framework. Accordingly, this chapter was more of an examination of the ramifications of some current ideas regarding the post-syntactic component of the derivation in the TAG framework than it was a reimagining of the PF interface. We demonstrated that head movement poses problems for TAG, much as it does for the MP in general, and that shifting this type of movement to the post-syntactic component of the derivation eliminates the need for more expressive TAG variants such as tree- and set-local MCTAG. We then demonstrated that in the specific case of English and Celtic T-C movement, there are empirical arguments in favor of the exclusion of such a phenomenon from narrow syntax, just as Chomsky (2001) has argued for in the abstract. In an aside, we also argued that another class of examples

that has been proposed as a challenge to pure TAG may in fact be derived without recourse to more expressive formalisms: what on the surface appears to be raising in the presence of an A'-extracted dative experiencer is in fact better analyzed as control, which is well within the derivational capacity of pure TAG.¹⁷ It follows that three out of the four cases posed by Frank (2004) as problematic from the perspective of pure TAG may in fact be plausibly explained via other analyses.¹⁸ The cases of subject raising in the context of T-C movement and in the context of A'-extraction of a dative experiencer, where the evidence is the most conclusive, in particular suggest that we should view the nonexistence of a pure TAG analysis not as a problem with the framework but rather as a prediction: if an example cannot be derived via pure TAG, then perhaps it either relies on post-syntactic phenomena or some of the assumptions that underly the derivation are incorrect.

¹⁷This is of course assuming that there is some mechanism of capturing the non-local dependencies of control within pure TAG. The analysis proposed, for example, by Shieber & Nesson (2006) involves MCTAG. However, it is the opinion of this author that control can probably be analyzed with pure TAG on the PF side with the STAG system proposed in the previous chapter. Regardless, the central point remains that these examples do not involve raising and are thus not problematic in the way that has been claimed.

¹⁸Frank (2004) also suggests an analysis for the fourth case, long movement, that does not involve MCTAG, although it is not without its own problems.

Chapter 4

A case study in Niuean raising

In the previous chapters, we have explored a method of extending Frank's (2004) TAG framework to the interfaces between syntax and the articulatory and interpretive systems of the language faculty, respectively. With this extension in place, we then saw how TAG interacts with, and indeed lends support to, the idea that some head movement is post-syntactic. This work has served the dual purpose of integrating TAG more fully into the MP and of informing minimalist syntactic theory with data from TAG. This chapter is in many ways a continuation of both of these efforts. Essentially, we will show that TAG can be successfully applied to languages that are typologically and genetically very different from the Indo-European languages for which and on which the system was developed and tested. Moreover, we will demonstrate that TAG makes accurate predictions that are otherwise somewhat mysterious. The status of TAG as a viable and useful component theory within the MP will thus be confirmed.

The particular exploration we will undertake in this chapter is subject and object raising in the Austronesian language Niuean. Since Seiter (1980) first documented the phenomenon, Niuean raising has confounded researchers with its typologically unique behavior. In particular, subjects and objects may indiscriminately raise, in manner that is reminiscent of English tough movement, into the subject position of a certain class of verbs. From the TAG perspective, this situation is complicated by the fact that Niuean is a verb-initial language, so that the sorts of problems we observed with raising in English questions and Welsh main clauses are likewise existent in Niuean. In contrast to these situations, we will argue that recourse to post-syntactic movement is not warranted, so that TAG predicts Niuean should not have raising at all. This prediction, we will argue, is borne out under a close examination of the data. Ultimately, we will demonstrate that Niuean raising is actually a movement free construction akin to English copy-raising, of which some examples appear below.

- (1) Subject-to-subject Raising:
 - a. It seems that John is unhappy.
 - b. John seems to be unhappy.
- (2) Copy Raising:
 - a. It seems like John is unhappy.
 - b. John seems like he is unhappy.

In the remainder of this chapter, we devote one section each to an introduction to Niuean syntax, a presentation of the data regarding Niuean raising, a discussion of the TAG prediction regarding this raising, and our account that Niuean raising is copy raising.

4.1 Vagahau Niue: predicate-initialness and other basic tenets of Niuean syntax

Our discussion in this chapter will draw primarily from examples and theories gathered and set down by two authors main authors, William Seiter and Diane Massam, as well as on the author's own field work in Auckland in January 2014. In what follows, we will present a very brief overview of Niuean syntax, covering

only the details relevant to the ensuing discussion. We will give special focus to establishing Niuean’s status as a predicate initial language featuring obligatory VP fronting in every clause. For a more complete picture, the reader is referred especially to [Seiter \(1980\)](#). Note that unless otherwise indicated, all examples are from the author’s field notes.

Niuean is an Austronesian language of the Tongic subgroup. It exhibits a morphologically ergative case system and VSO word order, with VOS possible in certain environments ([Massam 2000, 2001](#)). Niuean exhibits an ergative-absolutive alignment in all clauses, with subjects of intransitive verbs and objects of transitive verbs marked with absolutive case, and subjects of transitive verbs marked with ergative case. Case markings appear as particles that precede the relevant noun phrase, and are divided into two classes: pronominal and common. Case markers from the pronominal class are reserved for use with all pronouns and proper nouns, while elements from the common class are used in all other instances.

	Pronominal	Common
(3) Ergative:	e	he
Absolutive:	a	e

The standard surface word order in Niuean is VSO, although as we will see the initial element is really a predicate, not simply a verbal head. The table below summarizes the standard surface constituent order in a Niuean sentence.

(4) **Niuean surface word order**

interjections, responses	discourse particles	comp, connectives	TAM	neg	modals	predicate	postverbal particles, adverbials	noun phrases
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([Massam et al., 2006](#))

Some examples appear below.¹

- (5) a. Fia fano lahi a au ki Niue.
 want go greatly ABS I to Niue
 “I really want to go to Niue.”
 ([Seiter 1980: 10](#))
- b. Kua liu foki tuai a patu ko ke konahia.
 PERF return also ASP ABS guy that SBJ drunk
 “That guy has once again gotten himself drunk.”
- c. Kua kumata tuai e tagata naa ke hake motoka.
 PERF begin ASP ABS person that SBJ go=up car
 “That person has begun to go up by car.”

As we see in (5-b) and (5-c), complements to modal verbs, verbs of desire, intention, etc., are introduced by the subjunctive marker *ke*. This will be relevant in our discussion of raising.

We now have the tools to establish the means by which VSO word order (predicate-initial status) is derived in Niuean. The central argument is that, in contrast to Irish and Welsh, Niuean VSO order is derived via the fronting of the entire verb phrase to the specifier of TP. First, we will establish that the clause initial position where the verb occurs can host phrasal material; then we will provide examples where the verb appears sentence initially adjacent to its phrasal complement, which will precede the subject.

We focus first on so-called verbless clause constructions. The one we will examine here, termed the predicate nominal construction by [Seiter \(1980\)](#), features an absolutive DP preceded by the predicate marker *ko* as the main predicate of the clause. If the predicative DP is a proper noun or pronoun, including *wh*-words, there is no overt case marker:

- (6) a. Ko e kamuta a au.
 PRED ABS carpenter ABS I
 “I am a carpenter.”

¹TAM refers to tense, aspect, and mood particles.

- b. Ko e fale ke lima aki e fale i ko.
 PRED ABS house SBJ fifth ABS house at there
 “That house over there is the fifth house.”
- c. Ko Pule e faiaoga.
 PRED Pule ABS teacher
 “The teacher is Pule.”
 (Seiter 1980: 53,54)

Note that adverbs and clitics that normally occur post verbally follow the entire predicate nominal, not simply the predicative marker, as below.

- (7) a. Ko koe nakai a ia ma Haliua?
 PRED you Q ABS that VOC Haliua
 “Is that you, Haliua?”
- b. Ko e tau kamuta fakamua a lautolu.
 PRED ABS PL carpenter before ABS they
 “They were carpenters before this.”
 (Seiter 1980: 54)
- (8) Ko e tama gako a ia.
 PRED ABS boy fat ABS he
 “He is a fat boy.”

The position of the traditional post-verbal adverbs and clitics after the nominal part of the predicate nominal is highly suggestive that, at least in the case of the predicate nominal construction, the content occupying the sentence initial predicate position is rightfully a phrase, not simply a verbal or predicative head. To see why this is so, we first note that the presence of functional morphemes such as case markers indicates the presence of syntactic structure. Given that the predicate nominal is made up of (at least) the predicative marker and a *case marked* nominal, we conclude that predicate nominals exhibit syntactic structure in sentence initial position. But there is no syntactic structure without phrasal content, completing the argument. This claim is substantiated further in (8), where the predicate nominal is modified by an adjectival phrase that occurs before the post-verbal content. Indeed if the predicate position were occupied only by a lexical head, we would expect the post-verbal content to follow the predicative marker not the determiner phrase.

This seems to be at odds with the data in (5), where there is a sentence initial verbal head but no evidence of phrasal content. Data of this sort mirror the examples in Irish and Welsh, where a lexical head, the verb, alone moved to occupy the sentence initial position. Accordingly, given that we certainly want the predicate of a simple indicative clause to occupy the same sentence initial (or nearly sentence initial, see (4)) structural position regardless of whether that predicate is a verb or a predicate nominal, we are faced with a conundrum: how can a unique structural position host, in the one case, a predicative head, and in the other a predicate phrase? To shed some light on this issue we turn to the topic of Pseudo Noun Incorporation (PNI), a term coined by Massam (2001). As she discusses in great detail, PNI is a process whereby a direct object NP without any functional modifiers or case markers appears adjacent to the verb it complements, before any post-verbal adverbs or clitics and before the subject. Crucially, the NP may contain modifiers such as adjectives or relative clauses. In (9), the second sentence is related to the first in that its object has been pseudo-incorporated, while (10) exhibits the pseudo-incorporation of a noun with a subjunctive relative clause modifier.

- (9) a. Neafi, ne to e Sione e tau huli talo he mala.
 Yesterday PST plant ERG Sione ABS PL shoot taro at plantation
 “Yesterday, Sione planted taro shoots at the plantation.”
- b. Neafi, ne to huli talo a Sione he mala.
 Yesterday, PST plant shoot taro ABS Sione at plantation.
 “Yesterday, Sione planted taro shoots at the plantation.”
 (Seiter 1980: 69)
- (10) ...ke kumi mena ke nonofo ai a lautolu.
 ...SBJ seek thing SBJ settle there ABS they
 “... they sought a place to settle.”
 (Massam, 2001)

On the basis of these sorts of examples, [Massam \(2001\)](#) argues that PNI sentences likewise involve a phrasal constituent in the sentence initial predicate component. Various authors (cf. [Di Sciullo & Williams 1987](#), [Rosen 1989](#), [Baker 1997](#)) have attempted to attribute Niuean PNI to lexical operations; these strategies can generally be divided into two camps. The first argues that the incorporated noun and the verb have combined in the lexicon, resulting in an incorporated noun plus verb complex as a vocabulary item. The other asserts that syntactic operations are responsible for the adjunction of various X^0 heads into a larger lexical head, which then appear sentence initially. However, the data in (10) should convince even the most skeptical of readers that this sort of explanation is insufficient. It is simply not feasible, much less desirable, to argue that relative clause formation is anything other than a syntactic operation which results in the creation of a phrase. For example, note that English compounding can incorporate a verb and an object with adjectival modifiers, but not with relative clause modifiers.

- (11) a. He's a car-driver.
 b. He's a fast-car-driver.
 c. He's a *car-that-John-bought-driver.

It follows that PNI provides evidence that even in sentences without a predicate nominal, the predicate structural position is occupied by a phrase, not a lexical head. The conclusion [Massam \(2000\)](#) draws, and the one that we will adopt, is that the unique structural position reserved for a predicate always hosts a phrase. Apparent head movement is simply movement of a VP that lacks any arguments at the time the movement takes place. We will thus say that Niuean is *predicate-* rather than *verb-initial*.

With the evidence presented above, the stage is set for a description of the derivation process of a simple Niuean clause. First, note that Niuean lacks the finite/non-finite distinction, as well as robust φ -agreement ([Massam, 2005](#)). It follows that the obligatory nature of Niuean predicate-initialness is independent of any morpho-syntactic reflex. Owing to the similarities between this situation and the obligatory fronting of subjects in English to Spec TP, [Massam \(2000\)](#) argues that the origin of Niuean predicate-initialness is an EPP type feature on the tense head which obligates the merger of a predicate phrase into the specifier of TP.²³ This explains the phrasal nature of the predicate: the content that is drawn to the specifier of TP, given that it is merging into a specifier position, is obligatorily a phrase. In order to accommodate the presence of the verb on the left edge of the sentence, the predicate phrase that is being fronted must at least contain VP, and indeed this is the consensus in the literature.⁴

Under the leading account, established and refined by [Massam \(2000, 2009, 2010\)](#) transitive clauses are derived via merger of the object as the complement of the verb to form the VP. Relevant adjuncts are likewise merged directly into the VP. The object is then said to raise to specifier of a functional projection above VP to receive absolutive case. Next, the subject merges in a yet higher functional specifier, where it receives ergative case. The VP then undergoes movement to the specifier of TP. This sequence of moves derives the VSO word order, as depicted in the figures below. PNI clauses differ in that the object never leaves the VP and hence fronts with the verb; this explains the lack of case markings on and the surface positions of incorporated objects. Intransitive clauses are similarly derived. If the verb is unaccusative, so that the lone argument is a theme, it is merged directly into the VP, as in English. It then moves to a higher functional projection to receive absolutive case. If the verb is unergative, the lone argument is an agent and thus merges directly into a higher specifier outside of VP ([Massam, 2009](#)). The following diagram, borrowed from [Massam \(2009\)](#), depicts the relevant derivations.⁵

- (12) a. Transitive:
 $[_{TP} [_{VP_i} V t_j] T [_{ErgP} Agent Erg [_{AbsP} Theme_j Abs [_{vP} v t_i]]]]]$
 b. Unaccusative:
 $[_{TP} [_{VP_i} V t_j] T [_{AbsP} Theme_j Abs [_{vP} v t_i]]]$
 c. Unergative:

²Recall that the verb-initialness we observed in the previous chapter was limited to finite clauses. No such restriction exists in Niuean.

³See [Massam \(2000\)](#) for more justification of why the predicate is most likely in spec TP.

⁴There is some disagreement as to what else aside from VP fronts, if anything. For now we'll abstract away from this discussion, as it is irrelevant to our discussion.

⁵Note that all adjuncts must likewise evacuate the VP prior to VP fronting. The motivation for this movement is unclear, which is the major weakness of this account.

- d. PNI:

$$[\text{TP } [\text{VP}_i \text{ V }] \text{ T } [\text{AbsP Agent Abs } [\text{vP v } t_i]]]$$

This concludes our basic overview of Niuean syntax. The single most important detail for the ensuing discussion is the obligatory fronting of predicate phrases in Niuean. In particular, the presence on every tense head of an EPP feature that draws the VP to the specifier of TP has major ramifications in our TAG formalism.

4.2 Niuean raising

With the basic syntax of Niuean in place, we will now examine the raising data. This section will present the phenomenon in question and the major arguments in favor of treating it as movement based raising.

Seiter (1980) claims that certain Niuean verbs license an operation that he calls raising whereby the subject or object of a clause they embed may optionally appear in matrix subject position. These verbs include *maeke*, “can, possibly” and *kamata*, “begin.” Some examples appear below, where the a. sentences are related to b. sentences by raising.

- (13) Subject raising:
- a. To maeke ke lagomatai he ekekafo a Sione.
 FUT possible SBJ help ERG doctor ABS Sione
 “The doctor could help Sione.”
 - b. To maeke e ekekafo ke lagomati a Sione.
 FUT possible ABS doctor SBJ help ABS Sione
 “The doctor could help Sione.”
 (Seiter 1980: 158)
- (14) Object raising:
- a. Kua kamata ke ahi e Pule he kapitiga haaku.
 PERF begin SBJ visit ERG Pule ABS friend my
 “Pule began to visit my friend.”
 - b. Kua kamata e kapitiga haaku ke ahi e Pule.
 PERF begin ABS friend my SBJ visit ERG Pule
 “Pule began to visit my friend.”

Seiter (1980) identifies several arguments in favor of treating this data as raising in the English sense of the term, and not as, for example, control. That is, he argues that the “raised” argument originates in the embedded clause and is dislocated to the matrix clause via a movement operation. We outline three of his arguments. First, he points out that when idiom chunks are raised, the sentences maintain idiomatic force. With subject control verbs in Niuean, the idiom chunk may not be similarly separated from its verbal counterpart, so that idiom chunks allow us to rule out a control based account for the data.⁶ As an example, the verb *pouli*, “dark,” may take *a fafo*, “outside,” as its subject, to the exclusion of all other verbs. Moreover, this phrase, *pouli a fafo*, is used in general to describe darkness, not merely to say that it is dark outside. Seiter (1980) takes this as evidence that such a phrase is idiomatic, a claim we adopt here. When *a fafo* appears in the raised position, idiomatic force is preserved.

- (16) a. Kua teitei pouli tei a fafo.
 PERF nearly dark PERF ABS dark
 “It’s nearly dark.”

⁶Under standard assumptions, subject idiom chunks may not receive a thematic role from anything but the verb with which they form an idiom. Thus English raising verbs license subject idiom chunks, but subject control verbs do not.

- (15) a. The cat_i seems t_i to have John’s tongue.
 b. The cat_i wants PRO_i to have John’s tongue.

For reasons of space we don’t present the analogous control examples in Niuean, but they lack idiomatic force.

- b. Haane kamata a fafo ke pouli.
 PROG begin ABS outside SBJ dark
 “It’s beginning to get dark outside.”
 (Seiter 1980: 190)

A similar situation occurs with object extraction. The Niuean phrase *oeli e tau matahui*, “to get drunk,” is literally “to oil the knees.” However, idiomatic force is maintained even in if the object surfaces in the matrix clause of a raising verb.

- (17) a. Loto a au ke oeli e tau matahui, ti koli.
 like ABS I SBJ oil ABS PL knee then dance
 “I like to get drunk then dance.”
 b. Kua kamata tei e tau matahui ke oeli e lautolu.
 PERF begin PERF ABS PL knee SBJ oil ERG they
 “They’ve begun to get drunk.”
 (Seiter 1980: 191)

The second argument pertains to Niuean quantifier float. The universal quantifier *oti*, “all” may optionally be removed from the DP it modifies and encliticized to the verb in the same clause. Quantifier float is always limited to the clause that hosts the argument launching the float (see (19)).

- (18) a. Kua fia-momohe tuai e tau tagata oti naa.
 PERF want-sleep.PL ASP ABS PL person all that
 “All of those people have gotten sleepy.”
 b. Kua fia-momohe oti tuai e tau tagata naa.
 (Seiter 1980: 167)
- (19) a. Kua manako a lautolu oti ke mohe a Pita.
 PERF want ABS they all SBJ sleep ABS Pita
 “All of them want Pita to sleep.”
 b. *Kua manako a lautolu ke mohe oti a Pita.
 (Seiter 1980: 168)

Note now that raised subjects and objects can launch quantifier float in the matrix and embedded clauses. This suggests that such raised arguments are, at some point in the derivation, in both clauses. This in turn is strong evidence in favor of a raising analysis, especially given the non-thematic status of the matrix subject position.

- (20) a. Kua kamata tuai e tau tagata oti naa ke fia-momohe.
 PERF begin ASP ABS PL person all that SBJ want-sleep.PL
 “All of the people have begun to get sleepy”
 b. Kua kamata oti tuai e tau tagata naa ke fia-momohe.
 c. Kua kamata tuai e tau tagata naa ke fia-momohe oti.
 (Seiter 1980: 168)
- (21) a. Maeke e tau talo oti naa ke kai he faiaoga.
 possible ABS PL taro all that SBJ eat ERG teacher
 “Those taros can all be eaten by the teacher.”
 b. Maeke oti e tau talo naa ke kai he faiaoga.
 c. Maeke e tau talo naa ke kai oti he faiaoga.
 (Seiter 1980: 168)

The third argument involves agreement clitics. Certain verbs in Niuean agree with the number of their subjects via the agreement clitic *oo*, which directly precedes the verb and indicates that the subject is dual or plural. Raised subjects can trigger plural agreement on the embedded clause verb, thus indicating, once again, that they are functioning syntactically as the subject of the embedded clause, despite their surface positions.

- (22) Kua kamata tuai e tau tagata naa ke oo hake motokaa.
 PERF begin ASP ABS PL person that SBJ go-up.PL car

“Those people have begun to go up by car.”
 (Seiter 1980: 165)

Moreover, several verbs also agree obligatorily in number with their objects, where dual and plural objects trigger reduplication of the first syllable of their singular forms. Raised objects trigger plural agreement on embedded clause verbs.

(23) Kua kamata e tau akau ke hahala e Pita.
 PERF begin ABS PL tree SBJ cut.PL ERG Pita
 “The trees had begun to be cut by Pita.”
 (Seiter 1980: 166)

These two sets of agreement data conspire to demonstrate that raised arguments may trigger agreement in the embedded clause, which is explained nicely if they originated there and were extracted to clause initial position. A control analysis would be unable to account for these facts, given that PRO does not trigger number agreement.

As a final note, in cases of object raising the embedded clause features an ergative but not absolutive argument, a situation that is otherwise disallowed in Niuean. A simple means of explaining this behavior is to assume the object has raised out of its surface position, leaving behind the ergatively case marked subject.

These arguments lead Seiter (1980) to conclude that the data in (13) and (14) are instances of movement based raising, where the raised subject or object is displaced, via movement, from the embedded to the matrix clause.

4.3 Problems with the raising account: a TAG perspective

In this section we will point out some problems with the raising account described in the previous chapter. We will describe these problems from a TAG perspective, and many of the specifics will be internal to our TAG framework. However, the core issues, namely that Niuean raising is optional, unmotivated, and available to objects and subjects, are problems for any minimalist syntactic theory.

First we demonstrate that English style adjoining based accounts for raising are not tenable in Niuean. The simplest and most obvious issue relates to the verb initial word order. Consider the case of subject-to-subject raising. The raised subject cannot merely be displaced from its surface position by an intervening raising verb: in (13) the subject must appear to the left of the embedded clause verb, meaning that it must be displaced past another element. Likewise, it is immediately obvious that no such simple displacement account can hold in the case of object raising, where the object must be displaced past the entire embedded clause. The situation is in this way similar to the one discussed in the previous chapter, where we saw how Celtic verb-initialness interferes with the TAG analysis of raising. Unfortunately we cannot rely on post-syntactic movement to alleviate our troubles here. As we saw in a previous section, Niuean verb-initialness is the result of phrasal, not head, movement. Moreover, even if we could displace the verb post-syntactically, we would still be at a loss to account for object raising.

(13) To maeke he ekekafo ke lagomatai -- a Sione.
 ↑

(14) Kua kamata e kapitiga haaku ke ahi e Pule ...
 ↑

To compound these problems, we also point out that the particulars of Niuean syntax preclude the existence of raising auxiliary trees of the sort employed in English and Welsh. Recall that in the previous section, we asserted that the EPP in Niuean has the effect of drawing the VP to the specifier of TP. Accordingly, given that this movement is observed in all clauses, the TAG version of the EPP, repeated below, mandates that every elementary tree with a VP must also have a specifier position in its TP projection. There can therefore be no T'-recursive auxiliary trees in Niuean, so that even abstracting away from word order problems, there can be no account of raising that mirrors the English account. ⁷

⁷This situation has an analogue in Icelandic, a language where dative experiencer arguments are licensed to appear in specifier TP. Consequently, when a traditional raising predicate is combined in a clause with a dative experiencer, raising is blocked.

(25) **Extended Projection Principle**

A TP projection in an elementary tree τ must have a specifier if and only if there is some otherwise licensed element within τ that can be moved to the specifier of TP.

Beyond the structural and word order issues introduced by Niuean VP fronting, there is additional evidence that Niuean raising is not motivated by feature checking requirements at all, and hence is not enacted via adjoining. Recall that in English, subject-to-subject raising is intimately connected with the non-finite status of the embedded clause. The lack of a finite tense head with case and φ -features that can be checked against the subject obviates a tree-local valuation of the embedded subject's uninterpretable features. The raising verb, on the other hand, projects an elementary tree with a finite tense head, complete with case, φ , and EPP features, but without a subject. As such, an operation of adjoining targeting the T' node of the embedded clause elementary tree with the T' -recursive raising tree results in a configuration whereby the embedded clause subject and the matrix clause tense head can enter into a checking relation that values and eliminates their uninterpretable features. Adjoining is therefore licensed according to the Greed Principle. In Niuean, the lack of the finite/non-finite distinction immediately obviates some of the core features of this account. First, the raised subject can check its case feature in the embedded clause: in the absence of raising the subject receives ergative case. Second, while the exact mechanism responsible for φ -feature valuation is unclear in Niuean given that there is extremely limited agreement, it is clear that the subject's φ -features may be valued in the embedded clause. To see this we merely observe that raising is optional, so that in its absence feature checking and elimination must be occurring in the embedded clause. Furthermore, we cannot rely on the necessity of checking an EPP feature in the matrix clause, as we discussed extensively above. It follows that none of the feature checking requirements that motivate English raising are present in Niuean.

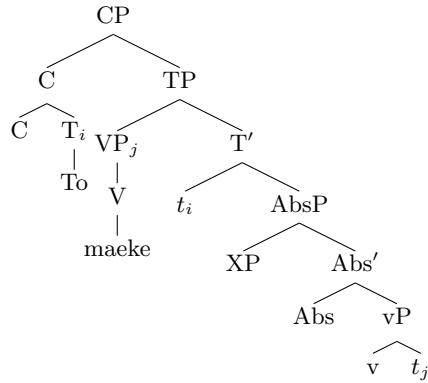
The fact that we can raise objects also calls into question any feature based motivation for raising, given that they enter all relevant feature checking relations with the verb they complement.⁸ There is no reason why this should not be the case in Niuean. Nor can topic or focus features can be employed as motivation given that speakers report no semantic difference between raised and non-raised examples. It follows that neither case, nor agreement, nor the EPP, nor topic, nor focus motivate Niuean raising, which is moreover always optional. The compounding of these facts renders any account motivated by feature checking simply untenable. Such a story requires the postulation of a feature which may only optionally be present in the derivation, which has no semantic or morphological reflex, and which serves no apparent purpose other than to motivate a surface word order abnormality. This is in every way contra the spirit and practice of features within the MP, leading to the conclusion that Niuean raising is not motivated by feature checking. The Greed Principle therefore dictates that adjoining is not licensed as a means of deriving the raising data.

If TAG is to derive the raising examples at all, then, it must be via substitution. This means that the raised phrase needs to be displaced within the embedded clause elementary tree to a position past the verb and tense marker. Under the assumption that tense moves to C in Niuean, this means we have to displace the subject to at least the CP domain, if not further. The embedded clause, being thus formed, must then substitute into a non-projected argument node in the matrix clause. We might derive the raised subject example from (13) with the following elementary trees for the main and embedded clauses, where the XP root of the embedded clause substitutes into the non-projected XP node in the specifier of the absolutive phrase of the main clause.

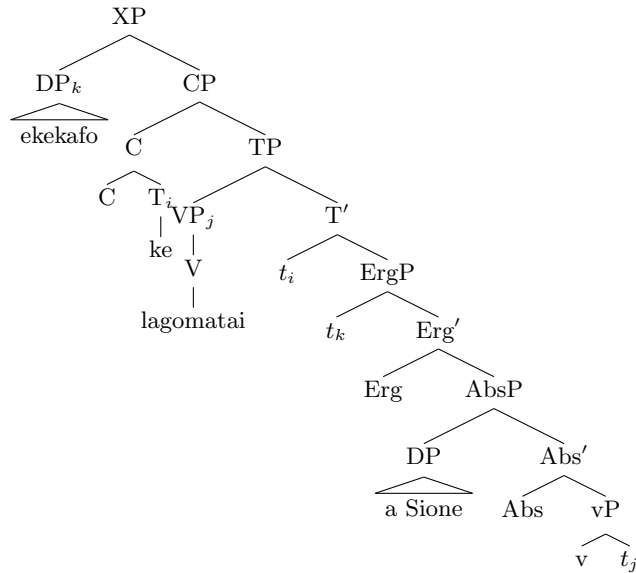
(26) a. Main clause:

-
- (24) a. Margir menn virðast vera í herberginu.
many men seem.3PL to be in the room
"Many men seem to be in the room."
b. *Margir menn virðast mēr vera í herberginu.
many men seem to me to be in the room
(Frank, 2004)

⁸Stepping back from the TAG framework, such movement is also in violation of minimality, given that the embedded subject is an argument DP closer to the landing site than the embedded object. I return to this issue at the end of the next section.



b. Embedded clause:



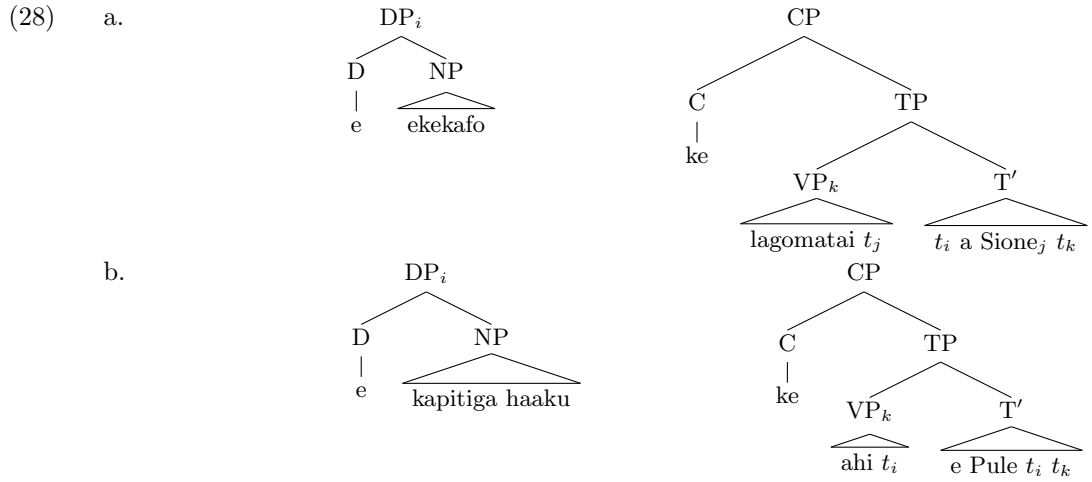
Before we go to the trouble of motivating the numerous theoretically suspect aspects of the trees above, note that a such substitution based account makes the prediction that Niuean subject raising should be limited to one clause: the displaced embedded clause subject can be raised past the embedded clause verb with tree-local movement followed by substitution, but displacement past a second verb would require either non-tree-local movement or an adjoining operation, both of which are precluded. However, Niuean appears to freely allow such super-raising, as in (27).

- (27) Kua kamata e ekekafo ke maeke ke lagomatai a Sione.
 PERF begin ABS doctor SBJ possible SBJ help ABS Sione
 “The doctor began to be able to help Sione.”

An account based on substitution alone simply cannot derive this data. Without an operation of adjoining, the embedded clause subject can only be displaced tree-locally; accordingly, the intervention of the *ke maeke* clause between the subject and its thematic position is not derivable.

The conclusion I draw from this discussion is that our TAG formalism is incompatible with Niuean raising. This leaves us with two options. First, we could opt for an extension of the TAG framework that allows us to derive (13), (14), and (27). There are two possible means of enacting this. The first is to once again introduce MCTAG into the PF derivation. (13) and (14) can likely be derived by making use of the tree sets of the following general form for the respective embedded clauses. Essentially the idea is to separate the raised element from the embedded clause so that we enact raising without making recourse to adjoining.⁹

⁹Although it is not reflected in the trees below, the argument that is to be raised will actually be a degenerate DP node in the elementary tree set associated with the embedded clause. The actual lexical content then undergoes substitution into this degenerate node. For clarity we do not show this step.



It is not clear however, even with MCTAG, how we might derive (27). The second method would be to eliminating the Greed Principle and posit what seem to be unmotivated elementary trees. We might then apply some variant of the substitution based account sketched above, with adjoining to derive the super-raising examples in (27). Employing MCTAG, on the one hand, is unappealing for all the reasons discussed in the previous chapter, not to mention the fact that even this might not be enough to derive (27). On the other hand, eliminating the greed principle is no more appealing. TAG relies on this to prevent over generation, and even if we were to successfully restrict or eliminate it, the trees required to derive the data would be theoretically questionable at best.

Alternatively, we could follow the precedent set in the previous chapter and take the inability to derive the raising examples with TAG as a prediction that such examples are not, in fact, what they seem. Certainly Seiter (1980) presents some convincing data in favor of a raising analysis where an embedded clause phrase displaced from its thematic position to a position in the matrix clause. As mentioned in the introduction, however, there are a number of problems with this account that are independent the problems unique to a TAG analysis. As we will now demonstrate, there is a better account of Niuean raising that not only ensures the data in question can be derived with TAG, but also obviates many of the framework independent problems with the raising analysis.

4.4 Reconciling the data: Niuean raising is copy-raising

In this section we will argue that so-called raising examples in Niuean are in fact not derived via displacement of an embedded clause phrase to the matrix clause. Rather, they involve base generation of the *raised* phrase in the matrix clause, along with a co-indexed embedded clause pronoun that is optionally null. The *raised* phrase and the co-indexed pronoun share a thematic role, as is common with standard raising, even though the two are not related via syntactic dislocation. This situation mirrors the behavior of English copy-raising examples, so that I will term the Niuean phenomenon copy-raising as well.

As evidenced by the English examples in (2), copy raising, which is attested in a wide variety of languages, is most often identified via the presence of an overt pronoun in the thematic position associated with the matrix subject. Accordingly, if we are to claim that the Niuean data are derived via the mechanism described above, we should expect to see some evidence of the embedded clause pronoun. And indeed Niuean optionally allows a pronoun co-indexed with the matrix subject to appear in just this position. Speakers report that the pronoun has the effect of emphasizing that the raised element is the sole agent carrying out the action, in the case of subject raising, or the sole recipient of the action, in the case of object raising. (29) features the examples from (13) and (14) with resumed gaps.

- (2) a. It seems like John is unhappy.
 b. John seems like he is unhappy.
- (29) a. To maeke he ekekafo ke lagomatai e ia a Sione.
 FUT possible ABS doctor SBJ help ERG he.3.SG ABS Sione

- “The doctor could help Sione.”
- b. Kua kamata a kapitiga haaku ke ahi a Pule a ia.
 PERF begin ABS friend my SBJ visit ERG Pule ABS he.3.SG
 “Pule began to visit my friend.”

To sketch the copy-raising proposal, our claim is that the data in (13), (14), and (29) are not the result of movement of an embedded clause argument to the matrix clause. Rather, these examples are derived by the merger of the raised argument directly into the matrix clause, accompanied by a corresponding merger of a pronoun in the embedded clause. Then, a post-syntactic operation of the sort described by Potsdam & Runner (2001) serves to unite the pronoun and the “raised” element into an argument chain with a single thematic role.

In order to adopt the account sketched above, there are three main facts that must be verified. First, we need to establish that the matrix subject position is a non-thematic one in the case of both subject and object extraction. Copy-raising always features a raised element and an embedded clause pronoun that share a thematic role. Seiter (1980) has already provided some argumentation in favor of this conclusion (see the discussion of idiom chunks in Section 4.2). The next step, which we have likewise already mostly taken care of, is to argue that the configuration in question is not the result of a displacement of embedded clause material at all, and that the embedded clause pronoun co-indexed with the raised element is directly merged in its surface position. We know that a movement based account is underivable with TAG, but we’ll present some additional evidence, independent of TAG, in favor of this conclusion. Finally, we must explain the optionality of the embedded clause pronoun, which is, for example, obligatory in English copy raising examples. Once we have established these facts, we will offer the details of the account.

To establish the non-thematic status of the raising verb subject position, note that an overt element need not appear here (see (13), (14)). In fact, overt arguments are not allowed in this position unless raising has occurred, just as with English raising verbs.

- (30) *John seems that Bill is angry.
- (31) a. *To maeke a Pule ke lagomatai he ekekafo a Sione.
 FUT possible ABS Pule SBJ help ERG doctor ABS Sione.
 “Pule was possible for the doctor to help Sione.”
- b. *Kua kamata a Sione ke ahi e Pule e kapitiga haaku.
 PERF begin ABS Sione SBJ visit ERG Pule ABS friend my
 “Sione began for Pule to visit my friend.”

Thematic positions, according to the thematic criterion, are not allowed to be unoccupied, so that the above data is confounding under an account that treats the raising landing site as thematic. Given that Niuean lacks overt expletive pronouns, however, the this data is consistent with the position being non-thematic.¹⁰ For a second argument, we default to the discussion in Section 4.2 on idiom chunks. Essentially, examples with raised idiom chunks maintain idiomatic force. This is true for both subject and object idiom chunks. Given that idiomatic force is linked to the idiom chunk receiving its thematic role from the verb with which it forms the idiom, we can conclude that raising verbs do not assign their subjects thematic roles. The final argument

¹⁰In fact Niuean lacks third person inanimate pronouns altogether.

- (32) a. Liti mai e maka!
 throw DIR ABS stone
 “Throw the stone here!”
- b. Liti mai!
 throw DIR
 “Throw it here!”
 (Seiter, 1980)
- (33) a. Ne paa he matagi e hala.
 PST close ERG wind ABS door
 “The wind closes the door.”
- b. Ne paa e haha.
 PST close ABS door
 “It closed the door.”
 (Seiter, 1980)

pertains to inanimate arguments. Verbs which assign agentive thematic roles to their subjects do not permit inanimates to occupy this position, presumably because they cannot bear the relevant agent thematic status. Thus in situations where idiom chunks or non-DP subjects are not permitted, inanimate subjects are likewise forbidden. For example, English examples with apparently copy-raised non-subjects do not maintain idiomatic force with raised idiom chunks, no do they permit expletive subjects.

- (34) a. *Advantage appears like Mary took it of me.
 b. *On the desk seems like a good place to find the book would be it.
 c. The cat seems like Bill said it has John’s tongue. (no idiomatic force)

With such uses of these verbs, inanimate subjects are likewise precluded, again because they cannot bear the relevant thematic role.

- (35) a. John appears like Mary punched him.
 b. ?*The door appears like Mary shut it.
 (36) a. Bill seems like Mary said he was hitting on her.
 b. ?*The wind seems like Mary said it was blowing hard.

As an additional example, English *begin* has been claimed to be likewise ambiguous (Perlmutter, 1970), sometimes assigning an external thematic role and sometimes not. Note that when we force *begin* to have a thematic subject by embedding it under a control verb, inanimate subjects are precluded.¹¹

- (37) Non-thematic subject:
 a. Advantage began to be taken of the workers.
 b. In the library began to be an attractive place to study.
 (38) Thematic subject:
 a. I forced Sione_i PRO_i to begin to visit Mele.
 (39) Thematic subjects cannot be inanimate:
 a. *I forced the door_i PRO_i to begin to open.

Given that Niuean allows non-animate phrases to undergo raising, we again conclude that the position hosting raised elements is non-thematic.¹²

¹¹PRO must receive a thematic role, so that controlling the subject position of *begin* forces it to be thematic.

¹²Most of the remaining diagnostics that have been proposed to identify non-thematic positions in English are difficult to test here. As we mentioned already, Niuean does not have expletive pronouns such as *it* or *there*, obviating any tests relying on the distribution of these items. However, there is an additional test that is potentially available: PRO is thought to require a thematic role, so that if the raising verb subject position is truly non-thematic, we should be unable to control into it. Seiter (1980) argues that Niuean has subject-control verbs much as in English, where a matrix subject licenses the appearance of PRO in an clause embedded subject position provided the matrix clause verb is a so-called “control verb.” Such verbs include *loto*, “want,” so that the following construction is licensed.

- (40) Fia loto a ia ke taa PRO e faaloku.
 want want ABS 3SG SBJ play ABS flute
 “He wants to play the flute.”
 (Seiter, 1980)

Other verbs such as *kotofa*, “choose,” and *tala*, “tell,” license so-called object control where a matrix clause object licenses PRO in the embedded clause subject position. If the subject position of a raising verb is non-thematic, we should expect, then, that it cannot be controlled. This does not seem to be the case.

- (41) a. Kua lali a Sione ke kamata ke ta e ia e faloku.
 PERF try ABS Sione SBJ begin SBJ play ERG he ABS flute
 “Sione tried to begin to play the flute”
 b. Kua lali a Sione ke kamata ke ta e faloku.
 (Seiter, 1980)
 (42) a. Fia loto a Sione ke maeke ke ta e ia a faloku.
 want want ABS Sione SBJ possible SBJ play ERG he ABS flute
 “Sione wants to be able to play the flute.”
 b. Fia loto a Sione ke maeke ke ta a faloku.
 (Seiter, 1980)

- (43) a. Kua kamata e laa ke hake mai.
 PERF begin ABS sun SBJ rise DIR
 “The sun began to rise.”
 b. Kua kamata e matagi ke agi malolo mai.
 PERF begin ABS wind SBJ blow strong DIR
 “The wind began to blow strongly.”

We will now present an additional argument against a movement based derivation of the data. The first argument is valid in any framework that admits traces or copies, including TAG. In contrast, for the second argument we’ll momentarily step outside of the TAG framework and demonstrate that if Niuean raising is enacted via movement, then it violates notions of locality even in mainstream syntactic theory; this argument is meant to serve both as an analogue to the TAG-based arguments provided in the previous section as well as a confirmation of our prediction in a traditional theory.

We borrow our first argument from [Potsdam & Runner \(2001\)](#); these authors present a problem with a movement based derivation of the English data in (2) that also manifests in Niuean. Under such an account, which is best captured in the work of [Ura \(1998\)](#), the raised subject undergoes normal syntactic movement into the matrix clause. The pronoun in the embedded clause represents the spelling out of a trace or copy left over from this movement.¹³ [Ura’s \(1998\)](#) argument is essentially that because the extraction of subjects from finite clauses is illicit in English, such a movement renders the embedded clause uninterpretable. The trace/copy left behind from the movement may thus be spelled out to “repair” the otherwise ungrammatical structures.

- (44) a. It seems like John is angry.
 b. *John seems like *t* is angry

Note that this spelling out of traces/copies to repair illicit movement also manifests in other places as well, such as the rescuing effect resumptive pronouns have on ECP violations:

- (45) a. *This is the painting that everyone wonders whether *t* will be for sale.
 b. ?This is the painting that everyone wonders whether *it* will be for sale.
 ([Potsdam & Runner, 2001](#)).

Slightly more specifically, [Ura \(1998\)](#) claims that the trace/copy may be spelled out as a pronoun to check the uninterpretable EPP and φ -features of the embedded finite T head which otherwise would be unchecked. A similar situation obtains in Igbo, which served as the basis of [Ura’s \(1998\)](#) original analysis. While the details are considerably more complicated in Niuean, which lacks finite/non-finite distinctions, an English type EPP, and robust subject-verb agreement, we might posit that the raising of a subject or object leaves some features unchecked in the embedded clause.¹⁴ If we assume that the pronouns which resume Niuean raising gaps are spelled out traces/copies, or in other words rescuing resumptive pronouns, we should expect that they behave like other such spelled out traces/copies. [Sells \(1984\)](#) examined several cases where such pronouns, which he refers to *intrusive pronouns* (IPs), behave differently than normal pronouns. One illustrative example is that they cannot be bound variables.

- (46) a. *I’d like to meet every linguist_{*i*} that we can’t remember when we had last seen him_{*i*}.

However, [Maria Polinsky \(p.c.\)](#) has argued that Niuean does not feature true control, so that the data above does not pose problems for our account. Indeed the argumentation pursued here should bolster whatever account she is developing. While it is beyond the scope of this work to delve further into this issue, I wanted to at least mention that there is a means of addressing this somewhat troubling issue.

¹³Within the TAG-framework, English type SSR does not involve a trace, so that it seems we can dismiss this account entirely. However, recall that if we did want to rely on syntactic dislocation to derive raising, we need to displace the raised phrase either past the embedded clause verb in an elementary tree local manner, or to a new tree altogether in an elementary tree set, and such movements do leave traces in the TAG-framework.

¹⁴For example, one proposal that might yield this scenario is to say that there is an absolutive case feature in every clause with a thematic subject that must be checked by a corresponding absolutive DP. This is reasonable given that absolutive case is the default and is present in every clause that has thematic subjects. As we saw above, raising verbs may conspicuously lack subjects, so that presumably they have no such feature. Conceivably, the raising of an phrase from the embedded clause might leave this feature unchecked. This is not meant to be a detailed proposal or analysis, but merely to demonstrate that such an argument is not incompatible with the facts.

- b. *There is no painting_i that John wonders whether it_i will be for sale.
(Potsdam & Runner, 2001)

Potsdam & Runner (2001) points out that in the relevant English examples, the embedded clause pronoun is permitted to be bound by a quantifier, which contradicts the predictions of a movement-based IP account.

- (47) a. Many students appear as if they won't pass this time.
b. Every argument seems as though it is flawed.

To test this in Niuean, note first that quantificational phrases may bind variables. In the data below, the bound variable interpretation of the boldfaced pronouns is readily acceptable.

- (48) Kua pehe e tau kapitiga oti haau kua matakutaku a **lautolu**.
PERF mention ABS PL friend all your PERF frightened ABS they
"All your friends say they are frightened"
- (49) Kua maheve e tau fanau oti ke taute e **lautolu** e foulua.
PERF promise ABS PL children all SBJ fix ERG they ABS boat
"All the children promised that they would fix the boat."

Now, observe that examples with raised quantificational phrases that bind the pronoun in the corresponding raising gap are just as acceptable as those above.

- (50) To maeke e tau tagata taane oti ke taute e tautolu a foulua.
FUT possible ABS PL man all SBJ fix ERG they ABS boat
"Every man is able to fix a boat."
- (51) Kua kamata e tau fanau oti ke fefeua e lautolu.
PERF begin ABS PL children all SBJ play ABS they
"The children had begun to play."

Following Potsdam & Runner's (2001) conclusion, this suggests that the Niuean data is not derived via movement.

Moving on to the second argument, we momentarily set TAG aside to offer an argument couched in traditional syntactic theory. In minimalist syntax, movement is affected via the MOVE operation, which targets an element already merged into the structure being derived and makes it available to undergo another merger. Such operations are bounded by what is known as the Shortest Move Principle.

- (52) **Shortest Move Principle**
Movement must target the closest object of the appropriate type.

Assuming a reasonable definition of closeness, this principle may be invoked to explain, among many other things, the unacceptability of (53-a). In particular, a movement operation with the matrix subject position as its landing site may not target *Mele* while *it*, which is also a subject DP, is closer to the landing site of the movement. A corresponding derivation which lacks *it* is wholly acceptable.

- (53) a. *Mele seems it is likely to eat taro.
b. Sione seems to be likely to eat taro.

If Niuean raising is the result of movement, then it appears to violate this principle, allowing analogues of (53-a).

- (54) ?To maeke a Pule ke maheve a Mele ke ahi e Sione a ia.
FUT possible ABS Pule SBJ promise ABS Mele SBJ visit ERG Sione ABS him
"It's possible Mele will promise that Sione will visit Pule."
- (55) ?To maeke a Sione ke ole a Mele ke ahi e ia a Pule.
FUT possible ABS Sione SBJ ask ABS Mele SBJ visit ERG he ABS Pule
"It's possible Mele will ask that Sione visit Pule."

We might try and dismiss this data by arguing that the subject position of the matrix clause is thematic, so

that the matrix subject and the embedded clause pronoun do not share a thematic role, and the data is merely a standard co-indexation of pronoun and antecedent. However, the matrix subject position in such examples freely permits inanimate subjects, something we argued previously should be unavailable if *kamata* assigned an external thematic role.¹⁵

- (56) a. Kua kamata e matagi ke logo a Pule ke agi malolo mai.
 PERF begin ABS wind SBJ sense ABS Pule SBJ blow strong DIR
 “Pule began to feel the wind blowing strong.”
- b. Kua kamata e laa ke kitia a Sione ke hake mai.
 PERF begin ABS sun SBJ see ABS Sione SBJ rise DIR
 “Sione began to see the sun rise.”

In fact, the availability of object raising presents an even simpler instantiation of a Shortest Move violation. The embedded clause subject is closer to the target of the raising and hence movement of the object should be precluded. It follows that under closer examination, the predictions made by TAG are in fact corroborated in mainstream syntax. In both cases, the data is overwhelmingly in favor of the conclusion that Niuean raising is not enacted via movement.

Finally, the topic of the optionality of the embedded clause pronoun is perhaps the easiest issue to attend to. As Seiter (1980) points out, Niuean licenses the deletion of pronouns in a rather unconstrained way, a rule he calls *Zero Pronominalization*.

Pronouns in Niuean are frequently deleted through a rule of Zero Pronominalization. The rule is optional, ungoverned, unbounded, and available for NPs of every syntactic type. (Seiter 1980: 51)

With a lack of any evidence to the contrary, we conclude that zero pronominalization can optionally delete an embedded clause pronoun, thus leading to the contrast between (13) and (14), on the one hand, and (29) on the other.

To summarize, we have established the following facts about Niuean “raising.” First, as originally pointed out by Seiter (1980), Niuean raising verbs do not assign their subjects thematic roles. As such, when idiom chunks appear as the subject of raising verbs, dislocated from their thematic position in the embedded clause, idiomatic force is maintained. Likewise inanimate arguments may be freely dislocated from their thematic position in the embedded clause and appear as the subjects of raising verbs, provided they are licensed in their original thematic position. Next, a movement based derivation of Niuean raising is a violation of basic notions of locality in both TAG and mainstream minimalist syntax; in the former, raising cannot be enacted with tree-local movement, and in the latter it violates the principle of shortest move. Finally, Niuean raising gaps may be optionally resumed with pronouns. Given the existence of the rule of the zero-pronominalization in Niuean, we assume that every raising example features a pronoun in the raising gap which may be optionally omitted.

To capture these facts, we propose the following account. In raising derivations, the “raised” argument and the embedded clause pronoun are both independent elements in the numeration that are merged directly into their surface positions in different elementary trees. These trees then combine via substitution just as if no raising had occurred. Nothing changes.

In the final step, a special process intervenes to establish the co-indexing and sharing of thematic role between the raised subject and the pronoun. Such a move is needed independently for English and every other language with copy-raising, so that I opt simply make recourse this unspecified operation to establish the correct relations. There are a few important considerations, however, that warrant mention. First, given that copy-raising will necessarily always involve the establishment of co-indexation and thematic sharing across elementary tree boundaries, whatever sort of mechanism is responsible is most likely extra-syntactic. Further evidence in favor of this conclusion comes from (54) and (55). The relationship between the raised element and its trace/copy is established across intervening material that almost always blocks syntactic dependencies of this kind. It is a mystery why the same mechanism responsible for these data cannot be likewise employed to rescue (53-a). Unfortunately it is beyond the scope of this thesis to delve much deeper into the phenomenon. Our goal was to establish that Niuean raising could be reconciled with the TAG framework, and in that task

¹⁵Since Niuean lacks overt third person inanimate pronouns, it is impossible to resume the extraction gaps when inanimates raise.

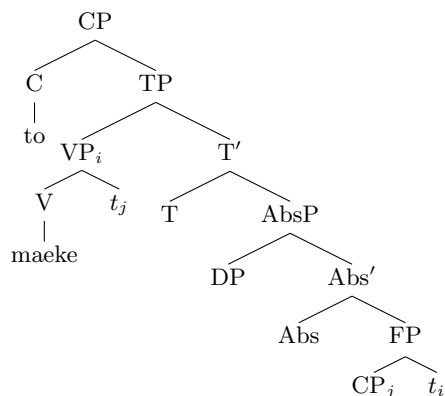
we have succeeded. Having argued that the data in question is not derived via syntactic dislocation, we leave the specifics of the co-indexing operation for another time.

Note that this proposal also offers an explanation for (most of) the data Seiter (1980) uses to argue for raising. The idiom chunk data follows straightforwardly from the sharing of thematic roles across the raised argument and embedded clause pronoun. In the case of number agreement, we standard assumption that the co-indexation procedure requires the target and the embedded clause pronoun to have the same number features. Accordingly, the pronoun can trigger the embedded clause number agreement.¹⁶

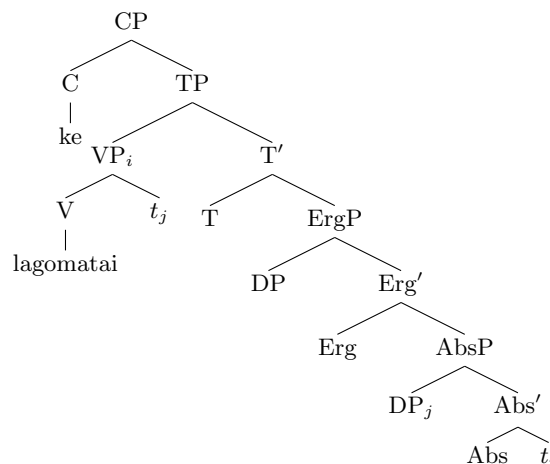
We document the syntactic component of the derivation of the PF object for (13) below as a representative example. I assume that the CP complement of the raising verb moves to a functional projection below the subject but above VP, labeled here FP. This is ancillary to the argumentation.

(57) Elementary trees

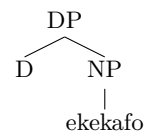
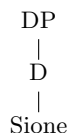
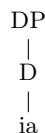
a. Matrix clause:



Embedded clause:



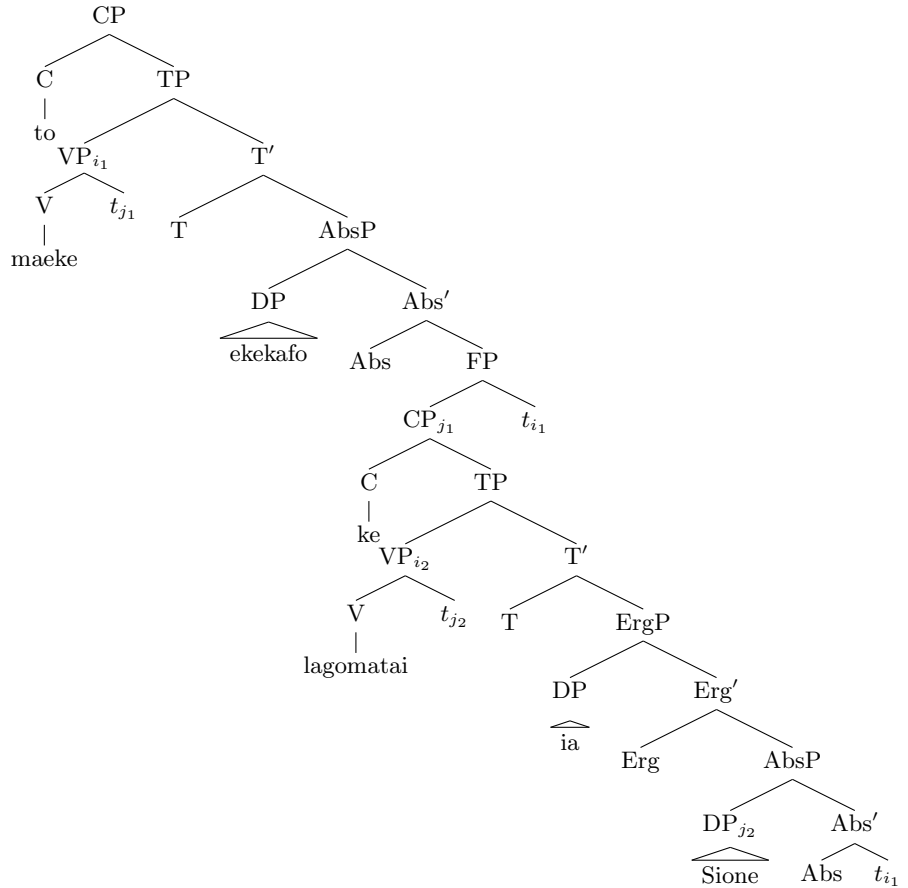
b. DP arguments:



Denote the matrix clause tree as α_0 , the embedded clause tree as α_1 , and the argument trees for *ia*, *Sione*, and *ekekafo* as $\alpha_2, \alpha_3, \alpha_4$, respectively. The derivation proceeds by substituting α_1 into α_0 at node 222221; α_2 substitutes into α_1 at node 2221, α_3 substitutes into α_1 at node 222221, and α_4 substitutes into α_0 at node 2221. The result is below.

¹⁶The quantifier float data is slightly more difficult to address. but Maria Polinsky (p.c.) has suggested that the distribution of *oti* is much more nuanced than Seiter (1980) makes it out to be.

(58)



The co-indexation procedure then serves the link the embedded clause pronoun and the matrix clause argument.

4.5 Conclusion

Raising is perhaps the single most elegant of the many elegant syntactic analyses within the TAG framework. Indeed it almost seems as if the TAG system was designed to handle English SSR, with its separation via adjoining neatly capturing the details and making perfect predictions in almost every instance. As we saw in the last chapter, the verb-initialness of Irish and Welsh intervenes to superficially tarnish the account. However, as we saw, the problems introduced by these languages are not insurmountable; by shifting a very specific and limited operation, T-C movement of verbal heads in finite clauses, out of the syntactic derivation, we reduced the troubling data to the well-behaved English case.

Niuean, on the other hand, in many ways represents a paradigm shift. Its verb initial order is derived via mechanisms that are much more clearly located within narrow syntax. Moreover, beyond the issue of word order in deriving the raising examples in Niuean, predicate-initialness poses problems in the very mechanism whereby English and Celtic raising is affected. Not only does Niuean lack any feature checking requirements to motivate its raising, but the trees responsible for deriving all instances of raising that have yet been analyzed with TAG are simply unavailable in Niuean. In keeping with the core proposal of this thesis, we equated the non existence of a TAG derivation of the Niuean raising as a prediction that such examples did not constitute raising at all. After careful examination, this prediction was borne out; in fact we even showed that standard minimalist syntax was at a lost to describe some facets of the Niuean data. This approach and its conclusion have broader implications both for TAG and for linguistic inquiry in general.

First, the Niuean data is an almost stunning confirmation of the predictive and explanatory power of TAG: the unavailability of traditional raising conforms perfectly with the TAG predictions. Moreover, by using a TAG-based system, we were able to link two things that might otherwise have seemed totally unrelated: raising and predicate-initialness. A standard minimalist theory might have totally overlooked what turns out,

in this case, to be a fundamental connection.

At a broader level, the data here leads to the typological prediction that Niuean style predicate initial languages should be incompatible with English type subject-to-subject raising, which is affected by syntactic dislocation. Further research will be needed to test the validity of this claim. More than just this prediction, however, this data affirms the importance of pursuing research in a variety of different frameworks. A theorist working within the MP but without knowledge of TAG might never have thought to ask about the relationship between predicate-initialness and raising. Now that a tenuous link has been established, researchers of all creeds can set out to determine its most primitive origins. It may well be that the TAG analysis of this or other phenomena is incorrect or incomplete, but at least now this particular question has been posed.

Chapter 5

Conclusion

In this thesis, we have contributed to the already substantial body of work on incorporating tree adjoining grammar into the Minimalist Program. Specifically, we demonstrated that interface issues can be cleanly and elegantly captured by a theory based on the synchronous variety of TAG. While there are certainly more details to be filled in pertaining to the derivation of the LF object in particular, our work has served to establish that the derivational model encapsulated in STAG is a viable alternative to the traditional Y based minimalist account. Moreover, we showed that the full incorporation of TAG into the MP brings empirical benefits commensurate to the abstract theoretical merits of such an incorporation, both for TAG and for the MP. Given that our model is consistent with the minimalist notions of spell out, we argued that cases of problematic head movement in TAG are best treated as post-syntactic phenomena. In particular, we presented evidence that if some instances of T-C movement are post-syntactic, then TAG can derive otherwise underivable examples involving subject-to-subject raising in English questions and Welsh main clauses. A similar argument obtains in the case of Romance clitic climbing, which is also ordinarily thought to be outside the generative capacity of pure TAG. This served the dual purpose of eliminating the need for formal extensions of the TAG framework and of providing new evidence that head movement is post-syntactic. Indeed we argued that the inability to derive data with TAG should not be viewed as a problem with the framework but rather as a prediction that the data is not what it seems to be. We first confirmed the validity of this claim with an example involving dative experiencers in English, then extended it to unusual behavior in the Austronesian language Niuean. Indeed we demonstrated that Niuean raising, which is not possible to derive with pure TAG and which has baffled researchers since its discovery, is in fact not raising in the traditional sense of the term. Once again, the strategy of treating the inability to derive data with TAG as a prediction was vindicated. The ultimate conclusion is that TAG is a viable minimalist syntactic theory; not only can it be seen to adhere to and in many cases reinforce the central tenets of the MP, but it also provides novel analyses of otherwise confounding examples.

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