Analyzing interacting phenomena: Word order and negation in Basque

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Proceedings of the 18th International Conference on
Head-Driven Phrase Structure Grammar

University of Washington

Stefan Müller (Editor)

2011

Stanford, CA: CSLI Publications

pages 46–59

Crowgey, Joshua & Emily M. Bender. 2011. Analyzing interacting phenomena: Word order and negation in Basque. In Stefan Müller (ed.), *Proceedings of the 18th International Conference on Head-Driven Phrase Structure Grammar, University of Washington*, 46–59. Stanford, CA: CSLI Publications. DOI: 10.21248/hpsg.2011.3.

Abstract

We explore the interaction of sentential negation and word order in Basque using a small experimental implemented grammar based on the Grammar Matrix (Bender et al., 2002, 2010) to test the analyses. We find that the analysis of free word order (Fokkens, 2010) provided by the Grammar Matrix customization system can be adapted to handle the Basque facts, and that the constructional approach taken in that analysis supports the integration of negation. Keywords: Basque/Euskara, [eus], word order, negation, Grammar Matrix

1 Introduction

We present a case study of using grammar engineering to explore the analysis of interacting phenomena, as proposed in Bender 2008. In particular, we look at the case of Basque [ISO-639: eus] word order and negation and ask whether existing HPSG analyses of each of these can be adapted to work together. The development work was facilitated by open-source grammar engineering tools, including the Grammar Matrix customization system (Bender et al., 2002, 2010), the LKB grammar development environment (Copestake, 2002) and the [incr tsdb()] grammar profiling software (Oepen and Flickenger, 1998). The grammar and the accompanying word order and negation test suite are available for download and further development and experimentation.[1]

Although word order is a central concern for theoretical syntax,[2] no HPSG analysis of major constituent word order has been presented which attempts to account for its attested ability to interact with negation (Dryer, 1988). As for negation, Kim (2000) examines sentential negation within the HPSG framework in a small selection of both European and Asian languages. Looking to Dahl (1979) for typology, Kim describes three types of negative marking strategies: morphological marking of negation, syntactic marking through a selected adverb, and negative auxiliary verbs. Word order is not impacted by negation in any of the languages Kim considers. Thus, on the basis of the existing literature, one might expect word order and negation to be independent (orthogonal) phenomena, whose analyses could perhaps be expected to be trivially interoperable crosslinguistically.

However, descriptive linguists have reported that negation interacts with word order in Basque (Manandise, 1988; Saltarelli, 1988), with negative and positive sentences occurring in differing word order patterns. Thus word order and negation

[†]We would like to thank Antske Fokkens, Esmerelda Manandise, and three anonymous reviewers for helpful discussions, scholarship, and comments. All remaining faults are our own.

This material is based upon work partially supported by the National Science Foundation under Grant No. 0644097. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

[1] `http://depts.washington.edu/uwcl/matrix/euskara/`

[2] At least those versions of syntax which claim to be surface-oriented.

can not be treated entirely independently in Basque. On the other hand, we find that our independently motivated analysis of the word order facts of non-negated sentences neatly sets up the machinery needed to handle the additional constraints that arise under negation. More specifically, word order patterns fall broadly into two classes and, on our analysis, each of these classes always employs a particular construction-specific rule. Because sentential negation is only compatible with one of these word order classes, we propose a HEAD feature, [NEGATED *bool*], and use it to ensure that negated and non-negated sentences can only occur with the observed major constituent orderings.

2 Basque

Basque is a language isolate spoken across the Western Pyrenees in Northern Spain and Southern France. It is an ergative-absolutive language with a rich system of agreement markers expressed on the finite element of verbal clauses. Most lexical verbs in Basque are incompatible with the morphological categories that indicate finiteness. For this reason, most Basque sentences contain an auxiliary verb which supports tense and mood markers, as well as agreement with the person and number of the verbal arguments. Thus a typical intransitive clause in Basque contains at least three elements: the subject, the lexical verb, and the finite auxiliary.[3] An example is given in (1) (Manandise, 1988, 8).[4] This example also illustrates what is often considered the basic order for Basque clauses (Saltarelli, 1988).

(1) Miren ibilli da
Mary.ABS walk.PERF 3SGO.PRES
Mary has walked. [eus]

With respect to the nearly free permutations of major constituent order, Laka (1996) points out that while there is much variation, the variants are not informationally equivalent. The position to the left of the lexical verb is singled out in Basque descriptions as the *galdegaia*, the object of inquiry, or the focus position. The importance of this notion is best illustrated with an example (2) (Manandise, 1988, 8-9). While all of the sentences in (2) are generally grammatical, only (2b) is an acceptable answer to the question in (2a). In the final section of this paper, we briefly discuss the focus position's interaction with the interpretation of negation.

(2) a. Liburu bat nork irakurri du?
book one.ABS.SG who.ERG.SG.FOC read.PERF 3SGO.PRES.3SGA
Who has read one book? [eus]

b. Liburu bat Mirenek irakurri du.
book one.ABS.SG Mary.ERG.SG.FOC read.PERF 3SGO.PRES.3SGA
Mary has read one book. [eus]

[3] Pronominal arguments may be indicated solely through agreement marking on the auxiliary.
[4] Glosses here and throughout are adapted from Manandise (1988).

c. Mirenek liburu bat irakurri du.
Mary.ERG.SG book one.ABS.SG.FOC read.PERF 3SGO.PRES.3SGA
Mary has read one book. [eus]

3 Analysis: Word order

While the ordering of major constituents in Basque is generally free, or more accurately, pragmatically determined, at least one author claims that Basque does not freely permute all combinations of the major constituents. Manandise's (1988, 15) constraint on possible orderings, is reproduced as (3).

(3) If the lexical verb is to the left of the auxiliary, then the lexical verb must be left-adjacent to the auxiliary.

(4) *Liburu irakurri Mirenek du.
book.ABS.SG READ.PERF Mary.ERG.SG 3SGO.PRES.3SGA
Mary has read a book. [eus]

Manandise further claims that this constraint holds for Basque main clauses with up to three NPs and that beyond this constraint, no further checks on major constituent order apply. The sentence in (4), for example, is ruled out by (3). In fact there are further constraints on word order: those imposed by interaction with polarity, which is discussed in the next section.

Manandise's constraint suggests a bifurcation of the data into those sentences in which the auxiliary precedes the lexical verb and those in which it follows. The patterns in (5) schematize these two (complementary) patterns. In aux-first strings, the NPs can occur freely around and between the auxiliary and the verb, as summarized in (5a). When the verb precedes the auxiliary, however, NPs may not intervene between them, as shown in (5b). First we turn our attention to achieving free word ordering amongst the first group.

(5) a. (NP) Aux (NP) V (NP)

b. (NP) V Aux (NP)

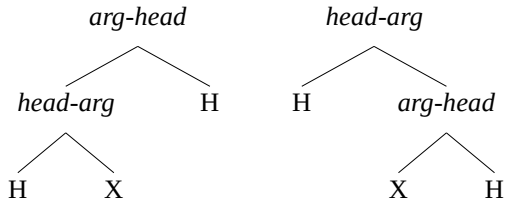
For the strings of the aux-first type (5a), we wish to allow free word order. We begin with the default analysis for free word order from the Grammar Matrix customization system (Fokkens, 2010).

Note that this analysis relies on binary branching rules. Following the English Resource Grammar (Flickenger 2000) and the Grammar Matrix, we take the somewhat pragmatic view that the role of derivation trees is in the first instance to serve as the scaffolding for mapping strings to semantic representations (while also modeling grammaticality). Accordingly, where the grammatical facts require a constituent, our grammar must posit one, but conversely, we don't make the strong claim that every constituent in our derivation trees will be motivated by

constituency tests. This is partially motivated by technical considerations: Our grammar is implemented within the DELPH-IN joint reference formalism (Copestake 2000), which requires rules to have fixed arity and fixed order of daughters. Given this, a grammar with binary branching rules needs far fewer rules than one that strives for flatter structures. In general, licensing free orders for n elements with maximally flat structure will require $n!$ rules. Grammars with fewer rules, even if they come at the cost of more complicated trees, are to be preferred for reasons of both parsimony and grammar maintainability.

Turning back to our analysis, as Fokkens notes, handling free word order entails much more than allowing unconstrained syntax. In addition to licensing all of the orders, the syntactic arguments need to be linked to the correct semantic positions. Fokkens handles this with a series of binary-branching rules of the familiar head-nexus types. However, simply providing both head-final and head-initial rule types for each phrasal rule leads to spurious ambiguity. To take a specific case, we consider auxiliaries: To handle the combination of properties between the verb and finite auxiliary in our grammar we take an argument composition approach to the auxiliaries (Hinrichs and Nakazawa, 1990). Such auxiliaries can combine with NP elements, and so can lexical verbs, so we have cases where multiple heads can compete for a given argument (with one head also taking the other as an argument). This ambiguity is schematized in (6), if *head-arg* rules have both head-final and head-initial forms, then both of these trees will be valid parses for the string *H X H* with no semantic difference between them.

(6)



Fokkens' approach constrains the space of possible analyses by requiring the grammar to apply any head-initial rules before any head-final rules.[5] In this way, left and right branching rules cannot factor across each other in the parse forest. Instead, given a [Aux, NP, Verb] sequence, only the bracketing [[Aux NP] Verb] is licensed.

The grammar must also rule out spurious ambiguity for sequences of the type [Aux, Verb, NP]. There is potential here for two parses using only head-initial rule types: [[Aux Verb] NP] and [Aux [Verb NP]]. The grammar we have designed enforces a single bracketing of these sequences automatically by taking advantage of the need for argument agreement on the auxiliary.

Auxiliaries in Basque agree with up to three arguments of the clause. We model this in the grammar by positing argument composition auxiliaries (Hinrichs and

[5] A feature ATTACH and a small value hierarchy are employed to effect this. See Fokkens (2010) for details.

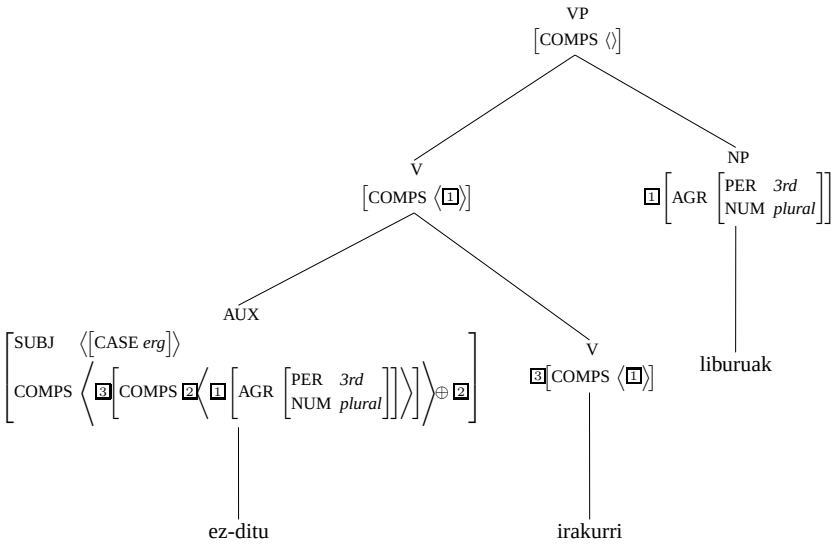
Nakazawa, 1990), and then simply having the inflected auxiliaries constrain the agreement features of all NP arguments on their valence lists. The feature structure in (7) shows some of the constraints stipulated on an auxiliary lexical type. This type inherits from Matrix core grammar type *arg-comp-aux-no-pred* (Bender et al., 2002). Note the nonempty specification for the auxiliary's first complement's first complement.

(7)
$$\left[\begin{array}{ll} \textit{trans-abssg-aux-lex} & \\ \text{SUBJ} & \left\langle \left[\text{CASE} \quad \textit{erg} \right] \right\rangle \\ \text{COMPS} & \left\langle \left[\begin{array}{ll} \text{FORM} & \textit{nonfinite} \\ \text{COMPS} & \boxed{1} \left\langle \left[\text{AGR}|\text{NUM} \quad \text{indef-or-sing} \right] \right\rangle \end{array} \right] \right\rangle \oplus \boxed{1} \end{array}\right]$$

We leverage this nonempty specification, along with the fact that in typical in HPSG grammars head-argument rules cancel elements off the valence list as the head path is projected, to constrain the analysis of sequences of the form [Aux, Verb, NP]. If the lexical verb first combines with its complement, a VP (COMPS satisfied) structure is the result. This VP is incompatible with the specification on the auxiliary's complement (as in (7) and (10)). The only licensed bracketing then, is [[Aux Verb] NP], as illustrated in (8, 9 and 10).[6]

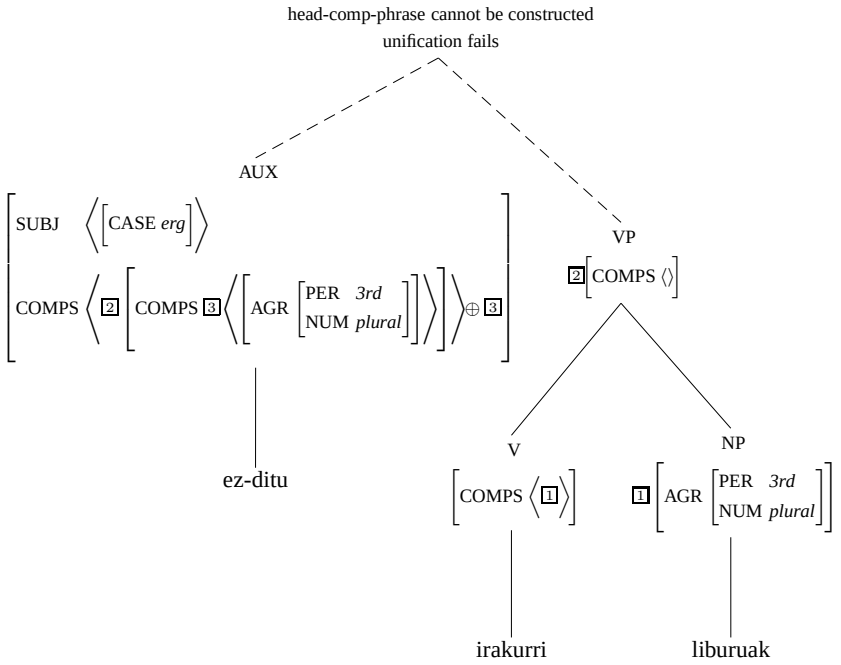
(8) ez-ditu irakurri liburuak
NEG-3PLO.PRES.3SGS read.PERF book.ABS.PL
has not read books [eus]

(9)



[6]We discuss the negation marker and provide analysis in the next section.

(10)



This analysis of the first set of data allows us to capture the flexible word order properties of Basque while avoiding spurious ambiguity. The table in (11) presents a summary of the discussion to this point. There are four rules, which combine NPs, Aux, and V in free word order patterns where the auxiliary precedes the lexical verb. We deal with potential spurious ambiguity in two patterns using the constraint on head-initial rules and valence list access.

(11)

grammar rules:	head-comp comp-head head-subj subj-head	
constraints:	head-initial rules apply low	
patterns:	H X H → [[H X] H] H H X → [[H H] X]	h-init constraint valence list access

Let us now turn to the set of examples in which the lexical verb precedes the auxiliary. Our analysis of the orders schematized in (5b) can't simply be the mirror image of those in (5a), because we need to rule out any strings in which an NP intervenes between the verb and the auxiliary. To accomplish this, the grammar is augmented with a verbal complex analysis. This option is also a part of the word-order library (Fokkens, 2010) that the Grammar Matrix customization system makes available. Rather than making the verbal complex available for all sentences, we use it only for the class of sentences schematized in (5b).

The grammar's verbal complex rule is presented in (12). This rule-type inherits from both *basic-head-1st-comp-phrase* and *head-final* types (Bender et al., 2002), which implement the Valence Principle and head-finality, respectively.

(12)
$$\begin{bmatrix} \textit{comp-aux-phrase} & \\ \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{AUX} & + \end{bmatrix} \\ \text{NON-HEAD-DTR}|\text{HEAD} & \textit{verb} \\ \text{HEAD-DTR}|\text{LIGHT} & + \end{bmatrix}$$

The feature, [VC *luk*] (mnemonic for verbal cluster), is defined in the grammar on phrasal and lexical *synsems*.[7,8] Lexical verb types are constrained to be [VC +], while auxiliaries are set to [VC −]. Head-complement rule types are then defined to inherit their VC value from their non-head daughter. These additional constraints are shown on the verbal complex rule in (13). In this way, an auxiliary which has picked up its lexical verb complement will form a phrase which is [VC +]. The value of VC on a phrase indicates whether or not the lexical verb is present in that phrase. The comp-head and subj-head rules are then made sensitive to the VC value, such that auxiliary-headed constituents cannot combine with subjects or objects unless they first combine with the main verb.

(13)
$$\begin{bmatrix} \textit{comp-aux-phrase} & \\ \text{VC} & \boxed{1} \\ \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{AUX} & + \end{bmatrix} \\ \text{NON-HEAD-DTR} & \begin{bmatrix} \text{VC} & \boxed{1} \\ \text{HEAD} & \textit{verb} \end{bmatrix} \\ \text{HEAD-DTR}|\text{LIGHT} & + \end{bmatrix}$$

To see how these types rule out phrases which contain one or more NPs intervening between the lexical and auxiliary verbs, consider the sequence [Verb, NP, Aux]. If the lexical verb first picks up the NP argument, the resulting valence list is shortened and the auxiliary will not be able to access (or constrain) case and agreement information on the NP (as described above). Thus the bracketing [[Verb NP] Aux] is ruled out. Secondly, we specify that in comp-head and subj-head rules, the head daughter must be [VC +]. In this way we avoid the bracketing [Verb [NP Aux]]. These two aspects of the grammar thus rule out the sequence under consideration, and the same facts generalize to cases with more than a single intervening NP; sequences that match the regular expression /Verb NP$^+$ Aux/ are equally unparseable.

[7] *lex-rule* types are also annotated such that they pass up the value of VC through the inflectional pipeline.

[8] *luk*, borrowed from the English Resource Grammar Flickinger (2000), is named after Polish logician Jan Lukasiewicz. It is a generalization of the type *bool* that is consistent with three values: $\{+, -, na\}$.

Turning now to grammatical strings, as with the aux-initial patterns considered above, we again confront the potential for spurious ambiguity, this time on sequences of the form [Verb, Aux, NP]. We do not wish to allow both bracketings [[Verb Aux] NP] and [Verb [Aux NP]]. The verbal complex rule we have just defined does not inherit from the *head-final-head-nexus* type which enforces that head-initial rules apply before head-final ones. This is because we use the verbal complex rule to ensure that the Verb and Aux elements appear adjacent to each other and despite the fact that the Aux element heads the phrase, we want the verbal complex rule to apply before any argument attachment in any licensed parse of the verb-first data. This is the motivation for the stipulation [LIGHT +] in the *comp-aux-phrase* presented in (13). Inspired by the LITE feature of Abeillé and Godard (2001), the feature LIGHT is defined on *synsem*s with a value *luk*. Lexical items are [LIGHT +], while phrases are [LIGHT −]. This stipulation ensures that the verbal complex rule applies before the auxiliary picks up any arguments in any successful parse.

The grammar as we have defined it thus far provides an implementation of Manandise's constraint on word order—modeling the partially free word order observed in Basque in an explicit, testable form. The table portraying information about the grammar is updated in (14) to review the grammar rules, the constraints we've defined, and ambiguous patterns that we've constrained. The next section discusses the overlay of the negation analysis onto the grammar presented.

(14)

rules:	head-comp comp-head head-subj subj-head comp-aux	
constraints:	head-initial rules apply low head-comp rules inherit VC from non-H-dtr head-final rules H is VC + comp-aux H is LIGHT +	
patterns:	H X H → [[H X] H] H H X → [[H H] X] *[V [NP Aux]] V Aux NP → [[V Aux] NP]	h-init constraint valence list access head-final rules H is VC + comp-aux H is LIGHT

4 Negation

Sentential negation in Basque is accomplished by the prefixation of a negative morpheme, *ez*, to the finite element (Manandise 1988, 12; Saltarelli 1988, 92). Manandise does not discuss the bound or free status of this morpheme, but she does present examples without whitespace between *ez* and the auxiliary—flouting typical orthographic conventions—in her introductory exposition. Saltarelli, on the other hand, explicitly calls this morpheme a particle, entailing an analysis as a free morpheme, but does not offer any argument. We follow Manandise here in treating

negation as bound for reasons analogous to those given in Kim (2000, 34) for the Korean morpheme *an*. Both Basque and Korean allow relatively free permutation of syntactic elements, but the position of *ez* is fixed to the auxiliary verb. There is no possible intervention of adverbials. These facts would have to be dealt with in the syntax if we treat *ez* as free, by treating it as bound, the Grammar Matrix's implementation of the Lexical Integrity Principle (Bresnan and Mchombo, 1995; Kim, 2000) ensures that bound morphemes cannot stray from their hosts. In our analysis, *ez* is added to *aux* types by a lexical rule.

As mentioned in the introduction, negation interacts with word order in Basque. The interaction is such that although Basque allows main clauses in which the lexical verb appears to the right or to the left of the auxiliary verb, under negation, only those constructions in which the main verb follows the auxiliary verb are licit.[9] Furthermore, in non-negated sentences, the auxiliary verb cannot appear to the left of the lexical verb, but must appear to the right (and, because of Manandise's generalization (3) it must appear immediately to the right). In this way Basque negated auxiliaries are in complementary distribution with non-negated ones with respect to their positioning on one side or the other of the lexical verb. Only those sentence-types described by the pattern in (5a) are compatible with negation, as shown in (15a), while (15b) shows patterns that can only occur without negation:

(15) a. (NP) ez-Aux (NP) V (NP)

b. (NP) V Aux (NP)

If we were to assume that negation and word order are independent—and just add the lexical rule to attach the negative morpheme to auxiliary verbs—the grammar will overgenerate, licensing strings that match the patterns in (16), even though these are uniformly ungrammatical:

(16) a. * (NP) V ez-Aux (NP)

b. * (NP) Aux (NP) V (NP)

Manandise augments her analysis with two more filters, a POS filter which rules out non-negated auxiliaries to the left of lexical verbs, and a NEG filter which rules out negated auxiliaries to their right. We formulate the specifics of these filters in terms of constraints on our analysis of word order patterns.

The analysis of word-order given above required the introduction of a construction-specific rule—a verbal complex rule which combined a left-adjacent lexical verb with a selecting auxiliary. We engineered this rule in such a way that it bisects

[9]This is only true of main clauses. In subordinate clauses, the lexical verb precedes the finite element because of an independent constraint on subordinate clauses which requires that the finite element appear finally. While the solution may rely on additional specialized rules, we believe that the approach presented here will scale as we extend our fragment to handle subordinate clauses as well.

a priori possible sentences into two groups: aux leading (5a) vs verb leading (5b). The verbal complex rule only and always appears in successful parses of the verb-leading examples. Thus, it provides a natural target for constraints that should apply to only one group or the other. We implement the constraint via a flag feature whose value is set by the negation rule and we stipulate an incompatible value for the instances of the verbal complex rule.

The grammar presented here thus defines [NEGATED *bool*] as appropriate for *head* types. We modify the lexical rule that carries out negation such that it is [NEGATED +]. The definition of a lexical verb is updated to specify [NEGATED −]. These changes ensure that the feature NEGATED encodes whether or not an auxiliary verb has been negated. Finally, we add to definition of the *comp-aux-phrase* (verbal complex rule) the stipulation [NEGATED −]. The lexical rule for negation and the updated verbal complex rule are given in (17) and (18). The interaction of these components conspires to rule out any examples in which the lexical verb appears to the left of a negated auxiliary.

(17)
$$\begin{bmatrix} \textit{neg-lex-rule} & \\ \text{HEAD}|\text{NEGATED} & + \\ \text{C-CONT}|\text{RELS} & \left\langle \begin{bmatrix} \textit{event-rel} & \\ \text{PRED} & \text{"neg\_rel"} \end{bmatrix} \right\rangle \\ \text{DTR}|\text{HEAD} & \textit{verb} \end{bmatrix}$$

(18)
$$\begin{bmatrix} \textit{comp-aux-phrase} & \\ \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{AUX} & + \end{bmatrix} \\ \text{NON-HEAD-DTR}|\text{HEAD} & \textit{verb} \\ \text{HEAD-DTR} & \begin{bmatrix} \text{LIGHT} & + \\ \text{NEGATED} & - \end{bmatrix} \end{bmatrix}$$

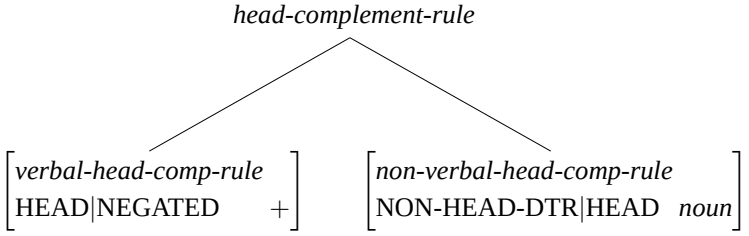
But at this point the grammar still overgenerates. We need to rule out sentence types where a non-negated auxiliary appears to the left of the lexical verb. The example in (19) is ruled out by Manandise's POS filter, but is licensed by our grammar as we've discussed it so far.

(19) *Da ibilli Miren.
3SGS.PRES walk.PERF Mary.ABS
Mary has walked. [eus]

We ruled out rightward negated auxiliaries by engineering the grammar so that all rightward auxiliaries pass through the verbal complex rule, then making this rule unavailable to negated verbs. In a similar fashion we can create a rule that all left-ward auxiliaries must pass through by creating subtypes of the head-complement

rule (20).[10] We still want to allow lexical verbs to combine with arguments without being negated, subtyping and constraining the rule in this way achieve this. Non-negated lexical verbs can pick up NP complements using the *non-verbal-head-comp-rule* and (only negated) auxiliaries can pick up their verbal complements using the *verbal-head-comp-rule*.

(20)



5 Conclusion and Outlook

We have seen that the existing analyses of (mostly) free word order and negation can in fact be adapted to work together to capture the facts of Basque. A key property of this success was the constructional approach taken by the word-order analysis, which led to the availability of specific rules on which to hang the constraints about negation.

The next step in this work is to consider the interaction of both word order and negation with focus. Focus is encoded in Basque word order, but negation also interacts with the focus position in Basque. In Basque, the element which appears just to the left of the lexical verb is focused. When this element is the negating auxiliary, Manandise (1988) treats the negation as having sentential scope. When the focused element is a NP, Manandise treats this construction as constituent negation. While a full treatment of information structure and its interaction with negation is left for future work, it seems quite likely that in fact both instances in fact involve sentential negation. It is well known that sentential negation in English is focus-sensitive (e.g., Fischer 1968 and Beaver and Clark 2008), as illustrated in (21).[11]

(21) a. Kim didn't read a long BOOK.

b. KIM didn't read a long book.

c. Kim didn't READ a long book.

[10] To achieve greater coverage with these rule types, we'll need to generalize the constraint on the head value of the non-verbal rule to be non-verbal, rather than strictly nominal.

[11] In these examples small caps indicate prosodically marked focus. Note that the default focus position for English is sentence final and focus can spread leftwards from that final position to successively larger constituents (Bolinger, 1961; Jackendoff, 1972).

d. Kim didn't read a LONG book.

Similarly, it would not be surprising to find that sentential negation is focus-sensitive in Basque. If focus is indicated through pre-verbal position, the interpretations that Manandise notes should follow.

We contend that the interfaces between information structure, syntax and semantics can only be fully understood via modeling with a precise, machine-readable grammar. We believe that the analyses presented here will form the basis of a grammar that can be extended to cover interactions with additional phenomena, including focus.

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