An *a priori* Typology of Bipartite Negation from an HPSG Perspective *

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Summary. In this paper I explore the logical range of sentential negation types predicted by the theory of HPSG. I find that typological surveys confirm that attested simple negation strategies neatly line up with the types of lexical material given by assuming Lexical Integrity and standard Phrase Structure Grammar dependencies. I then extend the methodology to bipartite negation and derive a space of predicted sentential negation types. I present details of the analysis for each type and relevant examples where possible.

Keywords: negation, exponence, typology, Grammar Matrix

1 Introduction

Every natural language exhibits sentential negation—the grammatical phenomenon whereby a linguistic construction is used to indicate that a sentence's semantic contribution is to be interpreted with a truth value opposite to that of its non-negated counterpart. This paper investigates and makes predictions about what particular constructions we should expect to find employed in the marking of negation across the world's languages.

HPSG theorists have provided analyses of negation for particular languages of interest[1] but this work attempts to generalize and make predictions about yet unseen negation types.

The methodology employed here is an *a priori* exploration. I look to HPSG theory for a model of lexical material and possible attachment mechanisms for morphs and I combine this with information about attested negation strategies reported in typological surveys of sentential negation to generate a family of negation analyses—a model of sentential negation from an HPSG perspective. Some of these analyses are familiar from HPSG literature, others are merely predicted by the methodology. Therefore, one purpose of this paper is to expose these analyses to a wider audience of linguists, who may know of a language to which a particular predicted analysis may apply.

1.1 Lexical Material in HPSG

Following Dryer (2005), this work assumes that negation must be indicated in a sentence by some lexical material, and that lexical material is composed of morphemes. Therefore, the first question to ask regards the relevant dimensions of variation for morphemes in HPSG.

Assuming the Lexical Integrity Hypothesis (Bresnan & Mchombo, 1995) and standard phrase structure grammar dependencies, we can create a partial typology of lexical material in HPSG as in (1). Below, these properties will be integrated into a broader typology of predicted negation types.

* This work would not have been possible without the assistance of my colleagues in the Grammar Matrix development group. Emily M. Bender, Antske Fokkens, Michael Goodman, Sanghoun Song and David Wax have each improved this research, remaining errors are my own.

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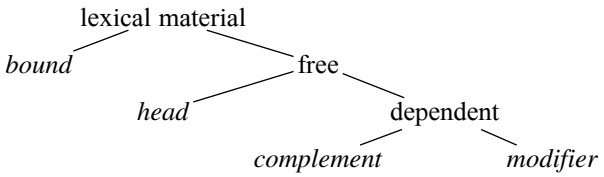
[1] For example, see (Kim, 2000) for Korean [kor], English [eng], French [fra] and Italian [ita].



(1)

1.2 Typological Survey

The broad categories of sentential negation as proposed in typological surveys partially overlap with the properties of morphemes in HPSG discussed above. The list of types given by Dahl (1979) is a representative example and is given in (2).

(2) a. morphological negation
b. uninflected negation particles
c. negative auxiliary
d. dummy auxiliary construction
e. double particle construction

Looking at Dahl's categories in light of HSPG theory and the typology of grammatical morphemes given above (1), there is a notable amount of correlation. The theory of grammatical morphemes has already predicted a large number of Dahl's types. Morphological negation corresponds to the *bound* node. Negative auxiliaries correspond to the *head* node under *free*. Uninflected negative particles corresponds to the *dependent* node of (1).

Furthermore, because a dummy auxiliary is not itself a negative word, Dahl's category "dummy auxiliary construction" (2d) can be seen as subsumed by his other categories, depending on the morphological status of the negator. In a fleshed-out, implemented grammar, the presence of the dummy auxiliary can be seen as a side effect of subcategorization and constraints on finiteness, topics not particular to negation.

Given this caveat, we have reduced Dahl's typology to three types which were predicted by the theory of grammatical morphemes: morphological negation, negative auxiliaries (syntactic heads), uninflected negative particles (syntactic dependents), but still outstanding is the deceivingly monolithic category "double particle construction".

1.3 Proposed Negation Typology

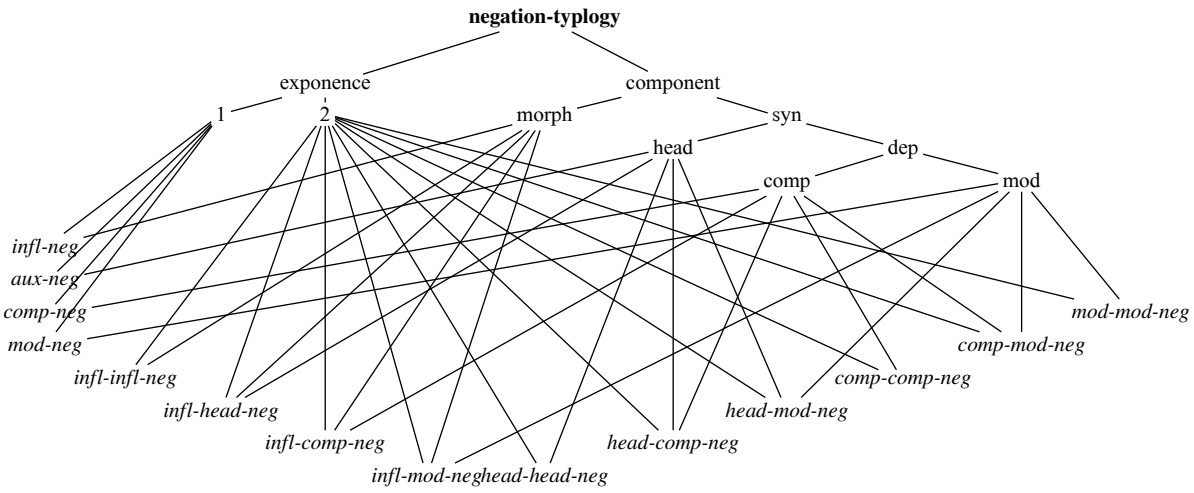


Figure 1: Morph type × exponence model of sentential negation

In this paper, I propose to unpack the category of "double negation" by adding a dimension of *exponence* to the typology of lexical material in (1) to derive the model in Figure 1. Typologists such as Dahl (ibid.) and Dryer (2005) have recognized that the exponcence of sentential negation can vary, but this work promotes the notion of exponence to a primary dimension of variation, deriving a family of subtypes for the henceforth unanalyzed category of double negation.

The main idea behind the model in Figure 1 is that both simple and bipartite negation constructions can be categorized in terms of the grammatical properties of the morphemes involved. Simple negation types were aptly predicted by the theory of HPSG morphology. This paper extends the approach to bipartite negation types, exploring each of the 10 predicted bipartite types to develop fleshed-out syntactic analyses where feasible. The work presented here has also been implemented in the LinGO Grammar Matrix (Bender, Flickinger, & Oepen, 2002; Bender et al., 2010) as an extension to the downloadable options for sentential negation. In this way, these analyses have been vetted by the development of grammatical test-suites for each type, which verify that the analyses work as expected. These test-suites and accompanying tests are part of the distribution of software available for download as the LinGO Grammar Matrix customization system.[2]

2 Typology

2.1 Simple negation

Here I briefly review the analyses for simple types before going on to to the bipartite negation types.

(3) a. s-ắm-á
1SG-eat-FV
I eat. [acv]

b. tsé-s-ùw-í d-ámm-ì
NEG-1SG-be-FV NMLZ-eat-FV
I do not eat. [acv]

(4) e-n syö-nyt omena-a
neg-1sg eat-PTCP apple-PART
I didn't eat an apple. [fin]

(5) I do not care
1SG AUX NEG care
I do not care. [eng]

(6) Musa rok gik mwa duŋ-duŋ ka
NAME throw rock PL much NEG
Musa didn't throw many rocks. [anc]

(3) is an example from Achumawi [acv] (Dryer, 2005) of a bound morphological negator which attaches to an auxiliary verb.[3] This type of morpheme can be modelled straightforwardly as an inflectional rule which attaches to auxiliary verbs and contributes the negation relation through C-CONT.

(4) provides an example of a negator as a syntactic head in Finnish [fin] (Dryer, 2005)—in this case an auxiliary verb which takes the lexical verb to be negated as a complement. This negative auxiliary verb can be modelled as contributing the negation relation through normal semantic composition of its own CONT value with that of its argument(s) via a head-complement rule. Assuming a grammar already has a model of semantically contentful auxiliaries, the idiosyncratic properties of the negative auxiliary are rather minimal, only the predicate name must be specified.

(5) shows a negated sentence of English [eng]. As mentioned above, (Kim, 2000; Kim & Sag, 2002) provide compelling arguments for treating the *not* of sentential negation as a selected complement of the auxiliary verb in the languages they analyze. For English, a valence-changing,

[2] The Grammar Matrix and Customization System is distributed under the MIT license and available for download as a subversion repository at `svn://lemur.ling.washington.edu/shared/matrix/trunk/` with user account "guest".

[3] Parallel to the English construction, here we see a dummy auxiliary introduced as the host to the negator. But the auxiliary is not itself a negative word.

non-inflecting lexical rule creates a version of the auxiliary which requires *not*, along with any other complements.[4]

(6) is an example from Ngas [anc] (Dryer, 2009), which is perhaps best treated as a modifier for two reasons. The first has to do with linguistic tradition and recursion. Kim and Sag (2002) treat finite (sentential) negation as a complement of the auxiliary after arguments based on the specific facts of English and French. They show that (in English) non-finite (VP) negation can recurse, but finite negation cannot. However, this argumentation is language specific. Without more facts about the syntactic structure of Ngas, we cannot apply their reasoning directly. The second reason comes from concerns of parsimony in a given implementation framework. In the formalism of Copestake (2002), argument lists are implemented as linked-lists whose length is not specified externally (cf. difference lists in the semantic representations). Thus, a monolithic lexical rule engineered to insert an additional complement at the end of the argument list of any verb is not possible. Instead, a specific lexical rule will have to be written for each verb valence class. This approach leads to an unnecessary over-complication of the lexical rule system. But this complication is avoided if the negator is attached by a head-modifier rule. The crux of this work is to provide a family of analyses which should be useful for the widest possible range of languages and grammar writers. So, these considerations have led me to include negation by modification alongside negation by complementation.

2.2 Bipartite negation

There are 10 bipartite negation types predicted by the methodology described in the introduction. Here, I examine each of these types in more detail.

infl-infl-neg Bipartite negation may be marked by two bound negators. Here, we can imagine two subtypes: (a) both negators are bound to the same head; (b) the negators are bound to separate heads. The case of (a) is attested, for example, in Izi-Ezaa-Ikwo-Mgbo [izi] (Dryer, 2009).

(7) ó tó-òmé-dú ré
3SG NEG-do-NEG well
He does not do well. [izi]

The (a) cases are readily modelled with existing approaches to implemented HPSG morphotactics, such as the one described in (Goodman & Bender, 2010) for the LinGO Grammar Matrix. One lexical rule can require the presence of another—and only one of the lexical rules will contribute the semantic relation and constraints shown in (8).

In the case of (b), with bound negators on separate heads, the only plausible situation is that one negator is bound to an auxiliary verb and the other to a lexical verb.[5] I have yet to find a report of such a construction, but the methodology here predicts its existence. A schematic example of such a structure in a SVO language where auxiliaries precede their arguments (and raise the VP subject) would look as in (8).

(8) np aux-neg1 iverb-neg2.

In terms of feature structures, this sort of construction is readily captured through the selectional properties of the auxiliary and lexical rules. The lexical rule that attaches to the auxiliary introduces negative semantics through C-CONT as in simple inflectional negation described above, but with the additional requirement that its lexical verb complement also be inflected for negation.

[4] As discussed in (Sag, Wasow, & Bender, 1999), this lexical rule treatment also parsimoniously sets up an analysis of a family of syntactic properties for English auxiliaries, the so-called NICE properties: Negation, Inversion, Contraction, Ellipsis.

[5] If the putative second negator is bound to a nominal, it is best conceived of as a case of negative concord, a phenomenon distinct from bipartite negation, cf. (De Swart & Sag, 2002)

To achieve this, the lexical rule will also constrain its head's COMPS value to require a particular FORM value—one which the lexical rule attaching to the lexical verb will specify.

infl-head-neg In this negation type, an inherently negative auxiliary verb is present and the lexical verb is marked with a required negative affix. I have not yet found a language with sentential negation of this type. Yet, schematically, such a construction looks as in (9):

(9) np neg1.aux iverb-neg2.

The feature structures involved in this negation type are like ones we have already seen. The negative auxiliary will also have to require the presence of *-neg2* on its complement through the FORM feature, and the grammar will have to contain a rule such as (9b) to introduce the negative affix to the lexical verb and constrain its FORM value.

infl-comp-neg This type is widely attested, as for example in French [fra] (Dryer, 2005) (10) (as analyzed by Kim & Sag, 2002).

(10) Je ne-vois pas la lune
1SG NEG1-see.1SG NEG2 the moon
I do not see the moon. [fra]

The facts of French suggest that the free negator, *pas*, carries negative force, so the lexical rule which attaches the inflection to the finite verb will place an element on the finite verb's complements list. For French, the additional complement is placed at the front of the list, so we don't run into any problem finding the length of the list.[6]

infl-mod-neg In this type, sentential negation is marked by verbal inflection, and a modifier is also present.

The case of Ma [msj] (Dryer, 2005; Tucker, Bryan, & Leslau, 1966, 130) (11) may present an example of such a construction. In [msj], the lexical verb is inflected by the prefix *tá-*, and an obligatory element which is inflected for agreement with the subject is placed at the end of the VP. Tucker and Byran refer to this element as a "postposition inflected for person". At first glance, the inflection on this element may suggest that it is in fact an auxiliary verb (thus an example of *infl-head-neg*). But in Ma, auxiliary verbs are placed before the lexical verb, a fact which militates against such an analysis.

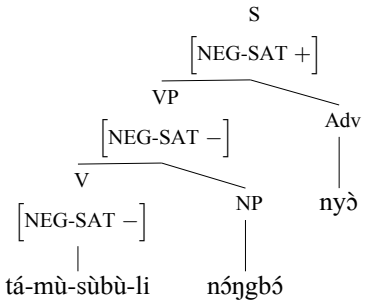
(11) tá-mù-sùbù-li nɔ́ŋgbɔ́ nyɔ̀
NEG-1SG-eat-PST meat NEG.1SG
I did not eat meat. [msj]

We can add the negative semantic relation via the inflectional lexical rule which attaches to the finite verb. To create the dependency between the inflectional marker of negation and the post VP modifier, an additional feature must be introduced. This *luk*-valued feature is termed NEG-SAT and is defined on *synsems*. The root condition is amended to require that grammatical sentences are [NEG-SAT *na-or-*+] and most phrase structure rules are annotated such that the value of NEG-SAT is passed up via the head-path. The lexical rule which introduces negation on the finite verb sets NEG-SAT to −. Finally, a subtype of head-modifier rule is defined to attach the free negator to a VP which is [NEG-SAT −] and create a resulting phrase which is [NEG-SAT +]. In this way, the lexical rule which attaches negation to the finite verb can only appear in a grammatical sentence which also picks up the secondary marker of negation once the VP is

[6] Linked lists support push and pop operations (akin to stacks). Placing an item on top of the stack is trivial. Finding the depth of the stack takes extra computation, as discussed above.

completed (12). The approach of using a head-modifier rule avoids the complication of creating separate types of lexical rule for each verbal valence class.

(12)



head-head-neg This type is considered grammatically incoherent. One head enforcing the presence of the other defines the second head as a dependent. This type is hereby discarded.

head-comp-neg In this type of double negation, an inherently negative auxiliary verb requires a grammatical complement. Schematically, such a construction looks as in (13).

(13) np neg1.aux iverb neg2.

On the surface, this type is similar to others we've seen above. The choice to model the *neg2* dependency as a complement or modifier will be dependent upon language specific argumentation. The schematic example shown in (13) can be modelled using a negative auxiliary as in (9), with the added requirement on the COMPS list for the negative particle. Note that in the cases where the introducer of negative force is a head, we do not encounter the problem of finding the length of the argument list because it is simply specified in the lexical entry for this auxiliary verb type—there's no need to alter this list once it has been defined.

head-mod-neg This type is similar to the *head-comp-neg* but the secondary negation marker is attached through head-modifier rather than head-complement rules. On the surface, the example looks identical to (13). To invoke this type language specific arguments about the grammatical system under consideration would have to be made. In general, considerations of parsimony go against this sort of analysis because the NEG-SAT approach described above for *infl-mod-neg* will have to be used. Given a negative head and a (free) negative dependent, the *head-comp-neg* approach is preferred. On the other hand, if syntactic tests for argument-hood fail, the NEG-SAT approach is still a viable way to handle these sorts of constructions.

comp-comp-neg In this type, negation is marked by two obligatory complements of a verb. As with the *infl-infl-neg* type described above, we can imagine two subtypes: a) both complements are subcategorized by the same verb; b) one complement is selected by an auxiliary the other by a lexical verb. The case of (a) can be modelled according to a lexical rule which attaches to a verb and modifies its COMPS list. If one of the complements appears at the end of the list, this sort of analysis incurs the difficulty discussed above: subtypes of the lexical rule must be posited for each valence class. An example from Afrikaans [afr] (Bell, 2004; Oosthuizen, 1998) (14) presents a structure which could be analyzed as a (b)-type case. The auxiliary must place a requirement on the lexical verb that it also have undergone a complement-changing lexical rule.

(14) Hulle was nie betrokke nie
they were NEG1 involved NEG2
They were not involved. [afr]

This dependency can be achieved via the engineering of a feature which is passed up the head path when a verb is negated. A head feature [NEGATED *luk*] can be introduced by a lexical rule (in this case, the same rule which introduces the verbal complement). Then the finite auxiliary will also require that its lexical verb complement be [NEGATED +].

comp-mod-neg In particular examples, this negation type would look similar to *comp-comp-neg*. Syntactic tests for the treatment of the secondary negator as a modifier will have to be made. We can create an analysis of this type using a lexical rule to introduce the *neg1* complement, and the NEG-SAT analysis (as presented above) to create the requirement that *neg2* be attached through a head-modifier rule.

mod-mod-neg To create a construction with two required modifiers, we can adapt the NEG-SAT approach described above such that the attachment of the first negator (rather than a lexical rule) sets the phrase's NEG-SAT value to −, then the second negator will still go through a specialized rule which will set the value back to +. Because only clauses which unify with [NEG-SAT *na-or-*+] are licensed, this approach will require *neg2* to appear whenever *neg1* does. Although there may be the intervention of other modifiers and complements, as expected for head-modifier constructions.

3 Outlook and Conclusion

I have presented an *a priori* typology of sentential negation in HPSG. This approach makes predictions about what negation types we expect to find in the world's languages and provides accompanying analyses for these types. The typology's predictions for simple negation are fulfilled by numerous examples, whereas the results for the bipartite section are less clear, mostly for lack of data. Typologists have avoided the subclassification of bipartite negation constructions—treating them as a monolithic group.

One contribution of this work is the proposal to treat bipartite constructions where the secondary negator is free and occurring after other verbal complements as involving head-modifier rules and the feature-passing of [NEG-SAT *luk*]. This approach provides two immediate advantages. The first (as mentioned above) is that it avoids the opaque and baroque approach of creating subtypes of COMPS-changing rules for each verb valence class. The second has to do with a reported phenomenon in a number of languages with bipartite negation: haplology of the secondary marker when multiple negations are embedded (for example, in Hausa [hau] (Crysmann, 2010) (15a), and Lubukusu [bxk] (Bell, 2004) (15b)). Haplology of the secondary marker follows automatically from the NEG-SAT approach because multiple negations do not create multiple NEG-SAT dependencies. After one (or many) negations have been attached to a clause, there is a single [NEG-SAT −] feature whose value will be + once the *neg2* marker is placed.

(15)

a. Peter se-abolele John ali Sally
Peter NEG1-tell John COMP Sally
se-amala ekasi ta (*ta)
NEG1-finish work NEG2 NEG2
Peter did not tell John that Sally did not finish her work. [bxk]

b. bǎ̀ bà zā mù tàfi ba (*ba) nè
NEG NEG FUT.1.PL go NEG NEG COP
It is not that we are not going. [hau]

There are two important next steps in this research. The first regards another option for grammatical attachment in HPSG: EDGE-marking. Edge-marking is the phenomenon whereby inflection appears at the left or right boundary of phrases, and is the approach that Crysmann (2010) defends for Hausa [hau]. Section 2 of Crysmann (ibid.) also provides a review of approaches to

EDGE inflection in HPSG. To represent a more complete inventory of HPSG morpheme placement strategies, EDGE-marking must be integrated into the small typology of (1).

The other future step in this research is to take a closer look at even more descriptive grammars in order to ascertain whether the predicted types given here do occur in natural languages and to deal with interactions between these predicted negation types and other components of grammars. The question of how well these analyses scale in the face of complex, implemented systems must be addressed.

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