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Word order, negation, and negative polarity in Hindi

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Abstract

In Hindi certain word ordering possibilities that are grammatical in non-negative sentences become ungrammatical in the presence of sentential negation. In movement-based accounts of such negation-induced word order constraints, the restricted word order has been argued to provide evidence that negative polarity items (NPIs) in Hindi are licensed at LF and s-structure while in English NPI licensing occurs at s-structure. I argue for a non-movement-based, uniformly monostratal (s-structure) account for the word order facts in Hindi, cast in the multimodal categorial grammar framework. The NPI licensing issue is dealt with independently following Dowty's monotonicity marking analysis.

This paper presents a uniform treatment of two related phenomena in Hindi: word order constraints imposed by sentential negation, and an asymmetry between Hindi and English negative polarity items (NPIs). I develop a theory set in multimodal categorial grammar (see e.g., (Moo97)) and argue that my treatment has several advantages over existing transformational accounts.

The structure of the paper is as follows. Section 1 presents the word order and NPI facts, and Section 2 discusses two transformational analyses of the related issue of NPI licensing, and points out several problems with these. Sections 3 and 4 present an alternative, monostratal account set in categorial grammar for the word order and negative polarity problems, and Section 5 concludes the paper.

1 Constraints on word order

Mahajan (Mah88) discusses the various ordering possibilities for a sentence with an intransitive or transitive verb and negation. Although he presents examples of both intransitive and transitive verbs, we will consider only transitive verbs here since the facts for these subsume those for intransitives. Let us first look at a representative set of acceptable and unacceptable sentences with a transitive main verb and its arguments, an auxiliary, and negation (I do not consider all possible word orders here due to space limitations). Although the facts presented below correspond to Mahajan's, the generalizations I give are my own.

(1)

(a)	*raam*	*roṭii*	*nahĩĩ*	*khaataa*	*thaa*
	Ram	bread	neg	eat-imp-part-masc	be-past-masc

'Ram did not (use to) eat bread.'

(b)	*raam*	*roṭii*	*khaataa*	*nahĩĩ*	*thaa*
	Subj	Obj	V	Neg	Aux
(c)	*roṭii*	*raam*	*nahĩĩ*	*khaataa*	*thaa*
	Obj	Subj	Neg	V	Aux
(d)	*roṭii*	*nahĩĩ*	*khaataa*	*thaa*	*raam*
	Obj	Neg	V	Aux	Subj
(e)	*roṭii*	*khaataa*	*nahĩĩ*	*thaa*	*raam*
	Obj	V	Neg	Aux	Subj
(f)	*raam*	*nahĩĩ*	*khaataa*	*thaa*	*roṭii*
	Subj	Neg	V	Aux	Obj

All these are instances of sentential negation, provided no special prosodic contour is employed (as discussed further on). Examples such as these show that the Subj(ect) and Obj(ect) can appear freely around the Neg-V-Aux or V-Neg-Aux cluster. By contrast, the following ungrammatical possibilities show that neither the Subj nor the Obj can appear anywhere within the Neg-V-Aux or V-Neg-Aux cluster (see (2a-d)). In each case, the relevant element is underlined (all these are intended to be cases of sentential negation, not constituent negation–this is discussed in the next sub-section).

(2)

(a)	**raam*	*nahĩĩ*	*roṭii*	*khaataa*	*thaa*
	Subj	Neg	Obj	V	Aux
(b)	**nahĩĩ*	*raam*	*roṭii*	*khaataa*	*thaa*
	Neg	Subj	Obj	V	Aux

(c) **raam nahĩĩ khaataa roṭii thaa*
Subj Neg V <u>Obj</u> Aux

(d) **roṭii nahĩĩ khaataa raam thaa*
Obj Neg V <u>Subj</u> Aux

Furthermore, the following examples show that Aux cannot precede the Neg-V complex (see (3a,b)), and that it cannot intervene between the Neg and V (see (3c-e)).

(3) (a) **raam roṭii thaa nahĩĩ khaataa*
Subj Obj <u>Aux</u> Neg V

(b) **raam roṭii thaa khaataa nahĩĩ*
Subj Obj <u>Aux</u> V Neg

(c) **raam roṭii khaataa thaa nahĩĩ*
Subj Obj V <u>Aux</u> Neg

(d) **raam khaataa roṭii thaa nahĩĩ*
Subj V <u>Obj</u> <u>Aux</u> Neg

(e) **raam khaataa thaa roṭii nahĩĩ*
Subj V <u>Aux</u> <u>Obj</u> Neg

Examples such as these allow us to conclude that V(erb) and Neg(ation) form an inseparable cluster in which internal order is free, the Aux(iliary) must appear to the immediate right of this complex, and Subject and Object may occur in any permutation outside this Neg-V-Aux complex.

1.1 Some apparent counterexamples

There are several apparent counterexamples to the generalizations I present above based on Mahajan's data. However, these turn out not to be cases of sentential negation, but involve either metalinguistic negation, constituent negation, or pragmatics-dependent auxiliary- or negation-fronting. In each case, a special prosodic contour is necessary (shown here simply by capitalization of the prosodically marked word).

Sentential negation is contrasted with constituent (contrastive) negation in (4) below. In (4b), the negated constituent can have the negation to its immediate right, thereby apparently violating the constraint regarding Verb-Negation contiguity. The same holds for instances of metalinguistic negation.

(4) (a) *Siitaa-ne kitaab nahĩĩ khariidii*
Sita-erg book neg bought
'Sita didn't buy a/the book.'

(b) *SIITAA-ne nahĩĩ kitaab khariidii (kisii-aur-ne khariidii)*
Sita-erg neg book bought someone-else-erg bought
'SITA didn't buy a/the book (someone else did).'

Similarly, although based on the earlier data we have claimed that the Auxiliary appears to the right of the verb (independent of whether negation is present or not), it can appear sentence-initially. But in this case as well, a special prosodic contour accompanies this auxiliary fronting. Consider the following sentences.

(5) (a) **hai mere-pas kitaab*
is me-with book
(Intended) 'I have a/the book.'

(b) *HAI mere-pas kitaab*
was me-with book
'I DO have the book.'

(c) *hai MERE-pas kitaab*
was me-with book
'It is me (and not someone else) who has the book.'

(5b) is fine just in case in a preceding discourse someone has directly or indirectly suggested that the current speaker doesn't have the book. The speaker could then utter (5b) to deny this previous assertion. (5c) is self-explanatory. Gambhir (Gam81) has also noted this kind of unusual word order in special contexts involving certain presuppositions.

Next, consider the following contrast:

(6) (a) **nahĩĩ siitaa-ne kitaab khariidii*
neg Sita-erg book bought
(Intended) 'Sita didn't buy a/the book.'

(b) *NAHĨĨ siitaa-ne kitaab khariidii*
neg Sita-erg book bought
'Sita didn't buy a/the book <u>after all</u>.'

(6a), uttered with normal intonation, is ungrammatical as sentential negation, but in (6b), which is fully acceptable, there is a presupposition to the effect that either someone tried to persuade Sita to buy a book or she was supposed to buy it for whatever reason, but she didn't buy it.

The above apparent counterexamples do not exhaust such "pragmatically driven" violations of the constraints mentioned above; see Bhatia (Bha95) and Gambhir (Gam81) for further details. Prosody is clearly implicated in these marked orders. In this paper I do not discuss anything other than sentences with sentential negation, uttered with normal intonation (see (Har96) for more details regarding what I mean by normal intonation in Hindi). The role of prosody will be addressed in future work.

Putting aside the above cases, in the next section I first summarize Mahajan's barriers-based account of these word order facts and the related NPI facts, and then Bhandari's (Bha98) minimalist treatment of Hindi and English NPI. I then try to show that neither of these provides a satisfactory account.

2 Subject vs. non-subject NPIs in Hindi and English

2.1 Mahajan on word order and negation

Mahajan ((Mah88), (Mah90)) has argued as follows. The direct object (DO) *sabzii*, 'vegetables', in (7a) cannot be scrambled from its canonical position to the right of the main verb *khaatii* when negation is present, as in (7b), but can be without the negation (see (7c)).

(7) (a) *siitaa* *sabzii* *nahĩĩ* *khaat-ii* *thii*
Sita(fem) vegetables neg eat-imp-fem be-past-fem
'Sita did not use to eat vegetables.'

(b) **siitaa* t_i *nahĩĩ* *khaat-ii* *sabzii*$_i$ *thii*
Sita(fem) neg eat-imp-fem vegetables be-past-fem
'Sita did not use to eat vegetables.'

(c) *siitaa* t_i *khaat-ii* *sabzii*$_i$ *th-ii*
Sita(fem) eat-imp-fem vegetables be-past-fem
'Sita used to eat vegetables.'

In (7a), " ... negation is adjoined to the right of the VP and V to AGR to I raising in Hindi gives the relevant word order ... " (Mah90, 337). (7b) above is ruled out by assuming that negation must raise at LF to adjoin to a finite IP for independent reasons; the DO, scrambled to a position below IP, is then a barrier to this LF movement since " ... adjunction to a maximal projection creates a barrier for any further extractions from within that maximal projection" (Mah90, 338-339).

Now consider these examples (also due to Mahajan (Mah90)), and the simplified tree diagrams for (8b) and (8c) below:

(8) (a) *siitaa* t_i *nahĩĩ* *khaat-ii* *th-ii* *sabzii*$_i$
Sita(fem) neg eat-imp-fem be-past-fem vegetables
'Sita did not use to eat vegetables.'

(b)	**koi-bhii*	t_i	*nahĩĩ*	*khaat-aa*	*sabzii*$_i$	*th-aa*
	anyone(masc)		neg	eat-imp-masc	vegetables	be-past-masc

(Lit.) ‘Anyone did not use to eat vegetables.’
(Intended) ‘No-one used to eat vegetables.’

(c)	*koi-bhii*	t_i	*nahĩĩ*	*khaat-aa*	*th-aa*	*sabzii*$_i$
	anyone(masc)		neg	eat-imp-masc	be-past-masc	vegetables

‘Anyone did not use to eat vegetables.’ (=‘No-one used to eat vegetables.’)

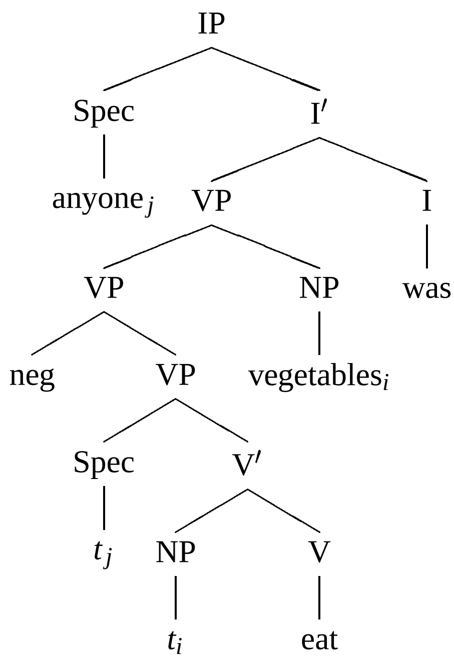


Figure 1: (8b)

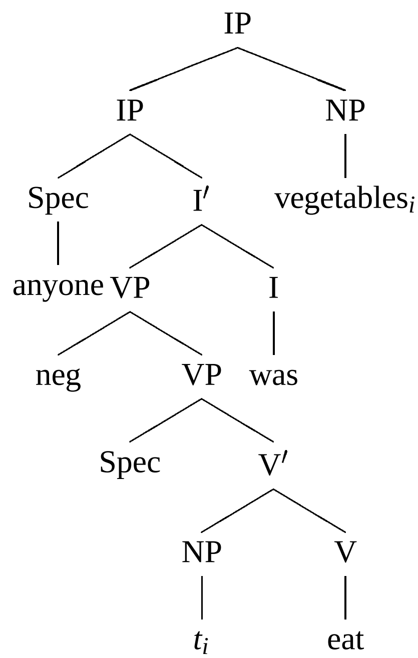


Figure 2: (8c)

According to Mahajan, (8a) is allowed because the DO is adjoined higher than I (to IP) and thus is not a barrier to LF movement of negation as it adjoins to IP above the scrambled DO. (8b) is ruled out as in the case of (7b), but (8c)’s grammaticality is taken to indicate that negative polarity items (NPIs) in Hindi must be licensed at LF, since both the scrambled DO and negation adjoin to IP (the former at s-structure, and the latter at LF), as shown in Figure 1 and Figure 2 (adjunction by negation at LF is not shown here).

Similarly, in the case of the transitive verb constructions given earlier, the subject and/or object may scramble to the right of the main verb and the auxiliary, and the ungrammatical possibilities are ruled out as in the case of (7) and (8).

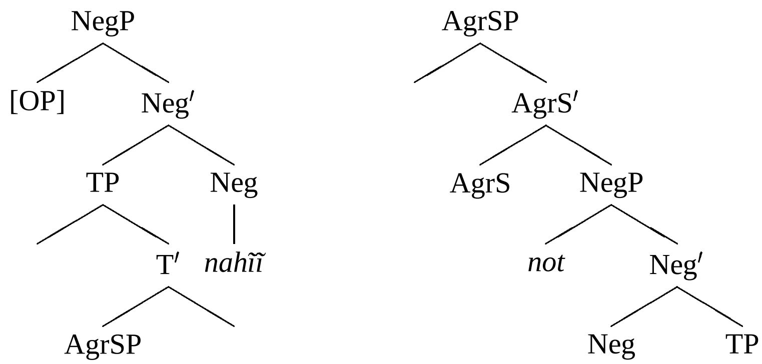
There are two problems with this analysis. First, Kim and Sag (KS95), and Abeillé and Godard (AG97), among others, have convincingly shown that the functional projection approach is both empirically and theoretically inadequate. Although this may eventually turn out to be a moot point (see (SR99) and (Ver99)), I explore the possibility of accounting for the facts without assuming functional projections.

The second problem relates to the connection between word order variation and NPI licensing. Mahajan (Mah90) proposes that NPIs must be c-commanded by negation and that there must not be any intervening barriers between negation and the NPI. This condition applies at both LF and S-structure in English, while in Hindi it applies only at LF. These different licensing conditions in Hindi versus English are ascribed to a parametric difference. Under this view, (8b,c) are taken to indicate that LF is the relevant licensing condition on NPIs in Hindi. However, consider examples (7b) and (8b); together these show that the negated sentence is ungrammatical irrespective of whether the subject is an NPI or not, so the argument that (8b) is bad because the subject is an NPI is not convincing–the ungrammaticality could be more straightforwardly argued to be due to the barrier to negation's (LF-)movement. Pursuing this idea, I argue below that the Hindi word order constraints and negative polarity licensing are independent issues.

2.2 Bhandari and others on the asymmetry problem

Two other proposals present different analyses of the asymmetry problem (although these do not discuss the word order issue): Bhandari (Bha98) proposes a Minimalist (Cho95) solution whereby licensing occurs purely at LF. Hindi negation projects a functional projection NegP and the negation head selects for Tense Phrase (TP). The difference between English and Hindi subject NPI licensing is due to the fact that the functional projection Agreement Subject Phrase lies below TP in Hindi, but immediately above NegP in English, as shown below. Since Neg c-commands SpecAgrSP in Hindi but not in English, subject NPIs are allowed in Hindi but not in English.[1]

[1]Dwivedi (Dwi91), although not concerned with the asymmetry problem, also proposes a functional projection NegP for Hindi negation, but in her case the negation head selects for VP and is selected for by Aspect Phrase, which is further selected by TP.



Hindi English

Figure 3

Vasishth (Vas97) presents a purely s-structure account of the asymmetry problem where NegP plays a crucial role in NPI licensing. Here, Brody's (Bro95) representational chains and Haegeman's Neg-criterion are the licensing mechanisms. All these analyses make several problematic assumptions, which I discuss next.

2.3 Problems with existing analyses

2.3.1 No NegP in Hindi

Mahajan (Mah88) has shown that Hindi negation cannot project a functional projection, so any account, such as Bhandari's or Vasishth's, both relying on functional projections, will first have to demonstrate that these are in fact sufficiently motivated in Hindi.

Mahajan's argument against NegP as a functional projection is that, given the fact that the main verb can move past negation, as in (9), we have to assume that the head movement constraint (Tra84) is not violated when the verb moves. This means that negation is not a head.

(9) (a) *raam aayaa nahı̃ı̃*
Ram came neg
'Ram didn't come.'

(b) *raam* t_i *nahı̃ı̃* *aayaa*$_i$
Ram neg came
'Ram didn't come.'

2.3.2 No motivation for LF-based NPI licensing in English

Culicover (Cul81), Laka (Lak94), and May (May77) have shown that NPI licensing in English is an s-structure phenomenon. Consequently, Bhandari's Minimalist analysis, which carries out English NPI licensing to LF, is hard to motivate.

Two of the arguments against LF licensing of NPIs come from quantifier lowering (QL) and reconstruction. May (May77) (also see (Las99, 18-19)) has shown that quantificational elements like NPIs cannot be regarded as undergoing the kind of QL that *some* undergoes in *some politican is likely to address John's constituency*. The reason is that if QL were to occur in the case of NPI *any*, *anyone is unlikely to address the rally* would be wrongly predicted to be grammatical, since the subject NPI could lower at LF to a position below the negative element *unlikely*. Laka (Lak94, 123) also argues that reconstruction (see (Cho77), (vRW86)) cannot allow LF licensing of NPIs since reconstruction would incorrectly predict *anybody wasn't arrested by the police* to be grammatical, as well as preposed VPs like *buy any records is what she refused to do*.

2.3.3 The role of downward monotonicity

The accounts of Mahajan, Bhandari, and Vasishth don't address the fact that downward monotonicity of the NPI licensor plays a central role in NPI licensing. In these analyses, downward monotonicity may be integrated by other means, of course, but it is merely a structural mechanism that ensures that only the grammatical sentences like (8c), and not (8b), are produced. We will assume that downward monotonicity is relevant for NPI licensing, at least in English and Hindi (see, e.g., (Lad79) and (Vas98)).

2.4 Desiderata for a theory of NPI licensing

To summarize the above discussion, existing analyses of the subject-object NPI asymmetry in Hindi and English have the problems that (i) the functional projection NegP is not motivated for Hindi, (ii) English NPI licensing cannot happen at LF, and (iii) the role of downward monotonicity in NPI licensing needs to be taken into account. In response to these issues, I present an alternative analysis of NPI licensing based primarily on Dowty's work (Dow94).

3 Multimodal categorial grammar

Categorial Grammar (CG) is a monostratal, strictly lexical framework for linguistic theory, a characteristic feature of which is the close interaction between the syntax and semantics of linguistic objects. Categorial type-logics (see (Car97) and (Moo97) for their relation to categorial grammar) build up complex syntactic units from atomic lexical entries using purely logical derivations. In the type-logical variant I adopt in this paper, I use the calculi **L**, the Lambek calculus, and **LP(◇)**, the Lambek calculus with permutation and modalities. Given certain empirical facts, the aim is to build a deductive system allowing the composition of form and meaning, treating the grammar as a system of logic, i.e., a system for reasoning about structured linguistic resources. The central idea is that the lexicon contains all the information needed for building up grammatical sentences, and the combination of words to form sentences is effected by means of a set of logical inference rules. Below, I give a brief overview of the way the system is built up. For a more detailed discussion, see (Moo97).

TYPES AND CONNECTIVES

We define basic types like $s, n, \ldots$, along with binary and unary connectives, both of which will serve as building blocks for lexical entries, as we presently show.

$\mathcal{B}$, the set of basic types, $\mathcal{B} = \{det, s, n, \ldots\}$

$\mathcal{C}$, the set of connectives, $\mathcal{C} = \{\bullet, /, \backslash, \multimap, \Diamond, \Box^{\downarrow}\}$

$\mathcal{T}$, the set of types, $\mathcal{T} ::= \mathcal{B} \mid \mathcal{T} \bullet \mathcal{T} \mid \mathcal{T} \backslash \mathcal{T} \mid \mathcal{T} / \mathcal{T} \mid \mathcal{T} \multimap \mathcal{T} \mid \Diamond \mathcal{T} \mid \Box^{\downarrow} \mathcal{T}$

The above definition for types $\mathcal{T}$ says that a legal type is either a member of the set of basic types, or some type(s) defined as in $\mathcal{T}$ related by any of the binary connectives $\bullet$, $\backslash$, $/$, $\multimap$, or the unary connectives $\Diamond$ and $\Box^{\downarrow}$.

In addition to these, the Gentzen sequent system we use here requires that for every class of n-ary *logical* connectors, there be an n-ary *structural* connector. For example, for the unary logical connectors $\Diamond$ and $\Box^{\downarrow}$, we have the structural connector $(.)^{\Diamond}$.

SEQUENTS

A set of sequents $\mathcal{S}$ is defined as follows: $\mathcal{S} ::= \mathcal{T} \mid (\mathcal{S}, \mathcal{S}) \mid (S)^{\Diamond}$.

Object-level statements are expressed by sequents $\Gamma \vdash A$, where $\Gamma \in \mathcal{S}$ and $A \in \mathcal{T}$. In $\Gamma \vdash A$, Γ is the ANTECEDENT, A is the SUCCEDENT; we read $\Gamma \vdash A$ as "A may be proven from Γ". So, for example, the sequent $\Gamma_1, \Gamma_2, \Gamma_3, \ldots \vdash A$ amounts to saying that the Γ_i's can be concatenated to give an expression of category A. A simple linguistic example would be *mary sleeps* $\vdash s$, where *mary* has type s/vp and *sleeps* has type vp (with appropriate λ-terms associated with each category), so that the sequent looks like $s/vp \;\; vp \vdash s$.

In the model theory, the categorial connectives are treated as modal operators, the type formulae being interpreted in the powerset algebra of Kripke-style relational structures (Moo97, 101-115).

THE ASSOCIATIVE LAMBEK CALCULUS: **L**

L has the following inference schemas:

$$\frac{}{A \vdash A}\ Axiom$$

$$\frac{\Gamma, A, B, \Delta \vdash C}{\Gamma, A \bullet B, \Delta \vdash C}\ \bullet L \qquad \frac{\Gamma \vdash A \quad \Delta \vdash B}{\Gamma, \Delta \vdash A \bullet B}\ \bullet R$$

$$\frac{\Gamma \vdash A \quad \Delta, B, \Delta' \vdash C}{\Delta, B/A, \Gamma, \Delta' \vdash C}\ /L \qquad \frac{\Gamma, A \vdash B}{\Gamma \vdash B/A}\ /R$$

$$\frac{\Gamma \vdash A \quad \Delta, B, \Delta' \vdash C}{\Delta, \Gamma, A\backslash B, \Delta' \vdash C}\ \backslash L \qquad \frac{A, \Gamma \vdash B}{\Gamma \vdash A \backslash B}\ \backslash R$$

These inferences are read from bottom to top. In any of the above inference schemas, the sequent(s) above the line are the PREMISES, and the sequent below the line is the CONCLUSION. The variables Γ, Δ, Δ' stand for possibly empty sequences (actually, the sequences contain category-meaning pairs; discussion of the semantic component associated with each syntactic operation is suppressed in this paper). I treat the binary structural connectives as implicitly associative.

I explain next some of these schemas that we will use. $\backslash$L and /L above allow a slash connective to be eliminated from the left-hand side. For example, the /L says that if we want to analyze a sequence with a forward slash "/", e.g., B/A, possibly preceded or followed by some material (hence the variables Γ, Δ and Δ'), and we can find a sub-sequence Γ that rewrites B, then we can get the result by analyzing Δ, B, Δ'. Similarly for the right slashes, except that in these the derived category contains a slash. See (Car97) for a more detailed discussion.

Finally, the *Axiom* rule comes into play in the sequent proofs. A sequent proof in this system is a finite tree such that every local subtree matches one of the schemas, and a sequent is derivable if (and only if) it forms the root of a tree whose leaves are instances of the axiom rule.

THE LAMBEK CALCULUS WITH PERMUTATION: **LP**

LP is simply **L** with the structural rule of Permutation (Permute) added on:

$$\frac{\Gamma[(\Delta_2, \Delta_1)] \vdash C}{\Gamma[(\Delta_1, \Delta_2)] \vdash C}\ \text{Permute}$$

Permutation is also compiled away in the Gentzen presentation by treating sequents as multisets. The linguistic relevance of Permutation will become clear when we look at some example derivations.

$$A \vdash A$$

$$\frac{\Gamma, A, B \vdash C}{\Gamma, A \bullet B \vdash C}\ \bullet L \qquad \frac{\Gamma \vdash A \quad \Delta \vdash B}{\Gamma, \Delta \vdash A \bullet B}\ \bullet R$$

$$\frac{\Gamma \vdash A \quad \Delta, B, \Delta' \vdash C}{\Delta, \Gamma, A \multimap B, \Delta' \vdash C}\ \multimap L \qquad \frac{A, \Gamma \vdash B}{\Gamma \vdash A \multimap B}\ \multimap R$$

$$\frac{\Gamma \vdash A \quad \Delta, A \vdash B}{\Delta, \Gamma \vdash B}\ Cut$$

With the inference rules involving the directionally insensitive connective $\multimap$, and treating the sequents as multisets, we now allow the argument A of a functor like $A \multimap B$ to appear to the left or right of the functor; this contrasts with our directional slashes in **L**, where $A \backslash B$ requires its argument A to be to its left.

THE MODALITIES $\Diamond$ AND $\Box^{\downarrow}$

The unary operators $\Diamond$ and $\Box^{\downarrow}$ are related to each other by the following equivalence (also see (Moo97)).

$\Diamond A \vdash B$ *iff* $A \vdash \Box^{\downarrow} B$

The interpretation of these two operators is defined by a binary accessibility relation R^2:

$[\![\Diamond A]\!] = \{b \mid \exists a(R^2 ba \wedge a) \in [\![A]\!]\}$

$[\![\Box^{\downarrow} A]\!] = \{a \mid \forall b(R^2 ba \rightarrow b) \in [\![B]\!]\}$

$$\frac{\Gamma[(A)^{\diamond}] \vdash B}{\Gamma[\Diamond A] \vdash B}\ \Diamond L \qquad \frac{\Gamma \vdash A}{(\Gamma)^{\diamond} \vdash \Diamond A}\ \Diamond R$$

$$\frac{\Gamma[A] \vdash B}{\Gamma[(\Box^{\downarrow} A)^{\diamond}] \vdash B}\ \Box^{\downarrow} L \qquad \frac{(\Gamma)^{\diamond} \vdash A}{\Gamma \vdash \Box^{\downarrow} A}\ \Box^{\downarrow} R$$

$\Gamma[A]$ in the above rules means that the material A in square brackets is some sub-structure (respecting structural bracketings of the left-hand side Γ of a sequent. We will use the $\Box^{\downarrow}$ modality to handle the word order facts. The basic idea is that sequents are in general permutable, but any types marked with the $\Box^{\downarrow}$ (and the $(.)^{\diamond}$ structural marking) do not allow permutation outside the boxed ($\Box^{\downarrow}$'ed) type.

With this brief introduction to the underlying framework, we turn to the empirical issues discussed above.

3.1 Getting the right word order

We can capture the word ordering facts by defining the lexicon as follows.

(10) (a) *nahīĩ*, 'not' $\rightsquigarrow (vp \multimap \Box^{\downarrow}vp) : \lambda P \neg P$

(b) *siitaa*, 'Siitaa' $\rightsquigarrow np : sita'$

(c) *sabzii*, 'vegetables' $\rightsquigarrow np : vegetables'$

(d) *khaatii*, 'ate' $\rightsquigarrow np \multimap np \multimap s : \lambda x \lambda y.eat(x,y)$

(e) *thii*, 'had' $\rightsquigarrow (vp \backslash \Box^{\downarrow}vp) : \lambda P.had(P)$

Some of these entries need explanation. The syntactic category of the negative *nahīĩ* is lexically specified as in (10a); vp is an intransitive or transitive verb phrase. The non-directional implication $\multimap$ indicates that the VP argument for negation may occur either to the left or the right of the negation. The result category $\Box^{\downarrow}vp$ ensures that after the verb and negation have combined together, nothing may intervene between them. The λ-term corresponding to the negation functor is the standard one and should be self-explanatory. In (10d), The lexical entry for *khaatii*, 'ate', says that it needs two *np*s as arguments in order to form an s, but that the ordering is free: the *np*s can occur before or after the verb (I ignore agreement issues here for expository purposes). The entry for the auxiliary verb *thii*, on the other hand, says that it needs some kind of verb to its immediate left in order to form a 'boxed' category of the same type, the $\Box^{\downarrow}$ ensuring that no argument of the verb can appear inside the cluster of negation-verb-auxiliary.

Let us work through a derivation to see how this works. In the following discussion, $np \multimap np \multimap s$ is abbreviated as tv. The sentence we derive is (7a). We will ignore the corresponding semantic operations of functional application of λ-terms and subsequent β-conversions for reasons of space.

First, we replace the lexical items with their syntactic types.

$$\frac{np \;\; np \;\; ((tv \multimap \Box^{\downarrow}tv \;\; tv)^{\diamond} \;\; tv\backslash\Box^{\downarrow}tv)^{\diamond} \vdash s}{siitaa \;\; sabzii \;\; ((nah\tilde{\imath}\tilde{\imath} \;\; khaatii)^{\diamond} \;\; thii)^{\diamond} \vdash s} \tag{11}$$

After that, the $\multimap L$ rule applies: the negation functor consumes its transitive verb argument, resulting in a $\Box^{\downarrow}tv$ category.

$$\frac{\dfrac{}{tv \vdash tv}\,Axiom \qquad np \;\; np \;\; ((\Box^{\downarrow}tv)^{\diamond} \;\; tv\backslash\Box^{\downarrow}tv)^{\diamond} \vdash s}{np \;\; np \;\; ((tv \multimap \Box^{\downarrow}tv \;\; tv)^{\diamond} \;\; tv\backslash\Box^{\downarrow}tv)^{\diamond} \vdash s}\multimap L \tag{12}$$

Next, the $\Box^{\downarrow}tv$ is reduced to tv by rule $\Box^{\downarrow}L$ and can now serve as an argument to the auxiliary $tv\backslash\Box^{\downarrow}tv$.

$$\dfrac{np\ \ np\ \ (tv\ \ tv\backslash\Box^{\downarrow}tv)^{\diamond}\vdash s}{np\ \ np\ \ ((\Box^{\downarrow}tv)^{\diamond}\ \ tv\backslash\Box^{\downarrow}tv)^{\diamond}\vdash s}\ \Box^{\downarrow}L \tag{13}$$

Then, the auxiliary consumes the verb, and we again get a boxed category, $\Box^{\downarrow}tv$, which can be reduced to tv as shown above using the $\Box^{\downarrow}L$ rule. The result of these operations is the top-most line in the derivation below. The topmost 'deduction' below is simply a substitution of $np \multimap np \multimap s$ for tv.

$$\dfrac{\dfrac{}{tv\vdash tv}\ Axiom \qquad \dfrac{\dfrac{np\ \ np\ \ np\multimap np\multimap s\vdash s}{np\ \ np\ \ tv\vdash s}}{np\ \ np\ \ (\Box^{\downarrow}tv)^{\diamond}\vdash s}\ \Box^{\downarrow}L}{np\ \ np\ \ (tv\ \ tv\backslash\Box^{\downarrow}tv)^{\diamond}\vdash s}\ \backslash L \tag{14}$$

The final deduction is a simple application of $\multimap L$ twice to give axioms.

$$\dfrac{\dfrac{}{np\vdash np}\ Axiom \qquad \dfrac{}{np\vdash np}\ Axiom \qquad \dfrac{}{s\vdash s}\ Axiom}{np\ \ np\ \ np\multimap np\multimap s\vdash s}\ \multimap L\times 2 \tag{15}$$

The entire derivation is shown below:

$$\dfrac{\dfrac{\dfrac{}{tv\vdash tv}\ Axiom \qquad \dfrac{\dfrac{\dfrac{}{tv\vdash tv}\ Axiom \qquad \dfrac{\dfrac{\dfrac{\dfrac{}{np\vdash np}\ Axiom \quad \dfrac{}{np\vdash np}\ Axiom \quad \dfrac{}{s\vdash s}\ Axiom}{np\ \ np\ \ np\multimap np\multimap s\vdash s}\ \multimap L\times 2}{np\ \ np\ \ tv\vdash s}}{np\ \ np\ \ (\Box^{\downarrow}tv)^{\diamond}\vdash s}\ \Box^{\downarrow}L}{np\ \ np\ \ (tv\ \ tv\backslash\Box^{\downarrow}tv)^{\diamond}\vdash s}\ \backslash L}{np\ \ np\ \ ((\Box^{\downarrow}tv)^{\diamond}\ \ tv\backslash\Box^{\downarrow}tv)^{\diamond}\vdash s}\ \Box^{\downarrow}L}{np\ \ np\ \ ((tv\multimap\Box^{\downarrow}tv\ \ tv)^{\diamond}\ \ tv\backslash\Box^{\downarrow}tv)^{\diamond}\vdash s}\ \multimap L}{siitaa\ \ sabzii\ \ ((nah\tilde{\imath}\tilde{\imath}\ \ khaatii)^{\diamond}\ \ thii)^{\diamond}\vdash s}$$

The derivation detailed above illustrates how we can account for the word order facts using these strictly lexically driven deductions. The ordering of negation with respect to the main verb is free, but the auxiliary verb must appear to the right of the result of the combination of the verb with negation. Thereafter, the arguments of the verb may combine in any possible permutation. The ungrammatical derivations are ruled out by the fact that any structural marking using $(.)^{\diamond}$ other than the ones shown in the above example will lead to a failure in derivation, modulo the refinement discussed below.

One kind of illegal derivation allowed by the system as set up above is the following. Recall the ungrammatical (7b):

(16)	**Siitaa*	*nahı̃ı̃*	*khaatii*	<u>*sabzii*</u>	*thii*
	Sita	neg	eat	vegetables	was

‘Sita did not use to eat vegetables.’

We can actually derive this ungrammatical sentence with the structural marking shown below (in the following derivation, $tv = np \multimap np \multimap s$ (transitive verb); $iv = np \multimap s$ (intransitive verb); and *Der* means “derivable”).

$$\dfrac{\dfrac{\overline{np \vdash np}\ \mathit{Axiom} \qquad \overline{np\ \ ((iv \multimap \Box^{\downarrow} iv\ \ \boxed{iv})^{\diamond} iv\backslash\Box^{\downarrow} iv)^{\diamond} \vdash s}\ \mathit{Der}}{np\ \ ((iv \multimap \Box^{\downarrow} iv\ \ \boxed{tv\ \ np})^{\diamond} iv\backslash\Box^{\downarrow} iv)^{\diamond} \vdash s}\ \multimap L}{\mathit{siitaa}((\mathit{nah\tilde{\imath}\tilde{\imath}}\ \ \mathit{khaatii}\ \ \mathit{sabzii})^{\diamond}\ \ \ \mathit{thii})^{\diamond} \vdash s}$$

Notice that the transitive verb can first combine with one of its arguments (the lower boxed material in the derivation above), and then can combine with negation as an intransitive verb (the higher boxed element). The way to prevent this is to ensure that negation looks for a *lexical verb*, i.e., a verb with none of its arguments satisfied. Since we are working in a multimodal system, this constraint can be incorporated straightforwardly. Instead of having only one modal operator $\Box^{\downarrow}$, we can also have a second one, say $\Box^{\downarrow}_{lex}$, which is defined similarly to $\Box^{\downarrow}$. We then mark a lexical verb with this new modal operator $\Box^{\downarrow}_{lex}$, and alter the lexical entries as shown below.

The revised lexical entries are as follows:

(17) (a) *nahı̃ı̃*, ‘not’ $\rightsquigarrow \Box^{\downarrow}_{lex} vp \multimap \Box^{\downarrow} vp : \lambda P \neg P$

(b) *khaatii*, ‘ate’ $\rightsquigarrow \Box^{\downarrow}_{lex}(np \multimap np \multimap s) : \lambda x \lambda y.eat(x,y)$

4 Constraining NPI licensing

4.1 Dowty’s reformulation of Monotonicity Logic

The main goal in (Dow94) is to try to answer the question: why do NPIs exist? His answer is that NPIs and negative concord (NC) facilitate natural language semantic processing and inference by explicitly marking downward monotone contexts (cf. (Isr98)). Since in this paper I am not concerned with the above question, but rather with the NPI licensing asymmetry discussed above, I present a highly abbreviated account of Dowty's theory, discussing only those elements that are relevant to our discussion.

Dowty begins by presenting a linguistically more suitable version of Sánchez-Valencia's (Val91) Natural Logic (but cf. (Ber99)). Lexical items are assumed to have monotonicity marking as indicated by the recursive definition for syntactic categories and types.

(18) (a) NP (= type e), S (= type t) and CN (= type (e,t)) are (primitive) categories.
(b) If A and B are any categories, so are A/B and $A\backslash B$.
(c) If A/B is a category, so are $A^+/B^+, A^+/B^-, A^-/B^+, A^-/B^-$.
(d) If $A\backslash B$ is a category, so are $A^+\backslash B^+, A^+\backslash B^-, A^-\backslash B^+, A^-\backslash B^-$.

For complex categories, the monotonicity marking on the result category of a functor is the complex category's marking.

(19) (a) $(A/B)^+ =_{def} (A^+/B)^+ =_{def} (A^+/B)$
(b) $(A/B)^- =_{def} (A^-/B)^- =_{def} (A^-/B)$

Most lexical categories appear in two formulations but with the same semantic interpretation. For example, *eat* $\in (NP^+\backslash S^+)/NP^+$ and *eat* $\in (NP^-\backslash S^-)/NP^-$. Upward and downward monotone functors, however, are special. They are constrained to appear as shown below (with similar definitions for $A\backslash B$):

(20) (a) Upward monotone functors appear in a pair of categories of the forms A^+/B^+ and A^-/B^-.
(b) Downward monotone functors appear in a pair of categories of the forms A^+/B^- and A^-/B^+.

Furthermore, NPIs are specified to have only negative monotonicity marking (with a similar statement for $A\backslash B$):

(21) NPIs appear in a category of the form A^-/B^- (or C^-).

Finally, a well-formed non-embedded sentence is defined as follows:

(22) If ϕ is of category S^+, ϕ is a well-formed non-embedded sentence.

In the following subsections, I show how this system, with some modifications, allows a straightforward treatment of the asymmetry problem.

4.2 Subject NPIs in English

As discussed earlier, polarity reversing elements like negative quantifiers, e.g., *nobody*,[2] only have the entry S^+/VP^- (or, of course, S^-/VP^+; see (20b)) for subject position and $TV^-\backslash VP^+$ for the object position.[3]

On the other hand, NPIs like *anyone* have only the entries S^-/VP^- and $TV^-\backslash VP^-$ for subject and object positions, respectively. The downward monotonicity constraints on NPIs are then enforced in an obvious way: **Anyone didn't come* is correctly ruled out, while *Nobody came*, *John didn't see anyone*, and *Nobody saw anything* are allowed, as shown in Derivations A, B, C, D, respectively.

I illustrate the way this works using Derivation A below. The other derivations proceed in a similar fashion.

$$\dfrac{\dfrac{\dfrac{}{vp^+ \vdash vp^+}\,\mathit{Axiom} \qquad \dfrac{\dfrac{}{vp^- \vdash vp^-}\,\mathit{Axiom} \qquad \dfrac{\mathit{FAIL}}{s^- \vdash s^+}}{s^-/vp^- \;\; vp^- \vdash s^+}\,/L}{s^-/vp^- \;\; vp^-/vp^+ \;\; vp^+ \;\vdash s^+}\,/L}{\mathit{anyone} \;\; \mathit{didn't} \;\; \mathit{come} \vdash s^+}$$

Derivation A

Derivation A shows the final monotonicity marking on the lexical items; let us unpack the derivation to show how we got there. Only the lexical entries for *anyone* and *didn't* have fixed monotonicity markings; the one for *come* is underspecified and could be VP^+ or VP^-. *Anyone* must have the entry S^-/VP^-, since it is an NPI (see (21)), and *didn't* must either be VP^+/VP^- or VP^-/VP^+, since it is a polarity reversing functor (see (20b)). Since *anyone* is the main functor, for the derivation to be legal, its argument, to its immediate right, is determined to be of the form VP^-. In order for this to happen, VP^-/VP^+ is chosen for *didn't* (this is because the result category in VP^-/VP^+ is VP^-). Now, since *come* is underspecified for monotonicity marking, it can serve as an argument for *didn't*, i.e., VP^-/VP^+, with a positive marking and will therefore be instantiated as VP^+. When *didn't* (VP^-/VP^+) combines with VP^+, the result is a VP^-, which can serve as an argument for the main functor S^-/VP^- to yield S^-. But this leads to a failure because of (22).

The other examples given below are self-explanatory.

[2] In this paper, we assume that such n-words are in fact negative quantifiers. Cf. (Acq97).

[3] "… each determiner in category $(S^\alpha/VP^\beta)/CN^\gamma$ above is assumed to have an object counterpart in $(TV^\beta\backslash VP^\alpha)/CN^\gamma$", Dowty, seminar handout, Winter 1999.

$$\dfrac{\dfrac{\dfrac{}{vp^- \vdash vp^-}\,Axiom \qquad \dfrac{}{s^+ \vdash s^+}\,Axiom}{s^+/vp^- \;\; vp^- \vdash s^+}\,/L}{nobody \;\; came \vdash s^+}$$

Derivation B

$$\dfrac{\dfrac{\dfrac{}{tv^- \vdash tv^-}\,Axiom \qquad \dfrac{\dfrac{}{vp^- \vdash vp^-}\,Axiom \qquad \dfrac{\dfrac{}{vp^+ \vdash vp^+}\,Axiom \qquad \dfrac{}{s^+ \vdash s^+}\,Axiom}{s^+/vp^+ \;\; vp^+ \vdash s^+}\,/L}{s^+/vp^+ \;\; vp^+/vp^- vp^- \vdash s^+}\,/L}{s^+/vp^+ \;\; vp^+/vp^- \;\; tv^- \;\; tv^-\backslash vp^- \;\; \vdash s^+}\,\backslash L}{John \;\; didn't \;\; see \;\; anyone \vdash s^+}$$

Derivation C

$$\dfrac{\dfrac{\dfrac{}{tv^- \vdash tv^-}\,Axiom \qquad \dfrac{\dfrac{}{vp^- \vdash vp^-}\,Axiom \qquad \dfrac{}{s^+ \vdash s^+}\,Axiom}{s^+/vp^- \;\; vp^- \vdash s^+}\,/L}{s^+/vp^- \;\; tv^- \;\; tv^-\backslash vp^- \;\; \vdash s^+}\,\backslash L}{nobody \;\; saw \;\; anything \vdash s^+}$$

Derivation D

4.3 Hindi NPIs

Hindi NPIs like *koii-bhii* are derived from the existential quantifier *koii*, 'some, a', by the suffixation of the focus particle *-bhii*, 'also/even' (see Lahiri (Lah98), and Lee and Horn (LH95)). *Koii* displays the same quantifier scope ambiguity as in English in conjunction with, e.g., a universal quantifier or negation ($X > Y$ means X outscopes Y):

(23) (a) *sab* *logõ-ne* *kisii-ko* *maaraa*
all people-erg someone-acc beat
'Everyone beat someone.' $\forall > \exists$ or $\exists > \forall$

(b) *koi* *nahĩĩ* *aayaa*
someone neg came
'Someone didn't come.' $\exists > \neg$ or $\neg > \exists$

However, when *-bhii* is suffixed, the polarity sensitive item is obtained.

(24) (a) **koii-bhii aayaa*
anyone came
'Anyone came.'

(b) *koii-bhii nahĩĩ aayaa*
anyone neg came
'No-one came.' $\neg > \exists$

I assume here that NPIs like *koi-bhii* are lexically of a lower type, NP^-, than the generalized quantifier *koii* or *kisii* (which have the type S^-/VP^- in subject position), thereby ensuring that NPIs are never the main functors and must appear in the scope of negation. This lower type allows them to appear more liberally, both in subject and object positions.

Support for treating *-bhii* marked NPIs as more liberal in nature comes from the fact that *-bhii* allows a wide range of NPIs to appear in many more licensing environments than that NPI might otherwise appear in (Vas98). For example, *uf karnaa*, 'to express distress', is a 'strong' NPI when it appears without any suffix; it is 'strong' in the sense that it appears only in strongly negative or antimorphic contexts like negation and not in other weaker negative contexts like the monotone decreasing NPI licensor *few people* and the anti-additive licensor *if … then* (see (vdW97) for details regarding the properties of these licensors). Notice that in (25a) and (25b) only the literal reading, not the NPI interpretation, is available, which is consistent with the fact that *uf karnaa* is a minimizer (Hor89, 399-400).

(25) (a) *#gaṇit-mẽ fel hone-par* **kam-hii** *vidyaarthii* uf kartee *haĩ*
mathematics-in fail become-on few-encl students onom do are
'It matters to few students if they fail in mathematics.'

(b) #**agar** *tum-ne injekshan lagne-par* uf kii *to mai tum-he*
if you-erg injection apply-on onom do then I you-to
ḍarpok samjhuun-gaa
coward consider-will
'I'll consider you a coward if you make even a sound when you get the injection.'

(c) *us-ne sab-kuch bec ḍaalaa lekin vimlaa-ne* uf **naa** kii
(s)he-erg everything sold gave but Vimla-erg onom not did
'(S)he sold off everything, but Vimla didn't show even the slightest distress.'

However, suffixing *-bhii* to *uf karnaa* transforms it into a weak NPI:

(26) (a)

gaṇit-mẽ	*fel*	*hone-par*	**kam-hii**	*vidyaarthii*	uf-bhii	kartee	*haĩ*
mathematics-in	fail	become-on	few-encl	students	onom-even	do	are

‘It matters to few students if they fail in mathematics.’

(b)

agar	*tum-ne*	*injekshan*	*lagne-par*	uf-bhii	kii	*to*	*mai*	*tum-he*	*ḍarpok*	*samjhuun-gaa*
if	you-erg	injection	apply-on	onom-even	do	then	I	you-to	coward	consider-will

‘I’ll consider you a coward if you make even a sound when you get the injection.’

(c)

us-ne	*sab-kuch*	*bec*	*ḍaalaa*	*lekin*	*vimlaa-ne*	uf-bhii	**naa**	kii
(s)he-erg	everything	sold	gave	but	Vimla-erg	onom-even	neg	did

‘(S)he sold off everything, but Vimla didn’t show even the slightest distress.’

Assuming, then, that NPIs like *koi-bhii* are of a lower, more liberally occurring type, NPI licensing in Hindi proceeds as shown in Derivation E for the sentence *kisii-ne-bhii kuch-bhii nahĩĩ khaayaa*, literally, ‘anyone anything not ate’ (=‘nobody ate anything’), where two NPIs occur, one in subject position, and the other in an object position. (tv^+ abbreviates $np^- \multimap vp^+$, which expands to $np^- \multimap np^- \multimap s^+$.)

$$\dfrac{\dfrac{\dfrac{}{np^- \vdash np^-}\,\textit{Axiom} \qquad \dfrac{}{np^- \vdash np^-}\,\textit{Axiom} \qquad \dfrac{}{s^+ \vdash s^+}\,\textit{Axiom}}{np^- \;\; np^- \;\; tv^- \multimap tv^+ \;\; tv^- \;\; \vdash s^+}\multimap L \times 3}{\textit{kisii-ne-bhii} \;\; \textit{kuch-bhii} \;\; \textit{nahĩĩ} \;\; \textit{khaayaa} \vdash s^+}$$

Derivation E

4.4 An advantage of this analysis: wider coverage

This licensing mechanism generalizes to NPI licensors of differing strengths. For example, consider the monotone decreasing NPI licensor *kam-hii log*, ‘few-encl people’, and the anti-additive licensor *agar* … *to*, ‘if … then’ (see (Vas98) for details of NPI licensing in the scope of these and other licensors). Assigning the type (s^+/vp^-) to *kam-hii log*, ‘few people’, and $s^+ \multimap s^-$ to *agar*, we get the correct possibilities for *kam-hii log kuch-bhii khaayenge*, literally, ‘few people anything will-eat’, (‘few people will eat anything’), and *agar koi-bhii kuch-bhii maange*, literally, ‘if anyone anything wants … ’ (‘if anyone wants anything … ’).

$$\dfrac{\dfrac{\dfrac{}{np^- \vdash np^-}\,\mathit{Axiom} \quad \dfrac{}{vp^- \vdash vp^-}\,\mathit{Axiom} \quad \dfrac{}{s^+ \vdash s^+}\,\mathit{Axiom}}{s^+/vp^- \;\; np^- \;\; np^- \multimap vp^- \;\; \vdash s^+}\,\multimap,/E}{\textit{kam-hii log} \;\; \textit{kuch-bhii} \;\; \textit{khaayenge} \vdash s^+}$$

Derivation F

$$\dfrac{\dfrac{\dfrac{}{np^- \vdash np^-}\,\mathit{Axiom} \quad \dfrac{}{np^- \vdash np^-}\,\mathit{Axiom} \quad \dfrac{\dfrac{}{s^- \vdash s^-}\,\mathit{Axiom} \quad \dfrac{}{s^+ \vdash s^+}\,\mathit{Axiom}}{s^+ \multimap s^- \;\; s^- \vdash s^+}\,\multimap}{s^+ \multimap s^- \;\; np^- \;\; np^- \;\; np^- \multimap vp^- \;\; \vdash s^+}\,\multimap \times 2}{\textit{agar} \;\; \textit{koi-bhii} \;\; \textit{kuch-bhii} \;\; \textit{maange} \vdash s^+}$$

Derivation G

The direction-sensitive slash in the lexical entry for *kam-hii log* rules out the word order variations shown in (27a,b) below, while the non-directional implication for *agar* allows the possibility of scrambling, as shown in (27c-e).

(27) (a) **kuch-bhii khaaenge kam-hii log*
anything will-eat few-encl people
'... '

(b) **kuch-bhii kam-hii log khaaenge*
anything few-encl people will-eat
'... '

(c) *kuch-bhii maange koii-bhii agar*
anything asks anyone if
'If anyone asks for anything ... '

(d) *kuch-bhii maange agar koii-bhii*
anything asks if anyone
'If anyone asks for anything ... '

(e) *kuch-bhii agar maange koii-bhii*
anything if asks anyone
'If anyone asks for anything ... '

Existing transformational accounts only discuss NPI licensing in the context of negation, not these other licensing contexts. It remains to be seen whether a transformation-based theory could adequately cover data such without introducing new constraints and mechanisms; the present treatment has the advantage that it requires no extra machinery to handle the word order variation discussed above.

5 Concluding remarks

This treatment of word order variation constrained by negation, and of NPI licensing has several advantages over a purely or partly LF-based, transformational account: (i) negation-constrained word order variation is treated independently of the negative polarity facts, as I have argued it should be, and moreover, word order variation is constrained lexically, not by invoking functional projections, whose general theoretical status has been called into question in the literature; (ii) a monostratal theory is developed in which NPIs are licensed due to the downward monotone property of their licensors, not mere c-command by the licensor; (iii) diverse licensing facts can be captured easily in this analysis; and (iv) due to the Curry-Howard correspondence, semantics is obtained compositionally without any extra machinery.

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Abbreviations used: acc = accusative; emph = emphatic; encl = enclitic; erg = ergative; fem = feminine; fut = future; imp = imperfect; masc = masculine; neg = negation; onom = onomatopoeia; part = participle.

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