OPTIMIZATION IN ARGUMENT EXPRESSION AND INTERPRETATION: A UNIFIED APPROACH

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Abstract

This dissertation investigates fixed word order phenomena in "free" word order languages and their consequences for linguistic theory. As has long been observed, languages with flexible word order, in certain circumstances, show "freezing" effects, whereby only a canonical word order is possible. I propose new generalizations to explain the two types of freezing effects, namely markedness reduction in marked grammatical contexts and the emergence of the unmarked, and show that these pervasive patterns of markedness are incompatible with the classical conception of grammar within generative linguistics where principles of universal grammar (UG) are both universal (by definition) and inviolable.

The analysis I develop here, set within the framework of Optimality-theoretic Lexical-Functional Grammar, captures the universal basis of word order freezing and its parallels to markedness reduction and emergence of the unmarked effects observed in other systems for argument expressions and in other components of grammar, while at the same time allowing for crosslinguistic variation.

The first part of the dissertation shows how the Optimality-theoretic account, based on the interaction between markedness constraints derived through harmonic alignment of prominence hierarchies and other constraints on word order, naturally captures the pattern of universal markedness and the basic generalization that highly marked argument types occur only in unmarked position in Hindi and Korean: in these two languages, noncanonical orderings are preferred options for marking a special information structure. However, in the special case of prominence mismatch, they are replaced by the less marked, canonical order. This is due to the ranking in which the markedness constraints banning marked argument types in the marked

positions dominate the information structuring constraints which favor realization of contrasting discourse prominence of arguments. Beyond providing a specific analysis for the freezing effects in Hindi and Korean, I show how the constraint system I develop can be employed to explain markedness reduction in the systems of contrast in other domains of morphosyntax.

In the second part, the model is extended to comprehension as well as production, demonstrating further advantages of the optimization-based approach to argument expression. It is shown that by defining grammaticality in terms of bidirectional optimization, we can account for the word order freezing effect as the emergence of the unmarked in comprehension grammar, in terms of the same set of markedness and faithfulness constraints that are independently motivated for a production-based optimization account of case patterns and constituent ordering.

Along with other optimization-based approaches to morphosyntax, the present study contributes solid evidence for fundamental structural parallels between phonology and syntax, and raises questions whether the arbitrary separation of linguistic phenomena and performance-related phenomena has any systematic theoretical and empirical significance.

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This dissertation started life as a term paper I wrote for the seminar on Optimality-theoretic syntax co-taught by Joan Bresnan and Judith Aissen in Winter 1999. The seminar, together with the joint Stanford/UCSC Optimal Typology project, made me realize that the kinds of markedness asymmetries one finds within a language bear striking relations to typological asymmetries across languages. The present dissertation is the outcome of my exploration of the relation between language-internal and typological markedness asymmetries in the domain of core clausal syntax.

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Abbreviations

ACC	accusative	ADJ	adjunct
AF	argument function	AFF	causally affected
ASP	aspect	AUX	auxiliary
BCK	background information	CAUS	causer
C.FOC	contrastive focus	COM	comitative
COMP	complementizer	COMPL	completive information
DAT	dative	DECL	declarative ending
DEP	dependence	DF	discourse function
END	sentence ending	ERG	ergative
EVAL	evaluator	FOC	focus
FUT	future	GEN	genitive
GEN	generator	GF	grammatical function
HON	honorific affix	IDENT	identity
INST	instrumental	IO	indirect object
LOC	locative	MAX	maximality
NEG	negation	NOM	nominative
OBJ	object	OBL	oblique
OM	object marker	PA	Proto-Agent
PERF	perfective	PP	Proto-Patient
PRED	predicator	P-ROLE	proto-role
PRES	present	PRON	pronoun
PST	past tense	S	subject
SEC.OBJ	secondary object	SENT	sentience
SUBJ	subject	TOP	topic
VOL	volitionality		

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Chapter 1

Introduction

1.1 Overview

Languages express the grammatical relations of argument roles through various morphosyntactic devices such as word order, case marking and agreement. The goal of this dissertation is to develop an explicit, formal account for the expression of grammatical relations that can explain the significant parallels that underlie variation in these central linguistic devices for argument expression both within and between languages.

The search for universals has always been a central interest in generative linguistics. Fundamental claims about universal properties of language were built into the architecture of Principles-and-Parameters Theory (Chomsky 1981). This theory has as its central claim that grammars of individual languages are built on fixed universal principles, which are assumed to be absolute and inviolable in every language, plus a specification of a limited number of variable parameters. A fundamentally different interpretation of universality is found in structural linguistics (Jakobson 1963[1932]; Trubetzkoy 1969[1939]), typological linguistics (Greenberg 1966a,b; Croft 1990; Givón 1990) and functional linguistics (Haiman 1985; Gundel et al. 1986, 1989), which developed the markedness approach of linguistic universality: all types of linguistic structure have two values, one of which is 'marked', the other 'unmarked'. Unmarked values are crosslinguistically preferred and basic in all grammars, while marked values

are crosslinguistically avoided and used by grammars only to express contrast. Thus, this markedness approach to universality embodies universality in a 'soft' sense.

Markedness relations have two major properties that defy easy treatment within theories of grammar which view language as the outcome of inviolable principles and an initial setting of the universal parameters. As has frequently been noted, markedness can be contextually imposed: the unmarked element can be used in place of the marked and hence has broader distribution. The substitutability of the unmarked for the marked and the broader distribution of the unmarked crucially depend on the specific contexts in which the unmarked is used and its relation to other elements in the system. The marked/unmarked relation is also often characterized as a multivalued relation such as a *scale* or a *hierarchy* rather than as a binary opposition between two absolute values, "marked" and "unmarked." Although markedness scales or hierarchies such as hierarchies of person, animacy, grammatical function, semantic role, etc. have played a central role in functional and typological work on morphosyntax, they have not been recognized in formal linguistics as linguistic universals primarily due to their variability and relative, scalar and contextual properties—both across and within languages. As a result, 'soft' markedness generalizations that depend on the morphosyntactic hierarchies have not received a principled explanation in current syntactic theory. With the emergence of Optimality Theory (Prince and Smolensky 1993), however, 'soft' universal constraints have been incorporated into the actual substance of the grammar.

The fundamental idea of Optimality Theory (hereafter OT) is that a grammar is a system of conflicting universal constraints which are violable and ranked in a dominence hierarchy. Variation across languages reflects different resolutions of conflicts among violable universal constraints. This dissertation addresses the question of how the formal expression of argument roles and their interpretation are constrained by major types of conflicting constraints fundamental in OT. In particular, the present work addresses this question by bringing in new evidence for the existence of such conflicts among violable universal constraints in morphosyntax from the fixed word order phenomenon, referred to as *word order freezing* (Mohanan 1992;

Mohanan and Mohanan 1994). The central idea is that the expression of grammatical relations of argument roles should not be understood in terms of the fixed, inviolable correspondence between syntactic and semantic structures, but as the dynamic process of optimization over parallel representations of linguistic structure. In this dissertation, I take steps to integrate an analysis of two types of freezing effects as instantiations of a single phenomenon of the emergence of the unmarked into the general theory of markedness.

Before discussing the empirical facts that I will be concerned with in detail, the following section presents the concept of markedness that I will assume throughout this work.

1.2 Markedness

The concept of markedness was developed in the Prague School of linguistics in the 1920s and 1930s. The notion of marked and unmarked values of a category was first applied to phonological systems by Trubetzkoy (1969[1939]) and to morphosyntactic categories and lexical meaning by Jakobson (1963[1932]). In Jakobson's early work, concerned with the structuring of oppositions, markedness emerged as a binary relation between a less delimited, inclusive unmarked category and a more delimited, exclusive marked category. In his later work on language universals and linguistic typology, markedness was extended as a coding of universal hierarchies, and features of grammar were treated as showing crosslinguistic, universal rankings of categories. These two notions of markedness in Jakobson's work have been adapted in quite different ways by the typological and generative approaches to linguistic theory. Here I will briefly outline a typological view of markedness developed in the work of typologists and functionalists.[1]

A key work in developing the typological view of markedness is a monograph by Greenberg (1966a), which offers the most exhaustive discussion of criteria for markedness and the crosslinguistic basis of typological markedness. Greenberg observed that unmarked grammatical categories within a language show a number of

[1]For the development of the generative conception of markedness, see Battistella (1990, 1996).

characteristics—including semantic indeterminacy, syntactic facultative expression, zero expression, inflectional syncretization, contextual neutralization, morphological regularity and defectization (1966a: 25–31). He further suggested that many of these correlate with greater frequency.

By linking the general notion of markedness as a type of asymmetry to both language-internal and typological distributional asymmetries, the typological approaches to linguistic markedness developed by Greenberg and others highlight two important points. One is that characteristics of markedness in phonology have parallels in other parts of grammar: a set of criteria for markedness provided by typological markedness can be applied regardless of whether a category is phonological, morphological, semantic or syntactic.[2] The second point is that the original Praguean notion of markedness is too restrictive for the study of typology. The classical markedness theory of the Prague School allows for only one type of markedness pattern: an absolute relationship between the two values of a binary-valued category, such as singular and plural, so that singular is unmarked and plural is marked. However, many markedness patterns involve a relation between multi-valued categories. For example, grammatical number includes not two values (singular and plural) but three or more (singular, plural, dual and trial). Typological evidence indicates that in a language with a singular-plural distinction, the plural is more marked than the singular, whereas in a language with a dual-plural distinction the dual is marked and the plural is unmarked (Greenberg 1966a). In the Praguean markedness theory, this leads to a paradox: on the one hand the typological evidence indicates that the plural is marked (relative to the singular), but other evidence indicates that the plural is unmarked (relative to the dual) (Croft 1990:96).

Croft, in his survey of the field of linguistic typology (1990), extends the original Praguean concept of markedness to relative markedness, and develops correspondingly an extended, quantitative approach to markedness. In particular, he distinguishes the following four types of typological universals:

[2]The work of Gundel et al. (1986, 1989) also argues that major principles of markedness apply across languages and across the components of grammar.

(1) **Four kinds of typological universals** (Croft 1990)

a. Implicational universals: Universals of the form "If P then Q", which state generalizations about logically dependent patterns, such as word order types (e.g. Greenberg's Universal 3: "languages with dominant VSO order are always prepositional" (Greenberg 1966b:78)).

b. Basic markedness relations: Binary asymmetries such as the relation between singular and plural, or active and passive.

c. Hierarchies: Multivalued relations such as the scale of number (singular > plural > dual > trial ("X > Y"="X is unmarked relative to Y")) and grammatical relations (subject > direct object > indirect object > oblique; see Keenan and Comrie's (1977) Accessibility Hierarchy).

d. Prototypes: Unmarked combinations of features that tend to occur together, such as person and subjecthood (Silverstein 1976).

Croft argues that the latter three types of universals can be identified using criteria similar to those proposed by Greenberg and that the criteria for markedness proposed in the typological literature can be reduced to three general criteria, as follows:[3]

(2) **Criteria for markedness** (Croft 1990)

a. Structural: Number of morphemes used to code a category. Unmarked, less marked and more prototypical categories tend to have shorter (or zero) forms.

b. Behavioral (inflectional, distributional and crosslinguistic): Number of cross-cutting distinctions/phonemes the marked and unmarked values contain; number of syntactic/phonological environments and language types in which the marked and unmarked values occur. The unmarked has a greater quantity of inflectional subdistinctions or a wider range of phonological, morphosyntactic or crosslinguistic environments.

[3]Givón (1990) proposes a similar set of criteria, defining markedness in terms of formal complexity, frequency distribution and substantive grounds.

c. Frequency (textual and crosslinguistic): Number of occurrences of the marked and unmarked values in text; number of languages in which the marked and unmarked values are found. The unmarked is more frequent.

As Croft notes, of these three criteria, the structural criterion is applicable to a subset of morphosyntactic phenomena only. The behavioral and the frequency criteria are the broadest, being applicable to the full range of both phonological and morphosyntactic phenomena (1990:92).

Along the lines of the typological approaches to linguistic markedness, in this work, I take a broad view of markedness, encompassing not only a binary relation between a less delimited unmarked term and a more delimited marked term, but also an asymmetrical, dynamic relation among opposed linguistic categories—segments, inflections, words in word classes and even syntactic structures. This somewhat broad characterization allows us to link markedness to hierarchies and prototypes and to link asymmetrical grammatical properties within languages to typological asymmetries. Moreover, by characterizing markedness not as an inherent, invariant property of a grammatical category but as a flexible, contextually determined relation, I allow an additional important consequence to follow: the possibility that an asymmetry between opposed categories can be dynamically determined on the basis of their use in a particular context and their relations to other elements in the system. Dynamic competition among the opposed elements within the systems of contrast, meaning or use is of course the essential idea of markedness in Jakobson (1963[1932]), and has been found to be pervasive in phonology and also in morphosyntax (Bresnan 2000a, 2001a).

One of the classic cases showing this contextual property of markedness relations is final devoicing in German. Voiced obstruents (a marked segment type) cannot occur in the syllable coda (a marked position) in German, as illustrated by the following alternation:

(3) Final devoicing in German

a. Bund (singular) [bʊnt]

b. Bunde (plural) [bʊnd-ə]

This situation is called 'contextual neutralization': in a context where the morphological form of the word suggests either phoneme may occur, in actuality only the least marked segment type such as a voiceless obstruent (in this case [t]) does in a coda position.

In morphosyntax, contextual neutralization has been mainly documented in the domain of inflectional paradigms. One example that Greenberg (1966a) gives is the use of the root (singular) form of the noun after all numerals in Turkish. On semantic grounds, one would expect singular only after 'one', but there is one form, the unmarked singular form, occurring after all numbers. These examples of contextual neutralization illustrate two important points. The first is that the distribution of the marked and unmarked forms crucially depends on the specific contexts in which they are used. The second point is that if the marked form becomes unavailable under the special circumstances of markedness, the unmarked form can fill in for the marked form and correspondingly has extended use.

In the past several years there has been a great deal of research on markedness in the generative tradition of morphosyntax. However, syntactic constraints are still widely assumed to be 'hard', and as a result, 'soft' markedness generalizations have not been formally integrated into most of the current generative approaches to syntax. So for a markedness-based approach to be integrated into a general theory of language structure, an important question that must be first addressed is what evidence for markedness effects there is in the core clausal syntax that can only be explained under a theory that crucially relies on the concept of markedness.

In the next section, I address this question by focussing on evidence for markedness reduction in typologically marked grammatical contexts and the emergence of the less marked form as a consequence of suppression of a more marked form under special conditions in the area of constituent ordering.

1.3 Topics of the Dissertation

Languages make use of various morphosyntactic devices such as word order, case, agreement, and (non)pronominal expressions for encoding grammatical relations of argument roles. While the palpable variability in these central morphosyntactic devices for argument expression within and across languages still remains one of the most difficult areas, what is more challenging for syntactic theories is the fact that there exists a situation where word order becomes fixed, and grammatical function becomes invariant even in languages allowing a high degree of flexibility in these systems. The fixed word order phenomenon or word order "freezing" found in many languages with variable word order is a good illustration of this situation. The phenomenon of freezing raises a number of important questions about how the overall linguistic architecture must be structured as well as the formal mechanisms for capturing the systematicity and variability in the systems for the expression of grammatical relations. Yet there has been a curious near absence of satisfactory treatments of this phenomenon of freezing in syntactic theory. This section examines the crucial questions raised by the phenomenon of freezing, which is the central focus of my inquiry, and proposes a unifying generalization underlying two different types of freezing phenomena. The discussion will focus on two languages with rich case marking—Hindi and Korean.

1.3.1 Markedness Reduction in Word Order

Word order is the domain where the characteristics of both variability and invariance are most saliently manifested within and across languages. The fixed word order phenomenon or word order "freezing" found in many languages with variable word order exemplifies this situation very clearly. Studies on word order patterns have suggested that a certain canonical word order becomes fixed under special circumstances in which the relative prominence relations of different dimensions of linguistic substance—grammatical functions, semantic roles, animacy, case, and positions in phrase structure—do not match. In Hindi, for example, marked types of subjects and objects without the prototypical properties of agent and patient are restricted

to unmarked word order positions. An example of the verb classes that take such marked subject types is 'unaccusative transitives' or 'nonvolitional transitives' (Mohanan 1994a, section. 7.1; Mohanan and Mohanan 1994, section. 4). Of the two arguments of the nonvolitional transitives one is sentient and the other may be sentient or nonsentient. The obligatory sentient argument of these verbs is marked with the dative case marker *-ko*, and the other argument has always has nominative case.[4]

Unlike transitive verbs with volitional subjects, nonvolitional transitives in Hindi are subject/object alternating verbs, i.e., either of the two arguments of the verb may be construed to be the subject, and the other the object. A subject obviation test can be used to demonstrate that either argument of nonvolitional transitives can be the grammatical subject. As argued in Mohanan (1994a), the Hindi pronoun cannot take the grammatical subject of its clause as its antecedent. Given this general principle governing the interpretation of Hindi pronouns, it follows that in (4), the nonvolitional experiencer, *Anuu*, is the grammatical subject; in (5), the theme, *Niinaa*, is the grammatical subject.

(4) Anuu-ko Niinaa uskii bastii-mẽ dik^{h}ii. [Hindi]
Anu-DAT Nina-NOM PRON-GEN neighborhood-LOC appear-PERF
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.' (Mohanan and Mohanan 1994: 175, ex. (41b)) ($\surd$S$_{exp}$O$_{th}$V, *O$_{exp}$S$_{th}$V)

(5) Niinaa Anuu-ko uskii bastii-mẽ dik^{h}ii. [Hindi]
Nina-NOM Anu-DAT PRON-GEN neighborhood-LOC appear-PERF
'Anu$_i$ saw Nina$_j$ in her$_{i/*j}$ neighborhood.' (Mohanan and Mohanan 1994: 175, ex. (41f)) ($\surd$S$_{th}$O$_{exp}$V, *O$_{th}$S$_{exp}$V)

An interesting fact is that the two grammatical function analyses, shown in (4) and (5) above, are compatible only with certain restricted word orders. According to Mohanan and Mohanan (1994: 175), the analysis of the nonvolitional experiencer as the grammatical subject in Hindi is required for all word orders except that in which the theme precedes the experiencer preverbally; this word order, shown in (5), can only receive the analysis of the theme as the grammatical subject, and in fact

[4]Nominative case in Hindi has no phonological realization.

it is the only possible word order when the subject is a theme and the object is a nonvolitional experiencer.[5] This point is illustrated by the sentences in (6), which are acceptable only under the interpretation of the experiencer as the subject. In the word orders shown in (6), the pronoun can only be coreferent with the theme because it is not the subject. This evidence suggests that the analysis of the theme as the subject is incompatible with the five orders in (6) and that the order of the subject and object becomes fixed as SOV order in the marked linking pattern when the subject is a theme and the nonvolitional experiencer is the object.[6]

(6) a. Niinaa uskii bastii-mẽ dik^{h}ii Anuu-ko. [Hindi]
Nina-NOM PRON-GEN neighborhood-LOC appear-PERF Anu-DAT
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.' ($\surd$O$_{th}$VS$_{exp}$, *S$_{th}$VO$_{exp}$)

b. Anuu-ko Niinaa uskii bastii-mẽ dik^{h}ii. [Hindi]
Anu-DAT Nina-NOM PRON-GEN neighborhood-LOC appear-PERF
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.' ($\surd$S$_{exp}$O$_{th}$V, *O$_{exp}$S$_{th}$V)

c. Anuu-ko uskii bastii-mẽ dik^{h}ii Niinaa. [Hindi]
Anu-DAT PRON-GEN neighborhood-LOC appear-PERF Nina-NOM
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.' ($\surd$S$_{exp}$VO$_{th}$, *O$_{exp}$VS$_{th}$)

d. Dik^{h}ii Niinaa Anuu-ko uskii bastii-mẽ. [Hindi]
appear-PERF Nina-NOM Anu-DAT PRON-GEN neighborhood-LOC
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.' ($\surd$VO$_{th}$S$_{exp}$, *VS$_{th}$O$_{exp}$)

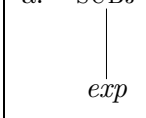
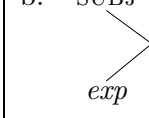
e. Dik^{h}ii Anuu-ko Niinaa uskii bastii-mẽ. [Hindi]
appear-PERF Anu-DAT Nina-NOM PRON-GEN neighborhood-LOC
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.' ($\surd$VS$_{exp}$O$_{th}$, *VO$_{exp}$S$_{th}$)

[5]The passive of triadic predicates shows the same word order pattern: the order of the subject and object becomes fixed as SOV order when the subject is a theme and the object is a goal (Mohanan 1992; Mohanan and Mohanan 1994).

[6]Examples with the reflexive are not presented here because reflexive binding in Hindi does not refer to the grammatical subject exclusively, and both the theme and the experiencer can bind the reflexive in the word orders shown in (6).

The word order pattern in Hindi nonvolitional transitives discussed so far is summarized in (7), with the relevant examples. We see that all orders except the OSV order in (a2) are possible with the unmarked linking pattern shown in (7a) where the experiencer is the subject and the theme is the object. In contrast, (7b) shows that the order of the subject and the object is frozen as unmarked SOV order in the marked linking pattern when the theme is the subject and the nonvolitional experiencer is the object.

(7) Table 1. Word order pattern in Hindi nonvolitional transitives

a. 	a1. $S_{exp}O_{th}V$ (ex. (6b))
	a2. *$O_{th}S_{exp}V$ (ex. (5))
	a3. $S_{exp}VO_{th}$ (ex. (6c))
	a4. $O_{th}VS_{exp}$ (ex. (6a))
	a5. $VS_{exp}O_{th}S$ (ex. (6e))
	a6. $VO_{th}S_{exp}$ (ex. (6d))
b. 	b1. $S_{th}O_{exp}V$ (ex. (5))
	b2. *$O_{exp}S_{th}V$ (ex. (6b))
	b3. *$S_{th}VO_{exp}$ (ex. (6a))
	b4. *$O_{exp}VS_{th}$ (ex. (6c))
	b5. *$VS_{th}O_{exp}$ (ex. (6d))
	b6. *$VO_{exp}S_{th}$ (ex. (6e))

As mentioned above, the arguments of Hindi nonvolitional transitives may be associated with two different grammatical function realizations. Interestingly, a close examination of the word order patterns summarized in (7) reveals that these two grammatical function realizations do not share the same surface string (strictly speaking, the precedence relation of the subject and the object). In other words, the string expressions of Hindi nonvolitional transitives are not ambiguous; they are each associated with only one grammatical function structure. For example, the string *Niinaa Anuu-ko dik^{h}ii* receives an SOV analysis in (b1) but not the OSV one in (a2); similarly, the string *Anuu-ko Niinaa dik^{h}ii* is only grammatical for the SOV analysis in (a1) but not for the OSV one in (b2).

The word order pattern in Hindi nonvolitional transitives exhibits intriguing interactions of various types of prominences as well—prominences on the dimensions of grammatical function, thematic role and position in constituent structure. Crosslinguistically, subject is canonically associated with the highest thematic role (e.g., agent or experiencer), and object is canonically associated with a non-highest thematic role (e.g., patient or theme). Therefore, it is more marked for a subject to be a theme rather than an experiencer, and for an object to be an experiencer rather than a theme. But the most marked situation obtains when the subject and the object are mapped onto marked thematic roles, *and* one (or both) of the subject and the object is in a marked position in the phrase structure configuration. This situation is manifested in the five ungrammatical structures in (b) in Table 1, where either a theme subject is not occurring in its unmarked clause-initial position as in (b2), (b4), (b5) and (b6), or an experiencer object is not in its unmarked preverbal position as in (b3), (b5) and (b6). In connection to the lack of ambiguity of the Hindi clauses with the nonvolitional experiencer and the theme, what is revealing about this case is the way the universal typological preference for the unmarked structure reveals itself in the Hindi data. As we will see in Chapter 2, of the two grammatical function realizations shown in (7) above, the allowed structure is the less marked one in which the linking of arguments to grammatical functions and the relative order of the two arguments is not also marked.

The descriptive generalizations that emerge from this pattern can be stated as follows:

(8) a. Generalization 1: **Avoidance of the Worst of the Worst**
Canonical SOV order becomes fixed in a Hindi nonvolitional transitive with a theme subject and an experiencer object. That is, such arguments should not be associated both with a marked role-function mapping and with a marked position.

b. Generalization 2: **Avoidance of Ambiguous Strings**
There is only one grammatical surface realization (i.e., linear order) for the alternative grammatical function realizations of the arguments of a nonvolitional transitive.

Word order freezing driven by avoidance of 'the worst of the worst' (Smolensky 1995) is in no way an idiosyncracy of Hindi. Across languages, marked argument types consistently show restricted behaviors with respect to word order, case marking, or valency alternations.

This general pattern in word order freezing raises an interesting dilemma. On one hand, the universal basis of this phenomenon calls for an analysis based on universal principles, because the pattern of markedness reduction in typologically marked grammatical contexts is a highly widespread one, extensively attested across systems for argument expression and other components of grammar as well as across languages. On the other hand, the analysis must allow for a great deal of language-particular variation, because languages differ according to which dimensions are relevant.

1.3.2 Word Order, Ambiguity and Recoverability

'The worst of the worst' is not the only source of freezing. It can also arise from morphological ambiguity. The key aspect of the freezing effect triggered by ambiguity is recoverability, i.e., the ability of a hearer to recover the grammatical relations of argument roles in a sentence.

Consider examples of the double nominative construction in Hindi in (9) and (10). The subject *patt^{h}ar* 'stone' is nominative because the transitive verb *tod* 'break' is not in perfective aspect, and inanimate object *botal* 'bottle' is also nominative. The examples in (9) and (10) show that the order of the two nominative constituents is "frozen" as SOV. This happens in a null context and in certain special discourse contexts (e.g., in an all-focus context). Reversing the order of the two arguments in (9) yields a new sentence in (10) in canonical SOV order rather than maintaining its meaning with an OSV order.

(9) Patt^{h}ar botal todegaa. [Hindi]
stone-NOM bottle-NOM break-FUT
(i) 'The stone will break the bottle.'
(ii) *'The bottle will break the stone.' (Mohanan 1992)

(10) Botal patt^{h}ar todegaa. [Hindi]
bottle-NOM stone-NOM break-FUT
(i) 'The bottle will break the stone.'
(ii) *'The stone will break the bottle.' (Mohanan 1992)

The multiple functions of some of the case markers in Hindi provide a further source of word order freezing in sentences with multiple nominals bearing the same case markers. For instance, the dative case marker and the accusative case marker in Hindi are identical: they are both *-ko*. The verb *sik^h* 'teach' in (11) can take either an ergative or a nominative subject. However, when a modal of obligation is superimposed on the verb, the dative case on that subject is required, as in (11).

(11) Raam-ko ilaa-ke bacce-ko gaanaa sik^{h}aanaa hai. [Hindi]
Ram-DAT Ila's child-ACC music-NF be-PRES
(i) 'Ram has to teach music to Ila's child.'
(ii) *'Ila's child has to teach music to Ram.'

In (11) the dative subject *Raam* canonically precedes the two nonsubject arguments, the accusative goal object and the nominative theme object. That is, the initial *-ko* marked NP is interpreted as the agent but not as the goal fronted to clause-initial position.

Similar facts are found in multiple nominals with the case marker *-se*, which indicates instrument, source, path, the demoted subjects of passive, and so on. In (13), the passive of (12), both the demoted agent and the source bear the case marker *-se*. Grammatical functions and thematic roles are often closely aligned in Hindi and therefore it is difficult to distinguish which of the two influences ordering. However, the examples in (13) provide justification for the proposal made by Mohanan (1992, 1994a) and others that it is in fact the thematic hierarchy that determines canonical order. In (13a) and (13b), the thematic role of the arguments does not match their

grammatical functions in terms of hierarchy: in spite of the fact that the initial *-se* marked NP is an ADJUNCT function, which is lower on the grammatical function hierarchy (i.e., SUBJ > OBJ > I.OBJ > OBL > ADJ (Bresnan 1994; Mohanan and Mohanan 1994; Bresnan 2001b)) than the nominative subject, it canonically precedes the subject. Here again, the initial *-se* marked NP is not interpreted as a fronted OBLIQUE.

(12) Coor-ne kal Ravii-se paise curaae. [Hindi]
thief-ERG yesterday Ravi-from money-NOM steal-PERF
'The/a thief stole money from Ravi yesterday.'

(13) a. Coor-se kal Ravii-se paise curaae gae. [Hindi]
thief-INST yesterday Ravi-from money-NOM steal-PERF go-PERF
(i) 'Money was stolen from Ravi yesterday by the/a thief.'
(ii) *'Money was stolen from the thief yesterday by Ravi.'

b. Ravii-se kal coor-se paise curaae gae. [Hindi]
Ravi-INST yesterday thief-from money-NOM steal-PERF go-PERF
(i) 'Money was stolen from the/a thief yesterday by Ravi.'
(ii) *'Money was stolen from Ravi yesterday by the thief.'

Therefore, following Mohanan (1992, 1994a) and also Sharma (1999), I assume that the canonical or unmarked word order in Hindi conforms to the thematic role hierarchy:

(14) Thematic Role Hierarchy (Bresnan and Kanerva 1989; Bresnan and Zaenen 1990)
agent > beneficiary > experiencer/goal > instrument > patient/theme > locative

A similar phenomenon is found in the Korean double nominative construction. For instance, in sentences where the case markings on both the subject and object NP constituents are identical (i.e., nominative), their order is fixed as SOV. For instance, two examples in (15) are only grammatical if interpreted in an SOV order,

and reversing the order of the nominal constituents of (15a) yields a new sentence (15b) with SOV order.

(15) a. Mary-ka ku kay-ka coh-ta. [Korean]
Mary-NOM that dog-NOM like-DECL
(i) 'Mary likes that dog.'
(ii) *'That dog likes Mary.'

b. Ku kay-ka Mary-ka coh-ta. [Korean]
that dog-NOM Mary-NOM like-DECL
(i) 'That dog likes Mary.'
(ii) *'Mary likes that dog.'

More generally, it is arguments bearing identical case markings, not just two nominative arguments, that are restricted to unmarked word order positions. This is illustrated by the following examples of the Korean causative construction, which takes a dative causee object and an oblique goal, which is also dative. Their order is fixed as OBJ-OBL, as shown in (16a) and (16b):

(16) a. Emma-ka appa-hanthey Mary-hanthey ton-ul mos-cwu-key
mom-NOM dad-DAT Mary-DAT money-ACC NEG-GIVE-COMP
hay-ss-ta. [Korean]
make-PST-DECL
(i) 'Mom made Dad not give money to Mary.'
(ii) *'Mom made Mary not give money to Dad.'

b. Emma-ka Mary-hanthey appa-hanthey ton-ul mos-cwu-key
mom-NOM Mary-DAT dad-DAT money-ACC NEG-GIVE-CE
hay-ss-ta. [Korean]
make-PST-DECL
(i) 'Mom made Mary not give money to Dad.'
(ii) *'Mom made Dad not give money to Mary.'

The Hindi and Korean examples above reveal the following generalization, based on Mohanan (1992):

(17) Generalization 3: Canonical word order determined by the grammatical function hierarchy or the thematic role hierarchy becomes fixed if the case markings on two nominal arguments of a single predicate are identical under two alternative thematic role interpretations of the nominals.

Similar freezing effects have been observed in previous studies in various languages with fairly free word order, mostly without an explanatory analysis[7] (e.g., Rudin (1985) and Siewierska and Uhlirova (1998) for Bulgarian; Lenerz (1977) for German; Holmberg (1998) for Icelandic; Kuno (1980) for Japanese; Gary and Keenan (1977) for Kinyarwanda; nameciteEngland83 for Mayan languages; Foley (1986) for Papuan languages; Siewierska and Uhlirova (1998) for Polish; Jakobson (1963[1932]) and Bloom (1999) for Russian; Hawkinson and Hyman (1974) for Shona), and occasionally cited as a problem for previous generative approaches to word order and case. One of the problematic aspects of the word order freezing is that it is not absolute but it is always possible to supply a context that brings out the interpretation "disallowed" in a null context (e.g., the OSV reading). In fact, it is usually fairly easy to find real-life examples where preferences for the unmarked word order and interpretation in sentences involving morphological ambiguity are overriden by constraints on the realization of information structure or selectional restrictions on verb arguments, and as a result the "disallowed" interpretation is the intended one. Given the fact that the mainstream position within generative grammar is that competence is merely a matter of grammaticality of word strings in isolation, this raises the more general question of what role is played by syntactic constraints and by other sources of "soft" information in the order and interpretation of arguments and how intuitions about disambiguation preferences can be best captured in a competence theory of grammar. These issues will be addressed in Chapter 3.

[7]Notable exceptions include Bloom (1999), who proposes an explicit, formal LFG account of word order freezing in Russian, and Kiparsky (1998), who has developed an account of restricted word order variation found in dative subject constructions and double nominative constructions in Hindi, Korean and Icelandic, based on his case licensing theory.

As this brief discussion has already shown, there are two major sources of word order freezing: 'the worst of the worst' and ambiguity. While they can arise from these two different sources, the word order freezing effects within languages reflect cross-grammar generalizations, which can be summarized as in (18), and reveal one unifying generalization stated in (19):

(18) a. The word order freezing effect found in particular languages under the special circumstances of markedness manifests the widely observed crosslinguistic pattern of markedness reduction in typologically marked grammatical contexts.

b. The word order freezing effect within particular languages under morphological ambiguity mirrors another broad crosslinguistic generalization about the relation between morphology and phrase structure in argument expression: across languages, there is often an 'inverse' relation between the amount of information about grammatical functions expressed by case marking and the amount expressed by phrase structures.

(19) **The Emergence of the Unmarked**:
The more marked, less canonical members of alternative argument coding devices are suppressed under the special circumstances of prominence mismatch and ambiguity, and as a result, the less marked, more canonical members emerge as the unmarked case.

As mentioned in the discussion of 'the worst of the worst' type of word order freezing in Hindi (section 1.3.1), in many languages with fairly free word order, free word order, even if preferred in most contexts to express the contrasting discourse prominence of arguments, becomes fixed in the typologically marked grammatical contexts (e.g., when the subject does not have prototypical agent properties). That is, noncanonical orderings are replaced by the less marked, canonical word order of particular languages to avoid 'the worst of the worst'.

The emergence of the unmarked as a consequence of suppression of the more marked expressions occurs in cases of morphological or structural ambiguity as well,

though more marked expressions become unavailable for a different reason. As illustrated above through word order freezing in Hindi and Korean (section 1.3.2), what emerges as an unmarked structure or interpretation in cases of potential ambiguity is typically one where the semantic role interpretation of arguments conforms to the unmarked or canonical word order in individual languages. The emergence of the unmarked effect has been documented in phonology (McCarthy and Prince 1994) and also in some recent OT-based studies of morphosyntactic inventories (Bresnan 2000b). The study of the phenomenon of freezing shows not only that it extensively occurs in the core clausal syntax but also that it underlies what has been regarded as a class of "exceptions" to the general principles governing argument expression.

The unified generalization of the emergence of the unmarked has not been captured in syntactic theory, and even each individual freezing effect has not received a principled explanation. In the current generative approaches to the syntactic realization of arguments, there are theoretical reasons for a near absence of satisfactory treatments of the phenomenon of freezing.

The prevalent approach to the syntactic realization of arguments has been one which seeks to account for it by postulating a universal template which encodes hierarchical relationships between the elements in the phrase structure. Within this approach, variation in the surface expression of arguments—word order, agreement, case—has been formally captured by various movement processes (head movement, adjunction, topicalization, incorporation, etc.) from canonical, basic phrase structural positions in which arguments receive their 'theta roles'. Grammar in this approach, then, can be said to be viewed as procedures for the sequential derivation of surface structures from more abstract, underlying structures. What possible analyses of the phenomenon of freezing emerge in this derivational model of grammar?

In terms of word order variation, the dominant formal strategy used to capture free word order in languages like Hindi has been to derive the varied surface orders of the sentential elements from an initial phrase structure configuration via movement (e.g., Gurtu 1985, Mahajan 1990, Speas 1990, Srivastav 1991, among others). The basic motivation for syntactic movement is based on the idea that word order at a more abstract underlying level of representation is the unmarked one, and that more

marked surface word orders are derived from this by transformational derivations, which are encoded by means of indexed traces. In the Minimalist Program (Chomsky 1992, 1995), all syntactic operations are obligatory and take place only if driven by some independent requirement in the grammar (e.g., formal features of Case or Agr). The worst of the worst generalization about the word order freezing in Hindi, however, is not easily captured by derivational approaches to word order variation. As pointed out in Mohanan and Mohanan (1994), in order to account for the freezing effects illustrated in section 1.3.1 in an analysis involving movement, it will be necessary to prohibit both NP movement and head movement if the theme is the Spec of AgrSP (subject position) and the nonvolitional experiencer is the Spec of AgrOP (object position). Furthermore, it will also be necessary to prohibit NP movement that yields the order of theme-experiencer-verb (see (7)) if the experiencer is the Spec of AgrSP. Finding out factors that prevent both NP movement and head movement may not be an impossible task, but the problem of how to relate them to typological markedness in a way that makes sense for the organization of grammar as a whole presents a serious challenge for derivational approaches to word order variation.

As for the freezing effects that arise from ambiguity, to date, the dominant position within generative syntax has been either to ignore it as belonging outside the realm of syntax, or to account for the recovery of grammatical relations by appealing to special "anti-ambiguity" constraints (e.g., Kuno (1980) and Lee (1993) on word order freezing in Japanese and Korean). One reason for the general neglect of the phenomenon of freezing is no doubt the widespread assumption that it is merely the result of a principle of the use of language, not one of the grammar of language, and thus lies outside the realm of syntax. However, there has been no empirical test suggested which could tell us whether a given phenomenon is syntactic or performance-related in nature. Without such a test, the separation of syntactic phenomena and performance-related phenomena is itself an arbitrary, theory-internal matter. For instance, word order freezing in the double nominative construction in Korean and Japanese has been treated as a phenomenon that lies outside the domain of a competence grammar in many current generative approaches to word order variation (e.g., Kim 1990), while at the same time there have been attempts to account for it in terms of transformational

movement (e.g. Miyagawa 1991; Whitman 1997). As I will discuss in Chapter 3 in more detail, however, the movement-based analysis proposed for double nominative constructions does not extend to word order freezing in sentences with non-nominative arguments that have identical case markings, which is driven by the same functional factor—ambiguity avoidance. Furthermore, the derivational approach derives the unmarked word order in the double nominative construction by means of derivations more complex than ones used to derive more marked word orders in the language. In sum, generative approaches to word order variation developed so far must say something extra whenever word order is fixed or when certain orders are ruled out by a language, thus failing to capture the general pattern of the emergence of the unmarked.

In sum, derivational grammar models do not allow us to explain the dual linguistic properties of variability and invariance that coexist in the same system for the formal expression of argument roles within a language. The formal mechanism of movement that has been developed primarily to explain variability in the surface expression of arguments does not extend to the account of their interpretation. As a result, the predictable, close relation between argument expression and interpretation is not captured.

What is required is an alternative model of grammar that allows for the unified account of argument expression and interpretation in terms of a single linguistic description. Optimality Theory, I believe, is an opportunity for realizing such a unified grammar model.

1.4 The Formal Framework

Optimality Theory (OT: Prince and Smolensky 1993) is a general theory of constraint interaction. The central idea of OT is that a grammar is a system of conflicting universal constraints which are violable and ranked in a dominance hierarchy. Variation across languages reflects the resolution of conflicts among violable universal constraints. A surface form is 'optimal' in the sense that it incurs the least serious

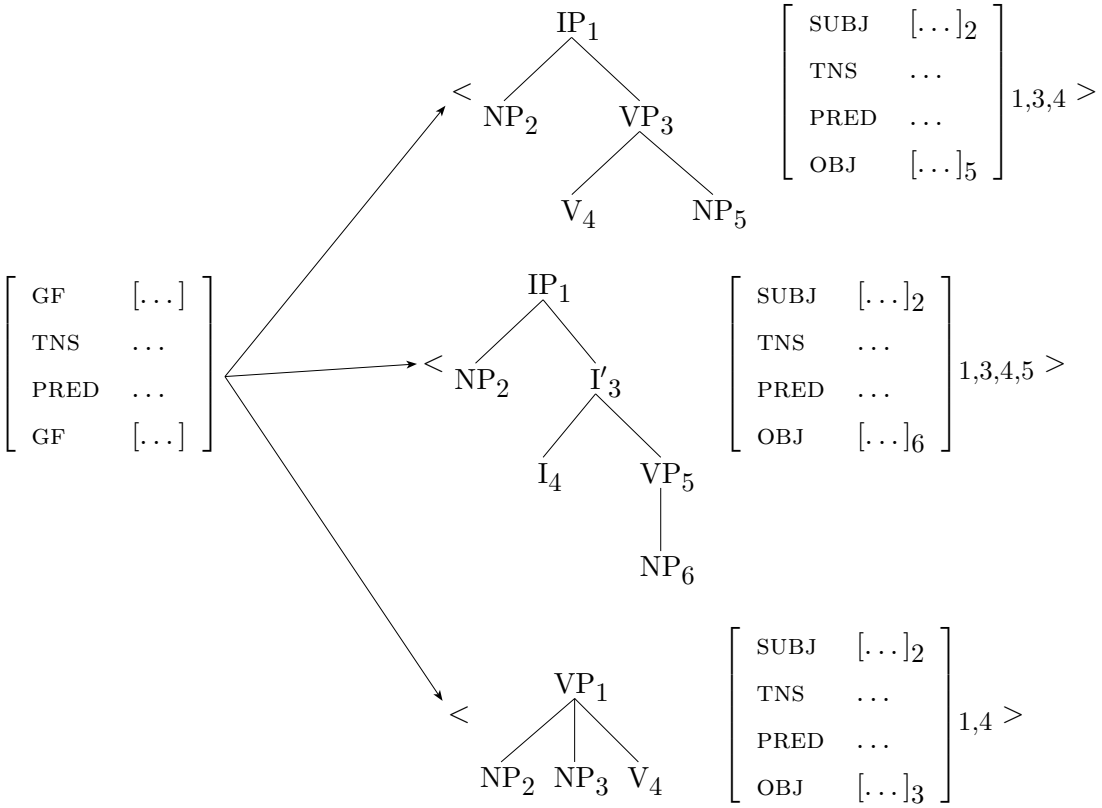
violations of a set of violable universal constraints, ranked in a language-specific hierarchy. OT has been applied to a number of areas of linguistic research since its extraordinary success in the domain of phonology. For the domains of syntax and semantics, a growing body of work has shown that many of the motivations for the OT approach to phonology are paralleled in syntax and semantics, since the pioneering work of Grimshaw (1997).

Because OT is a theory of interactions of grammatical constraints, not a theory of representations, it is compatible with a wide range of representational formats. Throughout this dissertation, I assume the formal framework of Lexical-Functional Grammar (LFG: Bresnan 1982; Bresnan and Kaplan 1982a; Bresnan 2001b) recast within the OT framework (OT-LFG: Bresnan 1996, 2000a,b,c, 2001a; Choi 1999; Kuhn 1999, 2000, 2001a,b; Sells (ed.) 2001a; Sells 2001b). A theory like OT-LFG which sees simultaneous competition between parallel, co-present structures as pervasive and constraint ranking as the means to resolve it provides an appropriate framework in which to approach the problem of word order freezing.

Grammatical representation in LFG consists of several different parallel structures none of which are derived from another structure. In particular, LFG separates information about grammatical functions from phrase structure information, and grammatical functions are not necessarily defined via phrase structure positions. Structural relationships are represented at c(onstituent)-structure, while grammatical functions are represented at f(unctional)-structure. Other co-present parallel structures include a(rgument)-structure (Bresnan and Kanerva 1989; Alsina 1993; Mohanan 1994; Butt 1995; Manning 1996), s(emantic)-structure (Halvorsen 1983; Halvorsen and Kaplan 1988; Dalrymple (ed.) 1999), and i(nformation)-structure (Choi 1999). The relationships between these structures are defined by mapping functions and only principles that define the mapping or correspondence between two levels can refer to them simultaneously; all other principles are internal to a single level. In OT-LFG the interactions between these structures are formalized as interactions between violable correspondence constriants that apply to parallel representations of linguistic structure.

In OT (Prince and Smolensky 1993), a grammar is a function mapping each linguistic input to its correct structural description or output. Within the OT-LFG framework (Bresnan 2000a,b,c, 2001a), inputs are taken to be a (possibly underspecified) feature structure representing some given morphosyntactic content independently of its language-particular forms of expression, and the universal input is modeled by sets of f-structures. Candidate sets consist of pairs of a c-structure and its corresponding f-structure, which is subsumed by the input f-structure (Kuhn 1999, 2000, 2001a,b). The overall scheme is illustrated below (Bresnan 2000c). The correspondence between structures is indicated by coindexing in this diagram.

(20) INPUT CANDIDATES



Given an underspecified input f-structure, a set of output candidates (i.e. possible types of formal realizations of that input that are available across languages) are generated by the GEN(ERATOR). Following Kuhn (1999, 2000, 2001a,b), I assume that

all candidates satisfy certain basic inviolable principles (e.g., Uniqueness, Coherence, Completeness, Extended Coherence, Argument-Function Uniqueness, X′-Theory (see Bresnan (2001b) for a detailed discussion.)), which can be encoded in an LFG grammar. That is, in the OT-LFG framework, the candidates for a given input can be defined as the structures generated by the LFG grammar encoding the inviolable principles, which are subsumed by the input in their f-structure (Kuhn 1999, 2000, 2001a,b).

The candidates are evaluated according to a function EVAL. More precisely, EVAL refers to a Constraint Set, consisting of a hierarchy of universal, violable constraints. Given a language-particular dominance ranking of the Constraint Set, the optimal/most harmonic/least marked candidate is one that best satisfies the top ranked constraint on which it differs from its competitors (Grimshaw 1997).

Thus, formally, an OT analysis concerns an evaluation of candidate expressions of some input or underlying form. In other words, OT usually takes a production or generation perspective, under which there is always a winner (or optimal realization of a given input). However, the problem for the production perspective that is prevalent in phonology and syntax is cases of *ineffability* (Pesetsky 1997), whereby a certain meaning is never realized by any grammatical expression in a given language because there is no grammatical expression from which that meaning can be recovered as the target interpretation. Thus, OT faces the problem of explaining the close interrelation between grammaticality and recoverability.

Recently, Smolensky (1998) has offered a solution to the problem of *ineffability*, based on his earlier proposal extending optimization in OT to comprehension as well as production. This extended model of optimization is generally called the *bidirectional* OT model (Smolensky 1996b; Wilson 2001). Let us briefly examine initial motivation for developing bidirectional OT.

Bidirectional optimization was first proposed in Smolensky (1996b), where he proposed to explain the lag of children's production abilities behind their ability in comprehension by generalizing the definition of an OT grammar to include two different parsing functions, one relevant to 'production' and the other to 'comprehension'. Production and comprehension functions can be formally defined as follows:

(21) Production and comprehension functions defined (Smolensky 1996b: 725)
f_{prod}(/i/) = H-maxs ∈ UGen | /i/ = Input(s)
f_{comp}([o]) = H-maxs ∈ UGen | [o] = OvertForm(s)

H-max = maximum Harmony; UGen = the universal set of all possible structural descriptions generated by the OT generator of candidates, Gen for all universally possible inputs /i/.

f_{prod} takes an input /i/ and assigns to it the most harmonic structural description (i.e. the structural description that has the maximum Harmony (H-max)) among the set of all those structures 's' the input part of which is /i/; f_{comp} operates on an overt form [o] and gives the most harmonic input for it among the structural descriptions the overt part for which is [o]. Thus an OT grammar under bidirectional optimization is to be understood as a function from the two dimensional space of candidates to their relative Harmony under a language-particular ranking of universal constraints. That is, grammars are parallel optimizations over structural descriptions containing both input and surface (Smolensky 1996b:729–730).

The relation between production and comprehension can be expressed alternatively as follows:

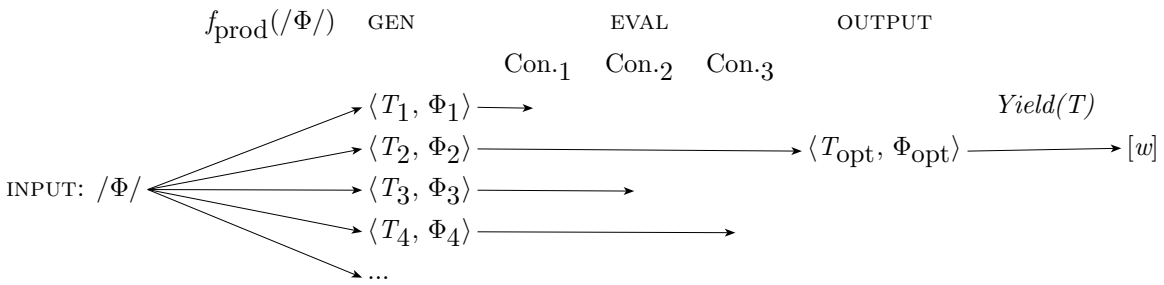
(22) Production/Comprehension Chain of /i/ (Smolensky 1998)
/i/—Prod → [s] — overt part ⟶ "o" — Comp →/i′/

/i/ is recoverable from "o", where /i/— Prod → [s], if "o" — Comp →/i/

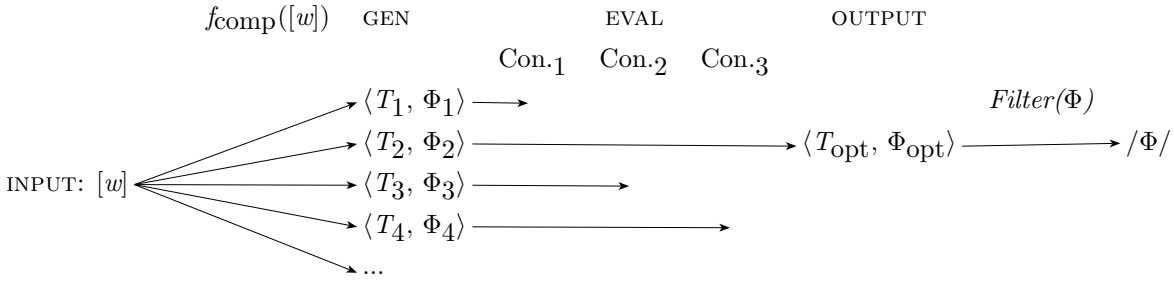
In syntax, we can think of production as function that takes an underspecified f-structure input to a set of fully specified c- and f-structure analyses, and comprehension as a function that takes the terminal string of the production output and gives a semantic content as an output. The general form of a bidirectional OT grammar that I assume in this work is illustrated in (23) and (24).

Bidirectional OT-LFG Framework: A Single Grammar for Production and Comprehension

(23) **Production-based optimization**



(24) **Comprehension-based optimization**



In the bidirectional OT-LFG model, the candidates are more accurately thought of as quadruples consisting of c-structures (lexical strings (w) and trees (T)), f-structures (Φ) and their correspondence functions (Bresnan 2000c). Following Kuhn (1999, 2001b), I assume the correspondence function *Yield* mapping a c-structure tree T onto the string of terminal symbols w, which we assume as the input to the comprehension-directed optimization. From the string input w, GEN will yield the candidate set of c- and f-structure pairs. The function *Filter* (Kuhn 2001b) applies to a fully specified candidate f-structure of comprehension to get back the kind of underspecified input f-structures that match the input to the production-directed optimization.

Crucially, applying optimization both in the production and comprehension directions permits formalization of recoverability in OT via comprehension-directed optimization. The essential idea is that grammatical outputs must have recoverable meanings. That is, if f_{prod} applied to a given input gives an optimal structure, s(=⟨/i/,

[o]⟩, a pair of input and output forms), then f_{comp} applied to the overt part of that structure, [o], should return the same input /i/. If a differenent input results from f_{comp}, then the original input is unrecoverable or ineffable, and we can consider the candidate ungrammatical under bidirectional optimization.

This extended model of optimization has two important properties: first, production-directed optimization is based on a candidate set with a common input content, whereas comprehension-directed optimization is based on a candidate set with a common overt form. Second, the same grammar (= UGen plus constraint ranking) can be used for both comprehension and production (cf. Boersma 1998, 1999, 2000; Hale and Reiss 1998).

The production/comprehension asymmetry in child grammar follows from the formulation of bidirectional optimization under these assumptions. Smolensky (1996b) argues that a general characterization of the child's grammar is that structural markedness constraints that reduce output markedness outrank faithfulness constraints that preserve contrasts in content and that this ranking is used in both f_{prod} and f_{comp}. Under such a grammar, the child's f_{prod} selects the least marked form for any given input. In comprehension-directed optimization the strings that the child hears determine the candidate set. Since all markedness constraints will be violated equally by every candidate in comprehension, the outcome of harmonic evaluation is left entirely to faithfulness constraints and the form most faithful to each adult form heard will be selected. So the same child's grammar accepts rich analyses that are not grammatical under her current constraint ranking, while at the same time giving her simple, unfaithful outputs.

Since its application to the long-standing conceptual dilemma for generative studies of child language acquisition, bidirectional OT has made significant impacts on other areas of linguistic research as well. It has provided a unified framework for explaining important problems such as the phonology/syntax conflict asymmetry, language-particular ineffability (Smolensky 1998) and grammar learnability (Tesar and Smolensky 1998; Boersma 1999). Moreover, a growing body of work has begun to demonstrate that many of the motivations for the bidirectional OT approach to language are paralled in phonology, syntax and semantics (Blutner 2000; Boersma 1999;

Lee 2001b) and that it has been motivated on computational grounds as well (Jäger 2000; Kuhn 1999, 2000, 2000a,b). In this work, I will present a development of a bidirectional OT approach to the expression and interpretation of grammatical relations, concentrating on the phenomenon of word order "freezing".

1.5 Data and Sources

Since the focus of this dissertation is expression of grammatical relations, I will be concerned with languages with rich morphological resources for argument expression. In particular, the in-depth studies will focus on Hindi and Korean.

The data that I cite is taken from published sources, from my own work, through consultation with colleagues, and through formal elicitation sessions designed to reveal particular grammatical generalizations. Data from published sources are cited with publication and page number. All other data are either elicited examples or my own examples.

1.6 Organization

This dissertation consists of three chapters besides this introduction. Chapters 2 and 3 present a formal account of the two types of word order freezing effects in Hindi and Korean; Chapter 4 summarizes the preceding chapters and discusses some implications of the present study and directions for future research.

Chapter 2 develops an approach to the phenomenon of freezing that arises from prominence mismatch, on the basis of word order freezing in Hindi and Korean. OT provides a natural way to explain the latent presence of universally unmarked structures in particular grammars and the systematic crosslinguistic variation in the asymmetrical behavior of different argument types. In OT, the class of inputs, candidate sets and constraints are universal. The same universal constraints and unmarked structures are present in every language. What determines how the unmarked/marked structures

emerge within each language is the ranking of those constraints. I will first discuss major types of constraints fundamental to OT (markedness and faithfulness constraints and other constraints that relate interacting levels of structure) and *harmonic alignment* (Prince and Smolensky 1993; Aissen 1999), an important formal device for deriving constraints that capture various hierarchy-driven markedness asymmetries. I then turn to the detailed examination of the complex phenomenon of word order freezing in two languages with extensive use of case marking, Hindi and Korean. I will show how the OT account, based on the interaction between markedness constraints derived through harmonic alignment of prominence hierarchies and other constraints on word order, naturally captures the pattern of universal markedness and the basic generalization that highly marked argument types occur only in unmarked position in Hindi and Korean: in these two languages, noncanonical orderings are preferred options to mark a special information structure. However, in the case of prominence mismatch, they are replaced by the less marked, canonical order. This is due to the ranking in which the markedness constraints banning marked argument types (e.g., subject without prototypical subject properties) in the marked positions dominate the information structuring constraints (e.g., topic is clause-initial), which favor the realization of contrasting discourse prominence of arguments.

Throughout my dissertation, the following two uniquely identifying aspects of OT, which distinguishes it from other generative theories of grammar, stand out:

(25) a. Violability: In OT, constraints are violable. If a form violates a particular constraint C, but no competing form presents a lesser violation, that violation of C may result in no severe impact on well-formedness.

b. Parallelism: In OT, "all constraints pertaining to some type of structure interact in a single hierarchy (Kager 1999:25)".

The idea that constraints are violable and universal is not the only conceptual innovation in OT. Equally important for the application of OT to syntax is the new definition of well-formedness that it provides: in OT for an output *o* to be grammatical in a given language, it not only needs to be an optimal output for some input *i*; *i*

needs to be the optimal input for *o* as well (Smolensky 1996b, 1998). This idea is neatly formalized by extending optimization in OT to comprehension or parsing as well as to production or generation.

Chapter 3 argues for the bidirectional view of syntax, concentrating on interaction of case marking and word order variation in Hindi and Korean. The motivation for developing a syntactic account of word order freezing under morphological ambiguity is the observation that it mirrors a broad crosslinguistic generalization about the 'inverse' relation between the amount of information about grammatical function expressed by case marking and the amount expressed by phrase structures. The goal of this chapter is to develop a formal account of the expression of grammatical relations that can capture this observation. The correlation between case marking and word order flexibility in scrambling languages seems intuitive. However, to date, pre-OT generative approaches to word order variation have not been successful. This is due to the basic architectural properties of generative models of syntax. In GB theories of syntax (Chomsky 1981, 1986), which view order as an abstract underlying property of sentences, the problem of accounting for surface orderings is handled together with other aspects of structure such as Case and Agreement. Such theories can easily account for word order variation within a particular language in terms of various movement processes, but lack any principled explanation of the coexistence of the flexibility and invariance of word order within languages. The word order freezing effect widely observed in scrambling languages does not follow naturally from frameworks like LFG which do not employ explicit transformational movement, either. In order to capture the generalization that 'morphology competes with syntax' both within and across languages formally, a mechanism like the candidate evaluation in OT is required.

Optimality Theory suggests a more general theory of the relation between alternative formal means of expressing the same grammatical relations. The basic architecture of OT, in which well-formedness is defined in terms of the outcome of competition among all universally possible candidates rather than in terms of the serial application of rules subject to filtering constraints, provides a natural way to

explicate the relation between formally different but functionally equivalent devices. However, word order freezing effects do not follow from the standard design of OT *per se*. The standard production-based OT model generates all possible orderings of argument phrases, both unambiguously and ambiguously case-marked, and hence does not predict any difference in word order flexibility between the two cases.

I propose to account for word order freezing effects by extending optimization in OT to comprehension as well as production (Smolensky 1996b, 1998; Wilson 2001) and show that a small set of faithfulness and markedness constraints, motivated independently for a production-based optimization account, can be applied to account for the disambiguation preferences. For cases where arguments bear distinct case markings, the effects of the syntactic alignment constraints favoring the unmarked order remain hidden behind other factors, in particular the preservation of semantic contrast between argument roles and case features (faithfulness). However, in contexts where the influence of faithfulness is absent, the alignment constraints operate decisively in comprehension. Since the string is fixed for all competing candidates in comprehension-based optimization, the analysis which interprets ambiguously case-marked arguments in accordance with the grammatical function hierarchy would be the most harmonic under the ranking proposed for Hindi and Korean (FAITHFULNESS $\gg$ discourse-based alignment constraints $\gg$ GF-based alignment constraints). It will also be shown that by enriching the string input to comprehension with contextual information, the bidirectional approach, based on the same set of constraints, captures the recovery of a marked interpretation of an ambiguous string.

It goes without saying that this approach to structure and interpretation, based on bidirectional optimality, raises many new research questions. General issues that need to be confronted include ambiguity and preferences among multiply available interpretations. In summarizing the major proposals in Chapter 4, I suggest that the stochastic OT is well-suited as a model for exploring these issues.

Chapter 2

Markedness Reduction in Word Order

Studies on word order variation in "free" word order languages fall into two major categories. The dominant approach has been one in which "free" word order or scrambling is driven by grammatical features such as Case and Agr(eement) (e.g., Gurtu 1985; Webelhuth 1989; Mahajan 1990; Speas 1990; Saito 1992; Lee 1993; Miyagawa 1997, among others). In this approach, scrambling is a consequence of Case/Agr-driven movement: a phrase is moved to a certain specifier position or adjoined to a specific functional category (e.g., IP) so that its Case can be licensed or its Agr feature can be checked off. Another approach has been suggested in which scrambling is an instance of semantically-driven movement (e.g., de Hoop 1996; Diesing 1992; Neeleman and Reinhart 1997, among others) or is a result of the interaction of syntax and discourse/pragmatics (e.g., King 1995; Costa 1998; Müller 1998; Samek-Lodovici 1996; Choi 1999, among others). In this approach the varied word orders are optional from a purely syntactic point of view: they are motivated by semantic factors, such as specific vs. non-specific interpretations and discourse considerations, such as topic and focus.

In many free word order languages, it is not uncommon to find fixed word order phenomena: a certain canonical word order becomes fixed under special circumstances in which the relative prominence relations of different dimensions of

linguistic substance—grammatical functions, semantic roles, case, and positions in phrase structure—do not match. Despite their important implications for syntactic theory relating to the formal mechanisms for capturing word order freedom, fixed word order phenomena, referred to as *word order freezing* (Mohanan 1992; Mohanan and Mohanan 1994), have received relatively little attention in recent literature on word order.

The central dynamic in word order freezing that arises from prominence mismatch is hierarchy alignment. As will be examined in detail in this chapter, in Hindi and Korean, for instance, word order is free when the unmarked association among grammatical functions, semantic roles, case and positions in phrase structure matches the relative prominence relations of these dimensions. However, free word order becomes fixed when the subject and object do not have prototypical properties of agents or patients. The preference for avoidance of the highly marked associations of prominence hierarchies reflects the alignment of the grammatical function hierarchy with a variety of substantive and structural dimensions.

This general pattern in word order freezing raises an interesting dilemma. On one hand, the universal basis of it calls for an analysis based on universal principles, because the pattern of markedness reduction in typologically marked grammatical contexts is a highly widespread one, extensively attested across systems for argument expression and components of grammar as well as across languages. On the other hand, the analysis must allow for a great deal of language-particular variation, because languages differ according to which dimensions are relevant.

This chapter[1] presents an OT account of word order patterns in Hindi and Korean that can account for both the free and fixed orderings of constituents. The goal is to develop an approach to word order that succeeds in capturing the universal basis of word order freezing and its parallels to markedness reduction observed in other systems for argument expressions and in other components of grammar, while at the same time allowing for crosslinguistic variation. In section 2.1 I present the facts on the word order freezing in Hindi and Korean that arises from prominence mismatch,

[1]This chapter is a revised and expanded version of Lee (2001b). Most of the examples and the main arguments are identical. The analysis and notation have been brought in line with the rest of the dissertation.

and discuss the problems posed by the data for previous approaches to word order variation. In section 2.2 I first introduce major constraints on constituent ordering, and show how basic clause structures and free word order in Hindi and Korean are derived by the interactions among these constraints. Sections 2.3 and 2.4 present an OT account of word order freezing in Hindi and Korean under prominence mismatch. It will be demonstrated that under the analysis developed here, word order freezing in "free" word order languages is not the exception, but just one of the options allowed by the universal scales of grammatical function, semantic role, case, etc. Finally, in summarizing in section 2.5, I discuss some implications that result from this account.

2.1 Word Order Freezing in Hindi and Korean

2.1.1 Word Order Freezing in Nonvolitional Transitives in Hindi

Hindi is a right-headed language with SOV canonical order. However, unlike Japanese and Korean, the surface order of elements is not strictly head-final. The possible permutations of a simple Hindi sentence are shown in (1). The three elements in a simple sentence can appear in any order.[2]

(1) a. Anuu-ne caand dek^{h}aa.
Anu-ERG moon-NOM see/look at-PERF
'Anu saw the moon.'

b. Caand Anuu-ne dek^{h}aa.

c. Anuu-ne dek^{h}aa caand.

[2]The canonical case for animate objects in Hindi is ACC, and the canonical case for inanimate objects is NOM. Verbs that are neutral to the animacy of their objects like *dek^{h}* 'see' can take either ACC or NOM depending on the animacy of their object (nominative case in Hindi has no phonological realization). This phenomenon of selective case marking on objects is a highly principled and widespread one, found in a variety of languages typologically remote from Hindi. See Aissen (2000) for a formal articulation of the idea that the higher in prominence an object is, the more likely it is to be overtly case marked.

d. Caand dek^{h}aa Anuu-ne.

e. Dek^{h}aa Anuu-ne caand.

f. Dek^{h}aa caand Anuu-ne.

Sentence (1a) reflects the 'basic', 'canonical' or 'unmarked' order, and the other orders are deviations from this canonical order (Gambhir 1981; Mohanan 1994a; Mohanan and Mohanan 1994). Such deviations are used to mark a special information structure and generally associated with shifts in prominence, emphasis and semantic effects (e.g., definiteness effects).

Despite a high level of word order freedom in this language, under certain circumstances, free word order freezes into a fixed, canonical order. For Hindi (Mohanan 1992; Mohanan and Mohanan 1994), and as I will show in the next subsection, Korean, one environment for restricted word order variation occurs when a sentence contains highly marked types of subject and object (i.e., transitive verbs without prototypical agent-patient argument relations). The other environment for word order freezing occurs when case morphology is unable to distinguish the grammatical function of the arguments. For instance, canonical word order becomes fixed if case markings on two nominal arguments of a single predicate are identical (Mohanan 1992). The focus of this chapter is the word order freezing arising from prominence mismatch, and the type of word order freezing that arises from morphological ambiguity will be discussed in detail in Chapter 3.

In Hindi, an example of a verb class that takes marked argument types is 'unaccusative transitives' or 'nonvolitional transitives' (Mohanan 1994a, sec. 7.1; Mohanan and Mohanan 1994, section 4). Of the two arguments of the nonvolitional transitives one is sentient and the other may be sentient or nonsentient. The obligatory sentient argument of these verbs always has dative case, as in (2) and (3).[3] While the ergative

[3]The dative subject construction in Hindi has been studied in detail in Bahl (1967), Davidson (1969), Mohanan (1994a) and Verma and Mohanan (1990), among others. DAT case on the subject may be induced by any of three types of predicates. The first is a small set of 'nonvolitional transitives' as in (2) and (3). Belonging to the second type are noun+verb complex predicates. A third source of DAT case on the subject comes from modality meanings such as 'urge' and 'oblige', derived from complex verbals involving auxiliaries (Mohanan 1994a: 142). Only the first type allow their arguments to alternate between subject and object.

subject in (1) carries the meaning of volitional action, the dative-marked arguments in (2) and (3) are nonagentive and nonvolitional. Unlike the objects of volitional transitives, the theme arguments in (2) and (3) must be nominative even if animate: they cannot be accusative because they do not have the semantic property of being an entity toward which an action or event is directed by a volitional inceptor of the action or event (Mohanan (1994a, sec. 4.4.3) contains a more detailed discussion of the nominative arguments of 'unaccusative transitives' or 'nonvolitional transitives').

(2) Anuu-ko caand dik^{h}ii.
Anu-DAT moon-NOM appear-PERF
'Anu saw the moon.' (Lit. 'To Anu the moon appeared/became visible.')

(3) Vijay-ko Ravii milaa.
Vijay-DAT Ravi-NOM find/encounter-PERF
'Vijay met Ravi unexpectedly.'

Unlike volitional transitives, nonvolitional transitives in Hindi are subject/object alternating verbs, i.e., either of the two arguments of the verb may be construed to be the subject, and the other the object.[4] Two syntactic tests for grammatical subjecthood in Hindi, namely the binding of the reflexive and subject obviation (the ability of the pronoun to take subject antecedents), can be used to demonstrate that either argument of nonvolitional transitives can be the grammatical subject. As argued in Mohanan (1994a: 122–127), the Hindi reflexive takes either a grammatical subject or a logical subject (i.e., the thematically highest argument role) as its antecedent, and the Hindi pronoun cannot take the grammatical subject of its clause as its antecedent.

The sentences in (4) show that the nonvolitional experiencer argument *Anuu* is the grammatical subject: the reflexive *apnii* takes it as its antecedent (4a); the pronoun *uskii* cannot be coreferent with it (4b).[5]

[4]The Marathi counterparts of Hindi nonvolitional transitives also show this property; see Joshi (1993).

[5]Evidence for the objecthood of the nominative argument in (4) comes from gapping facts in Hindi. In order to be gapped, an element must be identical to the gapper in both grammatical function and case. The nominative argument in (4) can both gap and be gapped by uncontroversial grammatical objects. See Mohanan (1994a: 142) for further details and examples.

(4) a. Anuu-ko Niinaa apnii bastii-mẽ dik^{h}ii.
Anu-DAT Nina-NOM self-GEN neighborhood-LOC appear-PERF
'Anu$_i$ saw Nina$_j$ in self's$_{i/*j}$ neighborhood.'

b. Anuu-ko Niinaa uskii bastii-mẽ dik^{h}ii.
Anu-DAT Nina-NOM PRON-GEN neighborhood-LOC appear-PERF
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

In (5a), either the theme or the nonvolitional experiencer can be the eligible antecedent of the reflexive. Given the principle governing the interpretation of the reflexive in Hindi, it follows that the theme *Niinaa* is the grammatical subject in (5a) and that the experiencer *Anuu*, the logical subject in both (4) and (5a), is the grammatical subject in (4). The subject obviation test supports this conclusion; in (5b) the pronoun cannot be coreferent with the theme argument *Niinaa*. Therefore, it is the grammatical subject.

(5) a. Niinaa Anuu-ko apnii bastii-mẽ dik^{h}ii.
Nina-NOM Anu-DAT self-GEN neighborhood-LOC appear-PERF
'Anu$_i$ saw Nina$_j$ in self's$_{i/j}$ neighborhood.'

b. Niinaa Anuu-ko uskii bastii-mẽ dik^{h}ii.
Nina-NOM Anu-DAT PRON-GEN neighborhood-LOC appear-PERF
'Anu$_i$ saw Nina$_j$ in her$_{i/*j}$ neighborhood.'

As discussed in Chapter 1, the two grammatical function analyses, shown in (4) and (5) above, are consistent only with certain restricted word orders. According to Mohanan and Mohanan (1994: 175), the analysis of the nonvolitional experiencer as the grammatical subject in Hindi is required for all word orders except that in which the theme precedes the experiencer preverbally; this word order, shown in (5), can only receive the analysis of the theme as the grammatical subject, and in fact it is the only possible word order when the subject is a theme and the object is a nonvolitional experiencer.[6] This point is illustrated by the sentences in (6), which are acceptable

[6]The passive of triadic predicates shows the same word order pattern: the order of the subject and object becomes fixed as SOV order when the subject is a theme and the object is a goal (Mohanan 1992; Mohanan and Mohanan 1994).

only under the analysis of the experiencer as the subject. In the word orders shown in (6), the pronoun can only be coreferent with the theme because it is not the subject. This evidence suggests that the analysis of the theme as the subject is incompatible with the five orders in (6) and that the order of the subject and object becomes fixed as SOV order in the marked linking pattern when the subject is a theme and the nonvolitional experiencer is the object.[7]

(6) a. Niinaa uskii bastii-mẽ dik^{h}ii Anuu-ko.
Nina-NOM PRON-GEN neighborhood-LOC appear-PERF Anu-DAT
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

b. Anuu-ko Niinaa uskii bastii-mẽ dik^{h}ii.
Anu-DAT Nina-NOM PRON-GEN neighborhood-LOC appear-PERF
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

c. Anuu-ko uskii bastii-mẽ dik^{h}ii Niinaa.
Anu-DAT PRON-GEN neighborhood-LOC appear-PERF Nina-NOM
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

d. Dik^{h}ii Niinaa Anuu-ko uskii bastii-mẽ.
appear-PERF Nina-NOM Anu-DAT PRON-GEN neighborhood-LOC
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

e. Dik^{h}ii Anuu-ko Niinaa uskii bastii-mẽ.
appear-PERF Anu-DAT Nina-NOM PRON-GEN neighborhood-LOC
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

The word order pattern in Hindi nonvolitional transitives is repeated in (7) below. We see that all orders except the OSV order in (a2) are possible with the unmarked linking pattern shown in (7a) where the experiencer is the subject and the theme is the object. In contrast, Table 1 below shows that the order of the subject and the

[7]Examples with the reflexive are not presented here because reflexive binding in Hindi does not refer to the grammatical subject exclusively, and both the theme and the experiencer can bind the reflexive in the word orders shown in (6).

object is frozen as the unmarked order (i.e., SOV) in the marked linking pattern when the theme is the subject and the nonvolitional experiencer is the object.

(7) Table 1. Word order pattern in Hindi nonvolitional transitives

a. SUBJ OBJ | | *exp* *th*	a1. $S_{exp}O_{th}V$ a2. $*O_{th}S_{exp}V$ a3. $S_{exp}VO_{th}$ a4. $O_{th}VS_{exp}$ a5. $VS_{exp}O_{th}S$ a6. $VO_{th}S_{exp}$
b. SUBJ OBJ \ / *exp* *th*	b1. $S_{th}O_{exp}V$ b2. $*O_{exp}S_{th}V$ b3. $*S_{th}VO_{exp}$ b4. $*O_{exp}VS_{th}$ b5. $*VS_{th}O_{exp}$ b6. $*VO_{exp}S_{th}$

Recall from Chapter 1 that this word order pattern in Hindi reveals the following two generalizations:

(8) a. Generalization 1: **Avoidance of the Worst of the Worst**
Canonical SOV order becomes fixed in a Hindi nonvolitional transitive with a theme subject and an experiencer object. That is, such arguments should not be associated both with a marked role-function mapping and with a marked position.

b. Generalization 2: **Avoidance of Ambiguous Strings**
There is only one grammatical surface realization (i.e., linear order) for the alternative grammatical function realizations of the arguments of a nonvolitional transitive.

The above discussion illustrates one theoretically significant aspect of restricted word order variation in Hindi and in other "free" word order languages in general:

restrictions on word order must refer simultaneously to different types of grammatical information such as information about argument structure, constituent structure and grammatical functions and to the relative markedness of different associations between these structures. As pointed out in Chapter 1, however, it is not clear how this can be done in pre-OT derivational approaches to word order variation, where these types of grammatical information are represented in derivationally related levels of structure, which are assumed to correspond perfectly at the underlying level.

In this chapter, I put forward an OT analysis of restricted word order variation in Hindi which captures both the generalizations stated in (8). It will be shown that the 'worst of the worst' (Prince and Smolensky 1993) generalization (8a) follows from the general model of hierarchy alignment in OT (Prince and Smolensky 1993; Aissen 1999) (section 2.3). The ungrammaticality of (a2) in (7) is part of the generalization about ambiguity avoidance and the preference for the unmarked structure, and the analysis to be developed here has it as a direct consequence without having to stipulate it using further constraints (sections 2.3).

2.1.2 Honorification and Word Order Freezing in the Dative-Subject Construction in Korean

'The worst of the worst' type of word order freezing is also observed in Korean, a canonical SOV language where the surface order of constituents is strictly head-final. The freedom of word order in sentences with a ditransitive verb *cwu-* 'give' is illustrated in (9).

(9) a. Mary-ka ai-eykey senmwul-ul cwu-ess-ta.
Mary-NOM child-DAT present-ACC give-PAST-DECL
'Mary gave a present to the child.'

b. Mary-ka senmwul-ul ai-eykey cwu-ess-ta.

c. Ai-eykey Mary-ka senmwul-ul cwu-ess-ta.

d. Ai-eykey senmwul-ul Mary-ka cwu-ess-ta.

e. Senmwul-ul Mary-ka ai-eykey cwu-ess-ta.

f. Senmwul-ul ai-eykey Mary-ka cwu-ess-ta.

With existential-possessive predicates and psych-predicates, the subject is marked with the dative case marker.[8] In the dative subject construction too, either order of the two arguments is allowed as shown in examples in (10) and (11).

(10) a. Mary-eykey kay-ka philyoha-ta.
Mary-DAT dog-NOM need-DECL
'Mary needs a dog.'

b. Kay-ka Mary-eykey philyoha-ta.
'Mary needs a dog.'

(11) a. John-eykey kohyang-i kulip-ta.
John-DAT hometown-NOM be missable-DECL.
'John misses his hometown.'

b. Kohyang-i John-eykey kulip-ta.
'John misses his hometown.'

However, freedom of word order disappears in the dative subject constructions when the honorified subject cooccurs with the honorific verbal agreement marker *-si*. This loss of word order freedom is illustrated in examples in (12) and (13).

(12) a. Lee kyoswunim-kkey kay-ka philyoha-si-ta.
Prof. Lee-DAT.HON dog-NOM need-HON-DECL
'Prof. Lee (honorified) needs a dog.'

b. *Kay-ka Lee kyoswunim-kkey philyoha-si-ta.
'Prof. Lee (honorified) needs a dog.'

[8]Evidence for the grammatical subjecthood of the dative argument of existential-possessive predicates and psych-predicates comes from honorification in Korean, a classic test for subjecthood in Korean. Only the dative argument but not the nominative argument is responsible for the honorific marking on the verb, signalled by the presence of the suffix *-si*. See Gerdts and Youn (1988), Kim (1990), Hong (1991) for further details and examples.

(13) a. Halmeni-kkey kohyang-i kuliwu-si-ta.
grandmother-DAT.HON hometown-NOM be missable-HON-DECL
'Grandmother (honorified) misses her hometown.'

b. *Kohyang-i halmeni-kkey kuliwu-si-ta.
'Grandmother (honorified) misses her hometown.'

The dative subject construction involving honorification like examples (12) and (13) may be considered more marked than the nominative subject construction in terms of morphological complexity and distribution. Dative not only is more marked than nominative crosslinguistically, but also shows a more restricted distribution than nominative within a language. In Korean, for instance, the most unmarked case, the nominative, is used for the subject of a basic intransitive verb and (di-)transitive verb and the object of certain classes of transitive verbs (to be discussed in Chapter 3 in detail). In contrast, the dative is selected by far fewer predicates than the nominative, used only to mark a goal-type argument of a ditransitive verb and an unaccusative transitive verb. By the similar distributional criteria, honorific forms of words and morphemes may be considered more marked than nonhonorific plain forms: they are found in considerably fewer languages. In languages with a highly developed honorification system, nonhonorific plain forms of words and morphemes are functionally unmarked: they are used in a wider range of social contexts, whereas their honorific counterparts are compatible only with certain particular social contexts in which a relation of owing honor may obtain between the speaker and the referent of the subject. I will discuss honorification in Korean in more detail in section 2.4.1. For now it is sufficient to note that word order freezing happens under morphological markedness, namely when the dative subject co-occurs with the honorific verbal agreement marker.

The word order patterns in Korean discussed so far are summarized in the following table:

(14) Table 2. Word order pattern in Korean

SUBJECT NP form	OBJECT NP form	Verb form	Word Order
N.HON-DAT	N-NOM	V.HON	SOV, *OSV
N-DAT	N-NOM	V	SOV, OSV
N.HON-NOM	N-ACC	V.HON	SOV, OSV
N-NOM	N-ACC	V	SOV, OSV

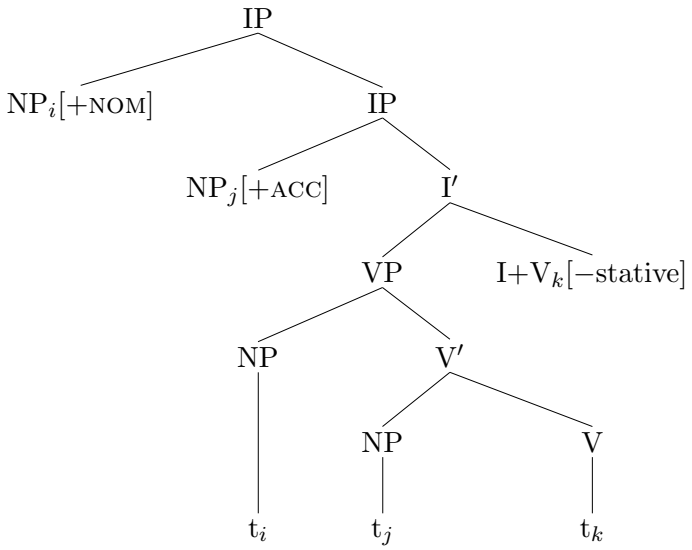
Word order freezing in the Korean dative subject construction is another clear case of avoiding 'the worst of the worst' scenario: the subject referring to an honorified being can appear in marked non-initial position except when it is in the marked dative case. In sharp contrast, the usual (di-)transitive clauses with a nominative subject do not show any word order freezing when the subject is honorified. The theoretical point of this discussion that needs to be captured is summarized in (15).

(15) Generalization 3: Canonical word order becomes fixed when the subject triggering honorific agreement on the verb is not in nominative case. That is, the subject triggering honorific agreement on the verb should not be in both a marked case and in a marked position.

As far as I know, no account has been proposed to explain this generalization, and in fact various approaches to scrambling mentioned so far have little to say about this. Here I will briefly discuss the problems posed by the Korean data for derivational approaches to word order variation.

In her dissertation on scrambling in Korean, Lee (1993) developed a very thorough analysis of word order variation with a number of important consequences. Assuming the VP internal subject hypothesis, she proposes that all arguments have to move out of VP and are adjoined to IP to be assigned Case, resulting in a S-structure representation like (16).

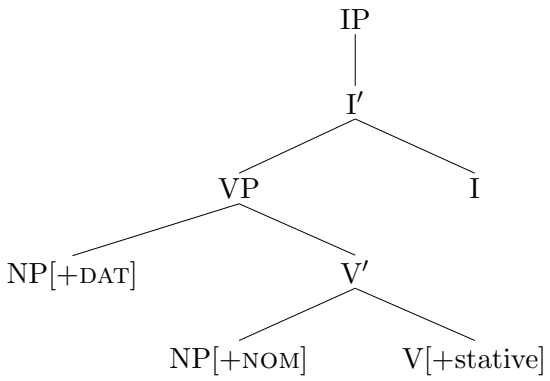
(16)



After head movement of the verb to I, both the nominative Case licenser, INFL, and the accusative Case licenser, INFL[−stative], are in the same position (the feature [−stative] is due to the verb) (Lee 1993: 68). This leads us to expect that the subject and the object may be arranged in any order, giving rise to scrambling effects.

Lee (1993) assumes that dative case is an inherent case, assigned at D-structure, which looks like (17).

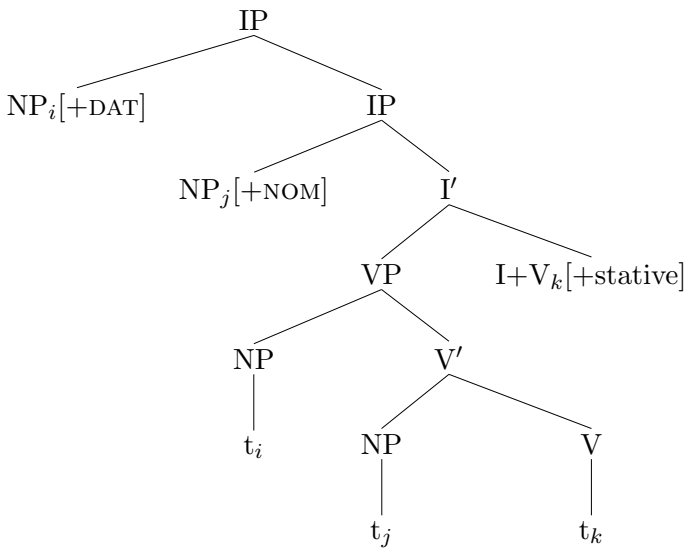
(17)



In (17) the subject of the dyadic stative predicates is assigned dative by the verb, and the object is assigned nominative (which is assumed to be the default case in Korean) under government by INFL. Since there is no Case-driven movement here, Lee's (1993) analysis predicts that there will be no scrambling, and therefore wrongly predicts fixed word order for all dative subject constructions in Korean.

The problem is not solved even if we assume that dative case is not an inherent case but a structural Case, as suggested by Yoon (1996). Under this assumption, then, the experiencer or possessor subject NP may be assigned dative Case either in its base-generated position, SpecVP, or in IP-adjoined position just like the accusative objects of non-stative transitive verbs (see (16)). Both the subject and the object move out of VP to be assigned Case, resulting in a S-structure representation like (18).

(18)



Thus, in this system scrambling is due to the fact that a dative subject can be assigned its Case either in its D-structure position or in IP-adjoined position. Since both the nominative Case licenser, INFL, and the dative Case licenser, INFL[+stative], are in the same position, the subject and the object may now be arranged in any order. However, this analysis predicts free word order for both the standard case frame (nominative-accusative) and the dative-nominative frame, missing the generalization that word order freezing happens in the dative subject construction only in a specific context—when the subject triggers honorific agreement on the verb. The only difference between the frozen and the non-frozen sentences is that only the former (e.g., (12a) and (13a)) contain the honorific marker -*si* on the verb, but not the latter (e.g., (10) and (11)). Given the lack of any theory-neutral evidence for the existence of AgrP and various Spec-head relations in Korean, it is difficult to ascribe the contrast

between the frozen and non-frozen sentences to their difference in syntactic structure and derivational complexity.[9]

In sum, the word order freezing phenomena in Hindi and Korean examined in this section strongly suggest that there is another important dimension that constrains word order independently of the discourse status of argument phrases or formal features such as Case and Agr, namely the relative *markedness* of argument types. A central problem is then how to formally relate the relative markedness of arguments along multiple dimensions to word order. In sections 2.3 and 2.4, I will show that a nonderivational analysis of syntactic markedness like the one offered by OT captures the markedness generalizations about the freezing effects in Hindi and Korean in a way that acknowledges the universal basis of these effects and at the same time accounts for the language-particular ways in which these effects are realized. As we will see, 'the worst of the worst' type of word order freezing discussed in this section follows naturally from the interaction of markedness constraints derived through hierarchy alignment, constraints on the realization of information structure and constraints on canonical ordering.

2.1.3 Markedness and Canonical Word Order

Before we analyze word order freezing effects with the perspective of markedness, it is essential to understand the concept of 'unmarked word order' itself.

Both Hindi and Korean are generally classified as SOV languages, i.e., a language in which the subject normally precedes the object and the object normally precedes the verb. In typological word order studies, the somewhat vague notion 'normal argument position' is usually expressed via the notion of the 'basic' word order of a language. The basic word order is typically identified as follows:[10]

[9]The phrasal head analysis of inflectional morphemes in Korean has been proposed by Whitman (1989), Ahn (1991), and many others. Ahn (1991) also suggests that the honorific marker *-si* and the negative marker *an* are syntactic heads of AgrP and NegP respectively. However, consistent with lexicalist theories of grammar, I will assume that Korean lacks functional projections and that verbal inflectional morphemes and case markers are affixes (showing lexical properties), following Han (1991), Sells (1995), Cho and Sells (1995), Kim (1999), and Choi (1999).

[10]For the formulation and critique of the basic word order as defined here, see Siewierska (1988).

> ... the order that occurs in stylistically neutral, independent, indicative clauses with full noun phrase participants, where the subject is definite, agentive and human, the object is a definite semantic patient and the verb represents an action, not a state or an event. In other words, it is the ordering of constituents in prototypical transitive clauses in the sense of Hopper and Thompson (1980). ... (Siewierska 1988:8).

This idea of a word order being basic amounts to a tacit claim that a clause containing lexical nouns in argument positions is more basic than a clause containing pronouns and that the order of nouns is therefore more basic than the order of pronouns.[11]

This classical model of 'basic word order' has not only been useful for typological word order comparisons but also has had a deep influence on generative theories of syntax, giving rise, for example, to the phrase structure rules of the base in generative syntax. Yet the criterion for determining what is basic mentioned above raises several questions, of which I would like to consider the following subset:

(19) a. What is the relation between 'basic' and 'dominant' word order (i.e., statistically most frequent word order)?

b. How does the basic word order relate to (various dimensions of) markedness?

c. What does it mean formally to be the unmarked word order?

Many linguists equate the basic order with the 'dominant' order (e.g., Greenberg 1966b; Hawkins 1983). As pointed out by Lambrecht (1986) and Siewierska (1988), however, the basic order, if defined as above, need not always correlate with the dominant linearization pattern in a given language.

A clear discrepancy between basic and dominant order is found in languages where bound pronouns, pronominal clitics and null pronouns are used for expressing a topical

[11] This widespread assumption is made explicit e.g., by Keenan (1976:308), who argues, on semantic grounds, that a sentence containing a lexical subject NP is more basic than a sentence containing a pronominal subject because only the former is context-independent and expresses a "complete thought".

referent and in languages which make frequent use of noun incorporation, whereby a nominal is affixed to the verb stem. It has been observed that transitive clauses with full lexical NPs are uncommon in these languages (see e.g., Butler (1976) for Mayan languages and Mallinson and Blake (1981) for Australian languages).

Another well-known source of discrepancy between basic and dominant order is the frequent use of left- and right-dislocations, as in current spoken French. Lambrecht (1986) shows that due to the use of such 'pragmatically-motivated' constructions, the SVO order in spoken French is clearly a minority pattern.

The second question is of a general nature: can the basic order, as defined above, be taken to be unmarked? Underlying the idea of the unmarkedness of the basic order is the belief that basic order needs to be motivated not only on statistical grounds but functionally. For example, Siewierska and Uhlirova (1998) argue for the basic SVO nature of Slavic languages based on the following evidence:[12]

> ... Functionally, SVO is the basic, unmarked order in the sense that a sentence with this order has the widest contextual applicability; it may be found in any position in a text, at the beginning, in the middle or at the end and each of the constituents may be contextually bound or unbound. The SVO order occurs in isolated sentences and in answers to questions such as *What happened?* ... (1998:107–108).

Note that 'functionally unmarked' here implies the widest contextual applicability or a minimum of contrast in terms of givenness or newness.

The basic order in the sense of functionally unmarked order naturally relates to the notion of a grammatical hierarchy: one finds the general pattern that the grammatical function hierarchy is directly manifested in the linear order of the arguments of the clause. That is, the conceptual ranking of arguments as described by the grammatical function hierarchy is mirrored in the physical sequence of arguments in the clause. Croft (1990) argues that this crosslinguistic pattern of basic word order is iconically motivated (Haiman 1985).

[12]Siewierska and Uhlirova (1998) further note that in clauses with two full NP participants SVO order is the statistically dominant order in Slavic languages.

This crosslinguistic preference for the SO order over others may ultimately be attributable to pragmatic functions in human communication or properties of the human perceptual and cognitive systems. Yet basic word order patterns cannot be solely explained in terms of such "raw" factors external to the grammar (e.g., iconicity or perspective) for two reasons. First, the grammatical function hierarchy-based word order pattern is subject to exceptions. Most common exceptions to the SO pattern are VOS order (found in many Mayan and Austronesian languages) and OVS order (found chiefly in Carib languages; Pullum 1977, 1981; Derbyshire and Pullum 1981). The question of why and how a language selects different word orders as basic cannot be answered by appealing to iconicity alone.[13]

This relates to the second reason why the existence of external motivation for basic word order does not amount to denying the basis of a formal analysis. As typological word order studies have shown, there are several grammatical factors that cannot be reduced to one and the relative strength of these varies from language to language. Even within languages, multiple linearization factors do not necessarily coincide in their predictions so that one cannot assume only one basic word order. These entail that there must be a language-particular system defining the balance of competing linearization factors.

If we conceive of word order as a multi-factor phenomenon and multiple linearization factors as conflicting forces that shape the word order of a given language, we can understand why, for example, the notion of basic word order has given rise to so much discussion and controversy in the literature on word order. This brings us to the third question: if there are multiple conflicting factors and each contributes to determining a particular word order, what does it mean formally to be the unmarked word order and how is it determined?

In my opinion, the right kind of approach to word order is one in which different conflicting linearization factors are analyzed simultaneously, without privileging one or the other factor. In such an approach the word orders found prominently in a particular language would be interpreted as language-specific solutions to the conflict arising among the different forces affecting linearization patterns. This idea is made

[13]This question is explored by Costa (2001).

explicit in recent optimization-based studies done by Grimshaw and Samek-Lodovici (1998), Samek-Lodovici (1996), Costa (1998) and Choi (1996, 1999), who suggest that different word orders are not optional but the result of different functional specifications in the input. Under this view, basic word order (i.e., the word order found in sentence-focus contexts) is not to be understood as underived word order (i.e., basic phrase structural position in which arguments receive their 'theta role') but rather as a consequence of optimization for inputs in which no elements are specified for topic or focus or in which the entire clause is specified for focus. This order is what is called 'canonical' or 'unmarked' word order (Choi 1996, 1999).

A more comprehensive approach to word order must not only cater for grammatical factors (e.g., grammatical function, semantic role, definiteness, referentiality, animacy) and contextual information, but also for the nature of the text. Perhaps it is in expository texts that more full NP participants would be found and hence the canonical order cannot be unequivocally considered to be unmarked under any conception of markedness without considering text types. Word order undoubtedly is also affected by intonation and length of constituents.

All of these are important aspects of order that should not be ignored, but such a broad investigation far exceeds the scope of the present study. My own purpose is to investigate relatively unexplored aspects of word order in so-called "free" word order languages, i.e., word order freezing, and to discuss the relevance of this phenomenon for linguistic theory.

2.2 Deriving Free Word Order in OT-LFG

So far I have presented data from Hindi and Korean suggesting that theories of word order need to incorporate the concept of markedness. I have also suggested certain generalizations that need to be captured by any general theory of word order and considered the concept of canonical word order. OT is a framework well-suited to the task of formally modeling the markedness generalizations because in this theory markedness is built into grammars in the form of violable universal constraints. In this section, I first briefly discuss the input representations and present major constraints

on word order and basic clause structure, proposed in recent works on constituent ordering. Then, for illustrative purposes, we will consider how the basic clause structure and free word order in Hindi and Korean are derived in the framework of OT-LFG.

2.2.1 Input

In OT syntax, the input is a language-independent characterization of the basic semantic and grammatical information of the phrase or clause. Within the OT-LFG framework inputs are taken to be a (possibly underspecified) feature structure representing (i) a predicator, and (ii) other morphosyntactic and semantic information of the lexical item and clause in a language-independent form (Bresnan 2000c). As an illustration, the input for the Hindi sentence in (20) would be the f-structure in (21).

(20) Anuu-ne caand dek^{h}aa.
Anu-ERG moon-NOM see/look at-PERF
'Anu saw the moon.'

(21)
$$\begin{bmatrix} \text{GF}_1 & \begin{bmatrix} \text{PRED} & \text{'Anu'} \end{bmatrix} \\ \text{GF}_2 & \begin{bmatrix} \text{PRED} & \text{'moon'} \end{bmatrix} \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{'see}\langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

As shown in the f-structure above, the OT-LFG input for syntax consists of a feature representation of the semantic content of an utterance (and some further pragmatic information (e.g., information structural status) and social meanings (to be discussed in section 2.4)); GF (for grammatical function) denotes an underspecified or generalized grammatical function.

The a(rgument)-structure is represented as the value of the PRED feature of argument-taking predicates which are identified with the GFs through subscribing. Therefore, the input representation is more accurately thought of as a pair of an underspecified f-structure and a-structure. Following Alsina (1993), I assume that the

a-structure contains Proto-Role classification of arguments: Proto-Agent (PA) and Proto-Patient (PP). The semantic properties of arguments that are relevant for argument realization form two clusters that define the Proto-Agent and the Proto-Patient (Dowty 1991). The following verbal entailments are those that characterize a PA:

(22) Proto-Agent Properties (Dowty 1991: 571)

a. volitional involvement in the event or state

b. sentience (and/or perception)

c. causing an event or change of state of another participant

d. movement (relative to the position of another participant)

e. exists independently of the event named by the verb

The verbal entailments that characterize a PP are the following:

(23) Proto-Patient Properties (Dowty 1991: 571)

a. undergoes change of state

b. incremental theme

c. causally affected by another participant

d. stationary relative to movement of another participant

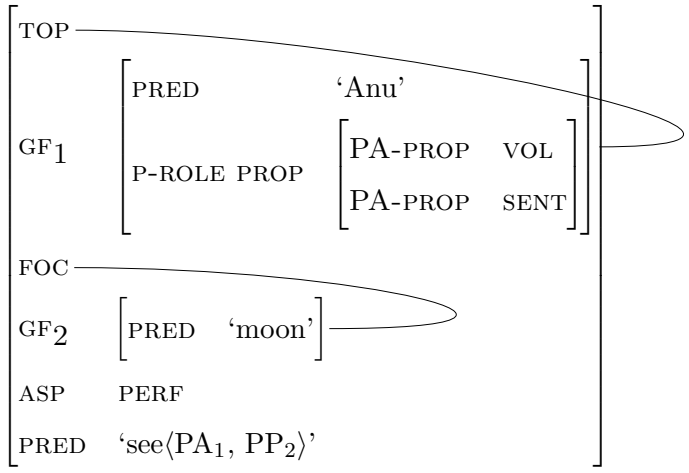
e. does not exist independently of the event or not at all

These proto-role properties can be represented with the features [PA-PROP VOL(ITIONALITY)], [PA-PROP CAUS(ALITY)], [PA-PROP SENT(IENCE)], [PP-PROP AFFECTED], etc. (Asudeh 2001), consisting of the attribute and value pair.

I further assume that the input also contains discourse-contextual information such as topic and focus (Choi 1996, 1999; Grimshaw and Samek-Lodovici 1998).

Now, suppose that the agent argument of the Hindi verb *dek* 'see' is introduced as the topic and the theme argument as the focus from the broader context. The

input for the Hindi sentence *Anuu-ne caand dek^{h}aa* 'Anu saw the moon' would be the feature structure in (24).

(24)


To sum up, I have characterized the form of the input. It is modeled as an abstracted feature structure, representing (i) a predicator, (ii) the proto-role properties of its argument(s), (iii) discourse-contextual information of arguments, and (iv) other morphosyntactic (e.g., tense and aspect) and semantic information.

2.2.2 Outputs and Constraint Interaction

Given an underspecified input f-structure (like the f-structure in (24)), a set of output candidates are generated by the generator GEN. The essential property of GEN is its universality: input and candidate sets are the same for all languages (this assumption is called 'richness of the base' (Smolensky 1996a)). For learnability, the input must be recoverable from the output (Tesar and Smolensky 1998). In OT-LFG the recoverability of the abstracted f-structure input from the output containing the overt forms of expressions is ensured by taking GEN to be a universal LFG which generates the possible types of candidate c(onstituent)-structures and their corresponding f-structures (for a detailed discussion of the choice of the representational format, see Bresnan (2000a) and Kuhn (2000a,b)).

Following Kuhn (1999, 2000, 2001a,b), I assume that the candidate f-structures are subsumed by the input f-structure, an assumption motivated by considerations

of decidability and complexity in processing.[14] Thus under the non-derivational, correspondence-based conception of GEN adopted here, the candidate analyses can be viewed as being generated from the input f-structure by monotonically adding non-semantic, purely grammatical features as well as particular GF realization (SUBJ or OBJ, for example). As we will see in section 2.4 and Chapter 3, this assumption about candidate generation has certain consequences for analyses of (honorific) agreement and case. The evaluation of these candidate structures is the function of EVAL(UATOR), the component of ranked, violable constraints.

The word order pattern in languages like Hindi and Korean can illustrate how constraints may interact. Although Hindi and Korean allow an extensive word order variation, and the order of constituents has even been characterized as syntactically free, word order in these languages is not random. Rather, the varied word orders are motivated both by semantic factors, such as animacy and specific vs. non-specific interpretations and discourse factors, such as topic and focus. As such, in order to determine the basic clause structure in Hindi and Korean, first it is necessary to analyze how these languages encode discourse functions.

In this work, I assume a four-way distinction of discourse functions based on two features in (25) (Choi 1996, 1999), following the distinction posited by Butt and King (1996).[15]

[14]Kuhn (1999, 2000, 2001a,b) argues that due to the assumption of the subsumption relation between the input and output f-structures, in a formal system for decidability, only those candidates which meet the subsumption requirement need to be considered, thereby avoiding the need to consider all logically possible candidates.

[15]Vallduví (1992) argues that the traditional bipartite divisions of a sentence drawn in terms of theme-rheme or given-new information are best understood in terms of a tripartite distinction, i.e., focus, link and tail. Choi (1996) proposes an extension of Vallduví's system whereby there is a four-way distinction based on two features: [±New] and [±Prom]. Following Vallduví, she assumes that a sentence is partitioned into two parts, focus and ground. She further classifies focus and ground, as in (i) to explain the distinct behaviors of the different types of focus and ground in scrambling.

(i) Sentence = focus, ground

	+PROM	−PROM
−NEW	Topic	Background
+NEW	Contrastive Focus	Completive Focus

Choi's (1996) original use of the two discourse features is different from Butt and King (1996) in

(25)

	+PROM	−PROM
−NEW	Topic	Background
+NEW	Focus	Completive Information

Topic and background share the feature [−NEW] since they both express the ground material (i.e., the material that a sentence shares with the preceding sentences), while focus and completive information are classified as [+NEW] information since they both introduce new information into the discourse. The more prominent information units of a sentence, i.e., topic and focus, are differentiated in terms of the feature [PROM] from their less prominent pairs, background and completive information respectively.

In Hindi and Korean topics occur in clause-initial position, which I assume to be a position adjoined to S, following the analysis of scrambling in free word order languages (e.g., Lee 1993; Choi 1999; cf. King 1995 for Russian; Dviwedi 1994, Sharma 1999 for Hindi; Butt and King 1996 for Urdu and Turkish).[16]

The use of topic (sentence topic as opposed to discourse topic) in the present study is consistent with much contemporary use of the term in syntactic theory (see e.g., Aissen (1992) and Shi (2000)). Of course, there is a notorious lack of consensus among linguists as to how the term topic should be defined. I will not attempt to evaluate competing definitions here, but will consider three standard interpretations of topic in order to emphasize the point that different types of topic must be recognized and that languages could differ as to which types of topic and how these are encoded.

One of the standard interpretations of topic is that of it is what the sentence is about. Under this conception, topic is what a sentence is about. According to Reinhart (1982), the defining property of topics is that they function as referential, existentially presupposed entries. She further argues that givenness is neither a sufficient nor necessary condition for topicality. It is notable that this characterization of topic does not appear to match the topic notion used in this work: the salient or prominent part which is the center of interest in the current discourse need not

that she differentiates between contrastive focus and completive focus, as in (i). I do not discuss contrastive focus in this chapter.

[16]The term 'scrambling' here is used to refer to the phenomenon of multiple possibilities of the order of phrasal constituents which carry argument functions rather than to the formal operation.

be referential or existentially presupposed.[17] The current notion of topic is also distinguished from what is called continuous or continuing topic. As (Choi 1999:86) notes, "a continuing topic need not be prominent and simply refers anaphorically to an entity which is already introduced in the discourse."

Interestingly, these three different notions of topic are encoded in different ways in Korean, although not all separately encoded in every language. A subject-of-predication is typically expressed as an initial NP in multiple nominative constructions (see section 3.1.2). Continuing topic and salient or shifted topic are both typically encoded by morphology: the former by means of null pronouns and the latter by the so-called topic marker -*nun*.

Although throughout this work I will use the term topic to refer to the salient, given material of a sentence, I will assume a more fine-grained typology of topic, discussed above, rather than being restricted to one strict definition of what topic should mean. Systematic differentiation among different types of topic will lead to more adequate description of the data and will help facilitate crosslinguistic comparisons as to which types of topic languages encode in which ways.

Apart from topic, the two most commonly employed discourse functions in Hindi are focus and postposed background (to be described shortly). The major function of focus is to provide new information relevant for the discourse structure. If there is only one focused constituent in the sentence, then it must appear immediately before the verb (Butt and King 1996; Sharma 1999). This is illustrated in (26).[18]

(26) a. Niinaa-ne Mohan-ko [tofii]$_{FOC}$ d-ii.
Nina-ERG Mohan-DAT toffee-NOM give-PERF
'Nina gave TOFFEE to Mohan.'

[17] See Arnold (1998) for an extensive discussion of the relation between salience and topic/focus.

[18] In Hindi, in addition to the preverbal focus, in-situ focusing of a phrase is possible in a sentence with multiple foci. This in-situ focus is always interpreted as contrastive focus, as illustrated in the example in (i) (taken from Butt and King 1996, fn. 7). I will not discuss multiple foci and in-situ contrastive focus in this dissertation.

(i) (Aadnaan-keliye nahii) Naadyaa-ne [Hassan-keliye]$_{CF}$ [Tofii]$_F$ xarid-ii.
Adnan-for Nadya-ERG Hassan-for toffee-NOM buy-PERF
'Nadya bought TOFFEE for HASSAN (not for Adnan).'

b. #Niinaa-ne [Mohan-ko]$_{FOC}$ tofii d-ii.
Nina-ERG Mohan-DAT toffee-NOM give-PERF
'Nina gave toffee to MOHAN.'

Certain syntactic and information structural differences divide nonprominent information into two types: preverbal (completive information) and postverbal nonprominent information (background information). Consider the Urdu/Hindi sentences in (27) and (28), taken from Butt and King (1996).

(27) Naadyaa kahãã-se aa rahii hai?
Nadya-NOM where-from come STATE be.PRES
'Where is Nadya coming from?'

(28) a. Naadyaa to abhii [tofii]$_{COMPL}$ [bazaar-mẽ]$_{FOC}$ xarid rahii
Nadya-NOM indeed just toffee-NOM market-LOC buy STATE
t^{h}ii.
be.PRES
'Nadya was just buying toffee at the market.'

b. #Naadyaa to abhii [bazaar-mẽ]$_{FOC}$ xarid rahii t^{h}ii [tofii]$_{BCK}$

Since *bazaar-mẽ* 'at the market' provides the information which answers the question in (27), it is focused, while the object *tofii* 'toffee' represents completive information, which expresses purely new information that is neither topicalized nor focused. In this context, the utterance in (28b), where *tofii* 'toffee' appears postverbally, is infelicitous because it presumes the toffee to be a familiar entity which represents known background information.

The various word order possibilities in different contexts discussed so far can be captured by interactions among potentially conflicting constraints in several parallel structures of grammar. In particular, in recent work on OT syntax, syntactic positioning has been successfully modeled as alignment constraints since the pioneering work of Grimshaw (1997) (e.g. Legendre 1996; Choi 1999; Costa 1998; Grimshaw 2001; Samek-Lodovici 1996). Formally, alignment constraints have the

form Align(α,E_1,β,E_2), where $E_{1/2}$ is an edge, Left or Right, and α and β are the elements to be aligned (see McCarthy and Prince (1993) and Kager (1999, Ch.3) for an overview of alignment in OT). More recently, an alignment-based approach to clause structure which does not assume complementary Left and Right alignment constraints has been developed by Sells (1999, 2001). Clause-level alignment constraints that can be used to describe the 'canonical' and 'noncanonical' orders of the arguments in a clause are also presented in his work, and these are of direct relevance here.

For the present purposes, what we will need in order to derive various possible orders of a verb's arguments is a set of alignment constraints which refer to clausal information about grammatical function (GF), semantic role and discourse function (DF). We can motivate the following clause-level alignment constraints:

(29) ALIGN$_{GF}$:

a. SUBJ-L: Subject aligns left in the clause.

b. OBJ-L: Object aligns left in the clause.

(30) ALIGN$_{\theta}$:

a. PA-L: Proto-Agent aligns left in the clause.

b. PP-L: Proto-Patient aligns left in the clause.

Information structuring constraints can also be stated as alignment constraints. The discourse motivation for locating background information at one end of the clause and other discourse information at the other seems transparent.

(31) Discourse-based Alignment Constraints:

a. TOP-L: Topic aligns left in the clause.

b. FOC-L: Focus aligns left in the clause.

c. BCK-R: Background information aligns right in the clause.

d. COMPL-L: Completive information aligns left in the clause.

The constraints in (29) and (31) are correspondence constraints between f-structure and c-structure, and those in (30) are correspondence constraints between a-structure and c-structure. We can think of these as having generalized alignment formulae as follows:

(32) a. Align(GF,L,β,L)

b. Align(AF,L,β,L)

Here AF (for argument function) is the elements of a-structure and β is the clause containing AF and GF. Strictly speaking, the elements that we need to align with the clause is the c-structure constituent bearing the argument function or the grammatical function (including syntacticized discourse function). Assuming this interpretation, we can understand the alignment constraint OBJ-L as meaning that the left edge of the NP bearing the grammatical function OBJ should be aligned with the left edge of the clause.

The basic clause structure of Hindi and Korean can be derived by the interaction of two types of alignment constraints: the clause-level alignment constraints introduced above and the alignment constraints referring to information purely about the local phrase structure. Examples of the latter type of alignment constraints are given in (33b) and (33c).

(33) Constraints on Clausal Skeleton (Sells 1999, 2001):

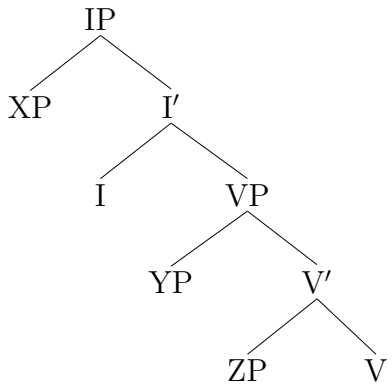
a. Clausal spine: The spine of the clause is any node sharing categorical features with the verbal head, including V, V′, I, I′, C and C′.

b. Spine-R: co-head aligns right in its local subtree.

c. VHD-L: X^0 verbal head aligns left in its local subtree.

The clausal 'spine' corresponds to the notion of 'Extended Projection' in the work of Grimshaw (1991, 1997). The equivalent LFG formulation is the notion of f-structure 'co-heads'—they are non-Specifier parts of IP and CP, annotated ↑=↓, which extend the clausal structure above VP or S (see Bresnan (2001b) and Sells (2001)). For illustrative purposes, let us consider the structure in (34a) with regard to the constraints in (33b,c). XP, YP and ZP are assumed to bear grammatical functions with respect the head.

(34) a.



b. Spine-R violations, 1 at I

c. VHD-L violations, 1 at V

Within each local subtree, the spine elements on the right are I′, VP, V′ and V; the spine element which is not on the right is I, and this violates Spine-R. The X^0 head elements are I and V, and the latter violates VHD-L.

Sells (1999, 2001) has proposed an antisymmetric constraint system for deriving the typologically attested space of c-structure configurations, using the alignment constraints Spine-R and VHD-L. For example, ranking Spine-R over VHD-L will give right-branching languages. SOV languages like Hindi and Korean, which lack the structural functional head of I, instantiate fully right-branching, with a single co-head, V, at the bottom.

For Hindi, the dominance ranking of the alignment constraints introduced so far is as (35). ALIGN_θ and ALIGN_{GF} can be treated as a shorthand for PA-L ≫ PP-L and SUBJ-L ≫ OBJ-L respectively. Also, the ranking relation of the two constraints

separated by the comma is not specified here. With the ranking in (35), a topic will always be more to the left than a focus in the same clause; and a background will always be more to the right than spine elements in the same clause.

(35) Ranking for Hindi: Bck-R, Top-L ≫ Spine-R ≫ Align$_\theta$≫ Align$_{GF}$≫ Compl-L≫ Foc-L≫ Vhd-L

Crucially, the ranking for Hindi in (35) can predict that when the arguments do not differ in informational status (e.g., topicality and givenness), the Align constraints will take effect, leading to SOV (or PA-PP) order; when there are differences, the canonical word order will however violate information structuring constraints such as Top-L, so that competitors with a noncanonical ordering may win out.

Korean differs from Hindi in one respect:[19] the stronger effect of Align$_{GF}$ than Align$_\theta$. This difference between Hindi and Korean can be handled by modifying the ranking of two types of Align constraints as follows:

(36) Ranking for Korean: Top-L≫ Spine-R ≫ Align$_{GF}$≫ Align$_\theta$≫ Compl-L≫ Foc-L≫ Vhd-L

Now, suppose that the experiencer argument *Anuu* of the Hindi volitional transitive verb *dek^{h}aa* 'saw' is topic (i.e., prominent given information) and the theme *caand* 'moon' is focus (i.e., prominent new information). In this context the input is as in (24) above. This results in the optimal output (37a), going through the constraint competition in Tableau 1 (violations of ordering constraints are computed by counting constituents from the left.[20]). Align$_\theta$ is omitted here, since it has the same effect as Align$_{GF}$ in this case. For our purposes here, we consider only candidates faithfully representing proto-role information and discourse information in the input in (24). Constraint evaluations which have no effect in determining the outcome are shaded gray.

[19] Another difference is that clause-final backgrounding in Korean is more restricted than in Hindi. I do not include Bck-R in (36) as its effects are not relevant here.

[20] Violations of Vhd-L are counted within a local subtree (here VP) (Grimshaw 1997). As argued convincingly in Sharma (1999), no arguments appear within the VP in Hindi, whether in specifier or complement position, and all arguments are generated directly under S. In other words, a VP does not contain the verb and its complements. Instead, the only VP-internal elements are those which are preverbally focused.

(37) Tableau 1. Volitional Transitives in Hindi

CANDIDATES:	BCK-R,	TOP-L	Spine-R	ALIGN$_{GF}$	COMPL-L	FOC-L	VHD-L
☞ a. [$_S$ S$_{TOP}$ [$_S$ [$_{VP}$O$_{FOC}$V]]]						*	*
b. [$_S$ [S$_{TOP}$ [$_{VP}$V]]$_S$ O$_{FOC}$]			*			**	
c. [$_S$ O$_{FOC}$ [$_S$ S$_{TOP}$ [$_{VP}$ V]]]		*		*			
d. [$_S$ [O$_{FOC}$ [$_{VP}$V]]$_S$ S$_{TOP}$]		**	*	*			
e. [$_S$ [$_{VP}$ V] S$_{TOP}$O$_{FOC}$]		*	**			**	
f. [$_S$ [$_{VP}$ V] O$_{FOC}$S$_{TOP}$]		**	**	*		*	

As noted previously, the varied word orders in Hindi are optional from a purely syntactic point of view: although all orders shown in Tableau 1 above are in principle available, each is preferentially brought out by a particular context to mark a particular information structure. In the present framework this can be captured by considering the role of the input (Choi 1996, 1999). For example, the candidate (37c) with OSV order corresponds more faithfully to (38); the candidate (37d) with OVS order, to (39) (in the f-structures below the proto-role properties associated with each argument role are omitted for simplicity). In other words, according to this analysis OSV becomes optimal for expressing the topical status of the object and the newness of the subject under the same ranking that yields (37a) as the optimal output; OVS is optimal for expressing the nonsalient status of the subject as background information.

(38)
$$\begin{bmatrix} \text{FOC} & \\ \text{GF}_1 & \begin{bmatrix} \text{PRED} & \text{'Anu'} \end{bmatrix} \\ \text{TOP} & \\ \text{GF}_2 & \begin{bmatrix} \text{PRED} & \text{'moon'} \end{bmatrix} \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{'see}\langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

(39)
$$\begin{bmatrix} \text{BCK} & \\ \text{GF}_1 & \begin{bmatrix} \text{PRED} & \text{'Anu'} \end{bmatrix} \\ \text{TOP} & \\ \text{GF}_2 & \begin{bmatrix} \text{PRED} & \text{'moon'} \end{bmatrix} \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{'see}\langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

To summarize, the varied word orders in Hindi and Korean and their related interpretations find a natural analysis in the OT-LFG framework combining the ideas

of imperfect correspondence and violable constraints. The next step is to explain why orderings in sentences with more marked types of subjects (e.g., nonvolitional subject and dative subject) are more restricted, and word order is even frozen in SOV order in the most marked situation (see the discussion in section 2.1).

2.3 Markedness Reduction in Word Order in Hindi

This section presents an OT-LFG account of the 'worst of the worst' type of freezing effects in Hindi. Central to my account is the use of harmonic alignment (Prince and Smolensky 1993; Aissen 1999) and local conjunction in OT (Smolensky 1995). I show that under the analysis I develop here, word order freezing in "free" word order languages is not the exception, but just one of the options allowed by the universal scales of grammatical function, semantic role, etc.

2.3.1 Harmonic Alignment and Markedness Constraints

In this section I demonstrate that the 'worst of the worst' type of the freezing effects in Hindi outlined in section 2.1.1 follows naturally from constraints derived from the general model of harmonic alignment developed in Prince and Smolensky (1993) and adopted in Aissen (1997, 1999).[21] The formal definition of harmonic alignment is given in (40) (Prince and Smolensky 1993: 136).

(40) Harmonic Alignment: Suppose a binary dimension D_1 with a scale X > Y on its element {X, Y}, and another dimension D_2 with a scale a > b > ... > z on its elements. The harmonic alignment of D_1 and D_2 is the pair of Harmonic scales:

[21] I wish to make clear some terminologies that I use throughout this section. First, as we will see, the constraints that will be introduced in this section refer to 'prominence'. The notion of *prominence* can be defined by ordering relations on linguistic substance in different dimensions—grammatical functions, semantic roles, case, etc, and corresponds to the notion of 'hierarchy' among the four types of universals that Croft (1990) proposes (see section 1.2). *Markedness* in this section concerns associations between elements of these different dimensions. An equivalent notion in Croft's (1990) typology of universals is 'prototype'. In this section I introduce a technical tool which expresses the relative markedness of different associations of prominence relations, i.e., *harmonic alignment*.

H_X: X/a $\succ$ X/b $\succ$ ... $\succ$ X/z
H_Y: Y/z $\succ$ ... $\succ$ Y/b $\succ$ Y/a

The *constraint alignment* is the pair of constraint hierarchies:

C_X: *X/z $\gg$... $\gg$ *X/b $\gg$ *X/a
C_Y: *Y/a $\gg$ *Y/b $\gg$ ... $\gg$ *Y/z

Harmonic alignment is an important source of constraints in OT, and was introduced originally to express the relation between syllable position and sonority: the more prominent position (the nucleus) attracts segments which are more sonorous, while less prominent positions (the margins) attract less sonorous segments. This paper extends an idea first proposed in Aissen (1997) and developed further in Artstein (1998) and Aissen (1999, 2000), that harmonic alignment plays a central role in the domain of morphosyntax to express the relative markedness of different associations of morphosyntactic prominence hierarchies. The basic idea is that the subject function plays a role in the clause analogous to that played by the peak in syllable structure: it is the most prominent grammatical function and thereby attracts elements which are relatively prominent on other dimensions such as semantic role (Aissen 1999:9).

Now we can apply the definition above to the two prominence scales relevant to the word order pattern in Hindi—the grammatical function (GF) scale and the semantic role scale, given in (41). I will adopt the scale Subject > Nonsubject (Aissen 1999) and the scale Proto-Agent (PA) > Proto-Patient (PP), where ">" means "more prominent than". As discussed earlier, the two proto-roles are cluster concepts defined in terms of Dowty's (1991) Proto-Agent and Proto-Patient properties. For present purposes, I use the last two elements of the decomposed prominence scale PA_{vol} > PA_{-vol} > PP proposed by Asudeh (2001), where the subscripted *vol* indicates the proto-role property of volitionality. In the predicates I discuss here, the experiencer argument corresponds to a nonvolitional Proto-Agent (PA_{-vol}), and the theme argument to Proto-Patient (PP).

(41) Universal Scales

a. GF: SUBJ > Non-SUBJ

b. Semantic Role: PA_{-vol} > PP

If the scales in (41) are harmonically aligned, we obtain the pairs of combined harmony scales in (42):

(42) Harmony Scales derived through Harmonic Alignment

a. H_1: SUBJ/PA_{-vol} $\succ$ SUBJ/PP

b. H_2: $\sim$SUBJ/PP $\succ$ $\sim$SUBJ/PA_{-vol}

The first two harmony scales concern the association between grammatical function and semantic role, and assert that the unmarked situation is for subject to be Proto-Agent, and for nonsubject to be Proto-Patient (The connective "$\succ$" is read as "more harmonic than".). The last two harmony scales involve the alignment of the grammatical function hierarchy and the structural position hierarchy. The corresponding constraint alignments are the pairs of structural markedness constraint hierarchies in (43):

(43) Constraint Subhierarchies

a. C_1: *SUBJ/PP $\gg$ *SUBJ/PA_{-vol}

b. C_2: *$\sim$SUBJ/PA_{-vol} $\gg$ *$\sim$SUBJ/PP

Each subhierarchy in (43) expresses the universal markedness relation (e.g., a clause with a PP subject will lose out to a clause with a PA subject, other things being equal).[22] The important property of the constraint hierarchies in (43) is that while

[22]The more expanded constraint subhierarchy *SUBJ/PP $\gg$ *SUBJ/PA_{-vol} $\gg$ *SUBJ/PA_{vol} explains grammatical function selection in languages like Hindi and Marathi. According to Joshi (1993), the only property that is important for subject selection in Marathi is whether the argument is entailed to be volitional by the predicate. For instance, nonvolitional causers (both animate and

the ranking of constraints within a subhierarchy is fixed (e.g., *SUBJ/PP always outranks *SUBJ/PA$_{-vol}$), individually they may be variously ranked with respect to other constraints.

However, showing that a Proto-Patient subject and a Proto-Agent nonsubject are more marked than a Proto-Agent subject and a Proto-Patient nonsubject is not enough, because both cases are still allowed in Hindi. we can use the mechanism of *local conjunction* (Smolensky 1995:4) to capture the 'worst of the worst' case in Hindi, when the idea that if the subject is both a Proto-Patient and in a noninitial position in the constituent structure.[23]

(44) The Local Conjunction of C_1 and C_2 in domain D, C_1 & C_2 is violated when there is some domain of type D in which both C_1 and C_2 are violated. Universally, C_1 & $C_2 \gg C_1$, C_2.

Smolensky (1995) proposes that UG provides grammars the option of forming local conjunctions out of universal constraints and that like the strict domination operator $\gg$, the local conjunction operator & would be part of UG, but the conjoined themselves would not. Following this proposal, I argue that Hindi has the local conjunction operator & as part of its grammar and ranks the conjunction of universal constraints higher than any of its component constraints.

To derive the pattern of universal markedness reflected in freezing effects in Hindi, let us consider conjunction of the subhierarchy C_1 in (43a) with the alignment constraint SUBJ-L. For the constraints under consideration here, the relevant domain

inanimate) cannot be grammatical subjects (Joshi 1993: 48). This differs markedly from the situation found in English and in Romance languages in which the entailment of causation is a more important factor than volitionality in determining subject selection. In order to capture this variation, it may be necessary to decompose PA into two types: arguments entailed to be a causer or to be volitionally involved in the event or state, and arguments which are not entailed to have these two properties. The variation in subject selection then can be accounted for by allowing reranking of the causation constraints on the subject and volitionality constraints on the subject in different languages.

[23]Local conjunction was first used in syntax in Legendre *et al.* (1995) for analyses of *wh*-extraction, and has been extended to various domains of morphosyntax. While the existence of local conjunction is amply motivated, their status is still a matter of controversy. See Kager (1999, section 9.2) for some critical comments.

is the clause. This results in the new constraint subhierarchy in (45). The high-ranked constraint in (45) expresses the basic idea that if subject is a highly marked Proto-Patient argument, it should not be in marked non-leftmost position. This most marked configuration excluded by this constraint obtains in sentences like (6b,c,d,e), repeated below as (46a,b,c,d). Recall from section 2.1.1 that these examples are acceptable only under the analysis of the nonvolitional experiencer as the subject, which cannot be the antecedent of the pronoun; the analysis of the theme as the subject in Hindi is compatible only with the theme-experiencer-verb order. Hence, when the Proto-Patient (e.g., theme) of a nonvolitional transitive verb is the subject *and* in a marked noninitial position, it is indeed the case of the worst of the worst that is not tolerated in Hindi.

(45) Conjoining SUBJ-L with C_1:
C_3: *SUBJ/PP & SUBJ-L $\gg$ *SUBJ/PA_{-vol} & SUBJ-L

(46) a. Anuu-ko Niinaa uskii bastii-mẽ dik^{h}ii.
Anu-DAT Nina-NOM PRON-GEN neighborhood-LOC appear-PERF
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

b. Anuu-ko uskii bastii-mẽ dik^{h}ii Niinaa.
Anu-DAT PRON-GEN neighborhood-LOC appear-PERF Nina-NOM
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

c. Dik^{h}ii Niinaa Anuu-ko uskii bastii-mẽ.
appear-PERF Nina-NOM Anu-DAT PRON-GEN neighborhood-LOC
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

d. Dik^{h}ii Anuu-ko Niinaa uskii bastii-mẽ.
appear-PERF Anu-DAT Nina-NOM PRON-GEN neighborhood-LOC
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

The ranking that emerges for Hindi is given in (47).

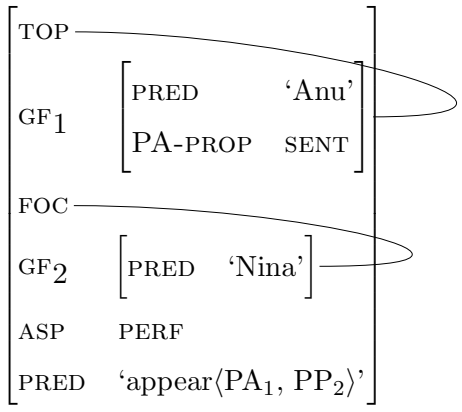
(47) Ranking for Hindi: *SUBJ/PP & SUBJ-L ≫ *SUBJ/PP, *∼SUBJ/PA$_{-vol}$ ≫ TOP-L≫ ALIGN$_{GF}$≫ FOC-L...

Note here that the locally-conjoined constraint is ranked higher than its component constraints *SUBJ/PP and SUBJ-L. Crucially, the higher ranking of the conjoined constraint that penalizes a PP subject in non-initial position over the information structuring constraints (e.g., TOP-L) has the effect of restricting the word order freedom motivated by discourse prominence of arguments: marked types of subjects (e.g., Proto-Patient subject) must occur in an unmarked position in the clause.

2.3.2 Constraint Interaction in Word Order Freezing in Hindi

Now, let us assume a discourse context in which the Proto-Agent is topic and the Proto-Patient is focus. This particular context renders an input like (48).

(48) Input:



This input then results in the optimal output (a1), going through the constraint competition in (49). The comma in the tableau indicates that there is no crucial ranking between the constraints separated by it. Also, candidates are again schematically represented, and constraints on the clausal skeleton and on argument-GF mapping are omitted, as their effects are not relevant here. Candidates (a1) to (a6) are associated with the same f-structure, where the Proto-Agent argument 'Anu' is canonically mapped to the subject, and the Proto-Patient 'Nina' to the object. Similarly, candidates (b1) to (b6) are paired with the same f-structure with the opposite linking.

Also, candidates labeled by the same number share the same c-structure string. For example, both candidates (a1) and (b1) share the same string *Anuu-ko Niinaa dik^{h}ii*.

(49) Tableau 2. Word order in Hindi nonvolitional transitives

CANDIDATES:	*SUBJ/PP & SUBJ-L,	TOP-L	ALIGN$_{GF}$	FOC-L
☞ a1. $S_{PA/TOP}O_{PP/FOC}V$				*
a2. $O_{PP/FOC}S_{PA/TOP}V$		*	*	
a3. $S_{PA/TOP}VO_{PP/FOC}$				**
a4. $O_{PP/FOC}VS_{PA/TOP}$		**	*	
a5. $VS_{PA/TOP}O_{PP/FOC}$		*		**
a6. $VO_{PP/FOC}S_{PA/TOP}$		**	*	*
b1. $O_{PA/TOP}S_{PP/FOC}V$	*!		*	*
b2. $S_{PP/FOC}O_{PA/TOP}V$		*		
b3. $O_{PA/TOP}VS_{PP/FOC}$	*!		*	**
b4. $S_{PP/FOC}VO_{PA/TOP}$		**		
b5. $VO_{PA/TOP}S_{PP/FOC}$	*!	*	*	**
b6. $VS_{PP/FOC}O_{PA/TOP}$	*!	**		*

Due to the two high-ranking constraints that penalize a highly marked type of subject occurring in noncanonical position, candidates (b1), (b3), (b5) and (b6) are ruled out immediately.[24] Among the remaining candidates, (a1) is the best; it satisfies more higher-ranking constraints than any other candidates.

Now, let's consider a context in which the nonvolitional Proto-Agent is a focus and Proto-Patient is a topic. This is illustrated in the following question-answer examples in (50) and (51). Suppose that a speaker A asked another speaker B the question in (50) and that the examples in (51) are possible answers to it in that they provide the

[24]I assume that when gradient alignment constraints like SUBJ-L are locally conjoined with other markedness constraint, the complex constraint is violated if and only if both of its component constraints are violated at least once. That is, I interpret the conjoined constraint *SUBJ/PP$_{-vol}$ & SUBJ-L as being violated by the four candidates (b1), (b3), (b5) and (b6), although among these, (b3) and (b5) are worse than (b1) and (b6) with respect to SUBJ-L.

hearer with information as to who saw Nina, namely Anu. The *what about Niinaa*? phrase, following Vallduví (1992), is used to identify the topic, namely the prominent old information which is the center of interest in the current discourse. Since *Anuu-ko* 'to Anu' provides the information which answers the question, it is focused.

(50) Aur Niinaa? Niinaa kisko dik^{h}ii?
and Nina? Nina-NOM who-DAT appear-PERF
'What about Nina? Who saw Nina?' (Lit. 'To whom did Nina appear?')

(51) a. [Niinaa]$_{TOP}$ [Anuu-ko]$_{FOC}$ dik^{h}ii.
Nina-NOM Anu-DAT appear-PERF
'ANU saw Nina.' (Lit. 'Nina appeared to ANU.')

b. *Anuu-ko Niinaa dik^{h}ii.

c. *Niinaa dik^{h}ii Anuu-ko.

d. *Anuu-ko dik^{h}ii Niinaa.

e. *Dik^{h}ii Niinaa Anuu-ko.

f. *Dik^{h}ii Anuu-ko Niinaa.

Among the six examples in (51), only (51a) is an appropriate answer where the topic appears canonically sentence initially, and the focus immediately before the verb. In contrast, in the sentences marked as ungrammatical the topic and focus are not in their canonical position, and as a result they are ungrammatical in the context of (50) as expected given the requirement that topic is clause initial and focus is immediately before the verb.[25]

Now, suppose that the sentences in (52b,c) are uttered by the speaker B as a response to the speaker A's question in (52a), followed by the utterances in (51).

[25]The examples in (51c) and (51d) are felicitous only in the context in which the preverbal NP is topicalized with the verb as an informational unit (Devyani Sharma, p.c., September 1999).

(52) a. Kahan?
'Where?'

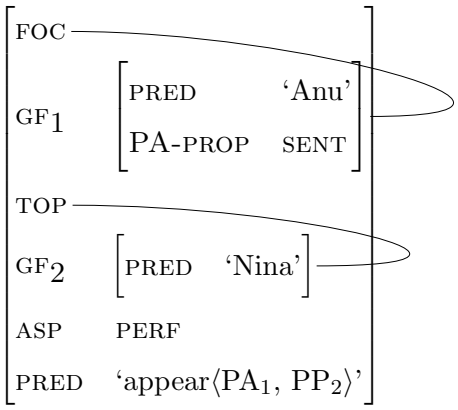
b. Apnii bastii-mẽ
self-GEN neighborhood-LOC
'in self's neighborhood' (Nina (theme) = apnii, Anu (experiencer) ≠ apnii)

c. Uskii bastii-mẽ
PRON-GEN neighborhood-LOC
'in her neighborhood' (Nina (theme) ≠ uskii, Anu (experiencer) = uskii)

As (52b,c) show, for the speakers of Hindi that I have consulted, Nina is the only eligible antecedent of the reflexive *apnii* within the context of (50) and (52b); it is also the only element in the clause that cannot be coreferent with the pronoun *uskii*. Therefore the facts on word order and coreference in (50)–(52) suggest that the theme argument *Niinaa*, not the experiencer *Anuu*, is the grammatical subject when the former is topic and the latter is focus.

Let us now see how the OT account explains word order freezing in the discourse context in which the nonvolitional Proto-Agent is a focus and the Proto-Patient is a topic. In this context the input is as (53). In this context, however, noncanonical linking becomes optimal under the same ranking, as illustrated in (54).

(53) Input:



The violation patterns for the two top-ranked markedness constraints for (b) candidates in Tableau 3 are just like those in Tableau 2, and they will remain the same

for all subsequent tableaux, because the violations of these conjoined constraints are not sensitive to discourse context. Thus, the constraint ranking proposed here accounts for the fact that in a clause with a Proto-Patient subject and a nonvolitional Proto-Agent object word order is fixed as SOV, capturing the basic generalization that highly marked argument types occur only in unmarked position.

(54) Tableau 3. Word order freezing in the marked linking pattern

CANDIDATES:	*SUBJ/PP & SUBJ-L,	TOP-L	ALIGN$_{GF}$	FOC-L
a1. $S_{PA/FOC}O_{PP/TOP}V$		*		
a2. $O_{PP/TOP}S_{PA/FOC}V$			*	*
a3. $S_{PA/FOC}VO_{PP/TOP}$		**		
a4. $O_{PP/TOP}VS_{PA/FOC}$			*	
a5. $VS_{PA/FOC}O_{PP/TOP}$		**		*
a6. $VO_{PP/TOP}S_{PA/FOC}$		*	*	**
b1. $O_{PA/FOC}S_{PP/TOP}V$	*!	*	*	
☞ b2. $S_{PP/TOP}O_{PA/FOC}V$				*
b3. $O_{PA/FOC}VS_{PP/TOP}$	*!	**	*	
b4. $S_{PP/TOP}VO_{PA/FOC}$				**!
b5. $VO_{PA/FOC}S_{PP/TOP}$	*!	**	*	*
b6. $VS_{PP/TOP}O_{PA/FOC}$	*!	*		**

We have now seen that under the OT approach developed here, word order freezing in nonvolitional transitives is not an idiosyncracy of Hindi. Rather it follows from constraint interaction as a manifestation of the general pattern of markedness reduction in typologically marked grammatical contexts. Furthermore, this approach derives the ill-formedness of other word orders that are ruled out in Hindi as direct consequences of a basic properties of OT—constraint ranking consistency across inputs.

2.3.3 Further Consequences of Constraint Ranking Consistency

Another type of structure excluded in Hindi is one like (6a), repeated here as (55b), where the subject is in initial position but the object is postposed. As discussed in section 2.1.1, this example is acceptable only in an the analysis where the postposed experiencer is the subject (55a) (i.e., $O_{th}VS_{exp}$); for many Hindi speakers, the $S_{th}VO_{exp}$ structure (55b) is not categorically prohibited but is dispreferred as the primary analysis of the string.

(55) Grammaticality of a string with theme-V-experiencer order

a. Niinaa uskii bastii-mẽ dik^{h}ii Anuu-ko. (OVS)
Nina-NOM PRON-GEN neighborhood-LOC appear-PERF Anu-DAT
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

a. *Niinaa uskii bastii-mẽ dik^{h}ii Anuu-ko. (SVO)
Nina-NOM PRON-GEN neighborhood-LOC appear-PERF Anu-DAT
'Anu$_i$ saw Nina$_j$ in her$_{i/*j}$ neighborhood.'

What we need to derive this pattern are simple markedness constraints on the association between grammatical function and background information, given in (56). Nothing more than this need to be assumed.

(56) *∼SUBJ/BCK ≫ *SUBJ/BCK

I assume that these constraints form a subhierarchy, which is present in every grammar in the same relative order and interleaved with other constraints (though I do not derive them through harmonic alignment). That is, nonsubjects are always more marked as background information [–PROM, –NEW] than subjects. The markedness expressed by this ranking is supported on statistical grounds.[26] As with Tamil

[26]Lambrecht (1986) accounts for the strong correlation between subject and backgrounding in terms of high activation state.

(Herring 1994:125), the postposed constituents in Hindi are overwhelmingly the grammatical subject when it is [–PROM, –NEW] (Sharma 1999).[27]

We could then rank the constraints in (56) with respect to the other constraints proposed in the preceding sections, to predict what kind of grammatical function analysis would be preferred for strings like the ones in (55). For Hindi, *∼SUBJ/BCK would be ranked above ALIGN$_{GF}$, as in (57) (the locally conjoined constraint is omitted). Under this ranking, in the absence of any relevant higher-ranking constraints, a candidate with a postposed nonsubject will lose out to a candidate with a postposed subject.

(57) Ranking for Hindi: BCK-R, TOP-L ≫ *∼SUBJ/BCK ≫ ALIGN$_{GF}$≫ FOC-L, *SUBJ/BCK ≫ VHD-L

Assuming the constraint ranking in (57), let's now consider how the ill-formedness of the S$_{th}$VO$_{exp}$ structure in Hindi follows from one basic formal property of OT—constraint ranking consistency across inputs. As shown in Table 3, for three distinct inputs in which the PA argument of a nonvolitional transitive is specified as a topic or focus or as discourse-neutral, neither of the analyses in (55) are optimal. However, in case the PA is specified as background information in the input, TOP-L and FOC-L are inapplicable in the determination of the positioning of the PA argument. Instead, BCK-R and the markedness constraint *∼SUBJ/BCK come into play in selecting the optimal analysis of the string. Of the two candidates with the PA argument in postverbal position, the S$_{th}$VO$_{exp}$ candidate is eliminated by *∼SUBJ/BCK, leaving the O$_{th}$VS$_{exp}$ candidate as the winner.

[27]Postposed elements in Hindi are usually (but not always) equivalent to tail-type information (Vallduví 1992). Sharma (1999) notes that the other element, less commonly found clause-finally than tail- or background-type information, is a type of emphatic focus, with features [+NEW] and [–PROM].

(58) Table 3. Consequence of constraint ranking consistency

INPUT	Optimal candidate
a. PA is TOPIC	$S_{exp}O_{th}V$ (see Tableau 2)
b. PA is FOCUS	$S_{th}O_{exp}V$ (see Tableau 3)
c. PA is neutral (unspecified for topic/focus)	$S_{exp}O_{th}V$ (due to ALIGN_{GF})
d. PA is BACKGROUND	$O_{th}VS_{exp}$ (due to $*\sim\text{SUBJ/BCK} \gg \text{ALIGN}_{GF}$)

In Lee (2001b), local constraint conjunction of a markedness constraint (*∼SUBJ/PA) and an alignment constraint (Spine-R) is used to rule out the candidate shown in (55b). The new account presented here does not rely on local constraint conjunction and instead derives some of the key markedness patterns in Hindi word order from the basic formal properties of OT—constraint violability and constraint ranking consistency across inputs—thus allowing increased generality not only for constraints but also for the entire analysis.

Furthermore, the current OT approach also subsumes under markedness the ill-formedness of the structure in which the theme object precedes the nonvolitional experiencer subject preverbally (i.e., candidate (a2) in Tableaux 2 and 3), a fact which appears to be unpredictable and specific to Hindi. As the examples in (59) clearly show, this word order can only receive the analysis where the theme is the grammatical subject.

(59) Grammaticality of a string with theme-experiencer-V order

a. Niinaa Anuu-ko uskii bastii-mẽ dik^{h}ii. (SOV)
Nina-NOM Anu-DAT PRON-GEN neighborhood-LOC appear-PERF
'Anu$_i$ saw Nina$_j$ in her$_{i/*j}$ neighborhood.'

b. *Niinaa Anuu-ko uskii bastii-mẽ dik^{h}ii. (OSV)
Nina-NOM Anu-DAT PRON-GEN neighborhood-LOC appear-PERF
'Anu$_i$ saw Nina$_j$ in her$_{j/*i}$ neighborhood.'

In order to see how the constraint system developed so far can capture this contrast, compare candidates (a2) and (b2) in Tableau 3 above, which correspond to

the structure of (59b) and (59a) respectively. As can be seen, for the high-ranking markedness constraints and information structuring constraints, (a2) and (b2) have the same constraint profile in any discourse context, since they share the same surface string of words. But we do see differences between (a2) and (b2) in the lower-ranking constraint $\textsc{Align}_{GF}$, since they differ only in grammatical function realizations. That is, here it is $\textsc{Align}_{GF}$ that breaks the tie and favors the less marked candidate (b2) with SOV order. Therefore, under the current OT account the ill-formedness of the O-theme S-experiencer V structure follows from its relative markedness compared to the other structure that competes with it. As pointed out in Chapter 1, however, this result cannot be easily achieved in derivational approaches to word order variation without such comparison: it is difficult to see how and why movement that yields the surface order of O-theme S-experiencer V is prohibited.

To summarize, these two subsections have presented an OT account of the word order freezing found in nonvolitional transitive verbs in Hindi. I have argued that harmonic alignment in OT can fruitfully be applied to the word order freezing phenomenon found in Hindi: the 'worst of the worst' generalization follows naturally from the general model of harmonic alignment. I have also shown that local conjunction of markedness constraints is highly appropriate for dealing with the relative markedness of argument types and their interaction with word order.

2.3.4 Dialectal and Crosslinguistic Variation

The previous subsection discussed word order freezing in Hindi as a categorical phenomenon. However, not all word order patterns in different varieties of Hindi can be described in this way. Before completing this section, let us briefly consider the speaker variation in Hindi and word order patterns in the same class of verbs discussed earlier in another Indo-Aryan language, Marathi. Table 4 in (60) summarizes the word order pattern of the arguments of a nonvolitional transitive verb for speakers of Hindi that I have worked with.[28] Overall, the varieties represented in (60) appear similar to the variety of Hindi which my analysis presented in the previous

[28]The pattern summarized here is based on a survey of eight speakers from the New Delhi area; the speakers vary by age and education.

section is based on: they show the same pattern of avoidance of 'the worst of the worst' in disfavoring the association between the marked linking (theme-SUBJECT and experiencer-OBJECT) and noncanonical orders in which the theme precedes the experiencer as in (b), or one (or both) of the arguments is in the postverbal position as in (d), (e) and (f). However, in these dialects, either of the two arguments of the nonvolitional verb may in principle be construed to be the subject, and the other the object in all orders shown in (60).[29] That is, in all orders, there is some construal ambiguity, but there is also a general preference for avoiding 'the worst of the worst'.

(60) Table 4. Speaker variation in Hindi

Word order	Preferred GF analysis
a. exp th V	S_{exp} O_{th} V
b. th exp V	S_{th} O_{exp} V
c. exp V th	O_{exp} V S_{th}
d. th V exp	O_{th} V S_{exp}
e. V exp th	V S_{exp} O_{th}
f. V th exp	V O_{th} S_{exp}

The varieties of Hindi represented in (60) also show a preference for the analysis of the postposed theme as the subject in the order shown in (c). As mentioned already in section 2.2, placing constituents to the right of the finite verb in a verb-final language such as Hindi and Turkish serves to de-emphasize these constituents. Pragmatically, such background postposings contain given or accessible (i.e., predictable) information prior to being postposed (Erguvanlí 1984; Herring 1994). The preference for the marked linking pattern in the order shown in (c) can be explained if we posit conflicting constraints on subject choice. A constraint which prefers subjects, typically associated with given information, over objects as the postposed element is more dominant than *SUBJ/PP in the varieties of Hindi represented in (60).

[29]That the two arguments alternate between subject and object seems evident from their behavior with respect to subjecthood tests involving reflexive binding, pronoun-antecedent relations and the conjunction reduction test (see section 2.1.1 and Mohanan (1994a)).

Marathi allows a more flexible association between semantic roles and grammatical functions and between positions in the constituent structure and grammatical functions.[30] The overall pattern, summarized in (61), is similar to the varieties of Hindi represented in (60). However, the analysis of the theme as the subject is not required for the order (b), in which the theme precedes the experiencer preverbally, and either the theme or the nonvolitional experiencer can be construed to be the subject. This can be modeled by interactions among potentially conflicting constraints relating parallel structures. More specifically, the ambiguity of the string expression in (61b) can be understood as reflecting a conflict between two constraints: a constraint that disprefers the marked role-function association and a constraint that disprefers the marked association between grammatical functions and phrase structural positions. The effects of these constraints are active when the prominence relations of semantic roles and positions in the constituent structure are reversed as theme-initial position and experiencer-noninitial position. The latter constraint is more dominant than the former constraint in Hindi.

(61) Table 5. Word order variation in nonvolitional transitives in Marathi

Word order	Preferred GF analysis
a. exp th V	S_{exp} O_{th} V
b. th exp V	S_{th} O_{exp} V, O_{th} S_{exp} V
c. exp V th	O_{exp} V S_{th}
d. th V exp	O_{th} V S_{exp}
e. V exp th	V S_{exp} O_{th}
f. V th exp	V O_{th} S_{exp}

Throughout this section I have assumed only one ranking relation in which two conflicting constraints are strictly ranked (*Constraint*$_1$ strictly dominates *Constraint*$_2$, or *Constraint*$_2$ strictly dominates *Constraint*$_1$. Variable outputs and the difference between categoricality and gradience in grammaticality are not naturally explained by an OT model assuming only one ranking relation, namely strict dominance. An alternative that is being actively pursued, especially in functionally-oriented OT (Boersma

[30] Ashwini Deo (p.c., January 2001) provided judgements on Marathi.

1997, 1998; Boersma and Hayes 2001), is to replace the strict ranking system with a weighting system in which a variably ranked constraint is associated with a numerical index indicating its relative strength with respect to other constraints. Variable constraint ranking has already been applied to the derivation of variable outputs in morphosyntax (Asudeh 2001). More recently, Bresnan and Deo (2001), in their study on *be* inventories in English dialects, have shown that stochastic OT grammars (to be discussed in Chapter 4 in more detail) can simultaneously generate both categorical and variable morphosyntactic outputs. It remains to be seen whether stochastic OT grammars are sufficiently general to deal with more complex cases of competition among alternative parsing analyses that are in free variation in a language, such as the Marathi case discussed above.

2.4 Markedness Reduction in Word Order in Korean

Marked associations of prominence hierarchies also provide an important source of word order freezing in Korean. Before we turn to how harmonic alignment and local conjunction play a role in the analysis of this phenomenon, let us first consider honorification, with which word order freezing is associated in an interesting way.

2.4.1 Subject Honorification in Korean: A Necessary Digression

Korean is a language which has a highly developed system of honorification for marking the speaker's social relationship with the addressee and/or the referent of the subject and nonsubjects of the sentence. The honorification system can be classified into three types, according to who the target of honoring is—subject honorification, nonsubject honorification and addressee honorification. Here I focus only on subject honorification as it is the only type of honorification that is directly relevant to word

order freezing in Korean.[31] The goal is to show the inventories of honorific forms of words and morphemes of a language can be derived from interactions of two types of constraints fundamental to OT—markedness constraints and faithfulness constraints. The analysis of subject honorification as 'lexicon optimization' in this section serves as a basis for the next chapter in which case patterns in Hindi and Korean are explained in a similar fashion as the interactions of markedness and faithfulness constraints.

Although the honorific system of Korean has been simplified considerably owing to the changes in social structure and cognitive values, the language still retains an extensive set of honorific morphemes and words that are sentitive to social statuses and distance, and solidarity between the speaker and addressee and between the speaker and third person referent of a sentence. Types of interpersonal relationships on which honorific patterns are based have also shifted from ascribed power relationships to achieved social statuses, and solidarity factors such as intimacy, ingroupness and informality have become significantly important. I do not attempt to exhaustively catalog the kinds of social contexts in which use of honorifics is required. It is sufficient to note here that in certain social contexts, a relation of owing honor may obtain between two individuals, for example, between superordinates and subordinates in a work situation, between teacher and student in a school-related situation, or between a member of an older generation and a member of a younger one in a family situation.

The dynamism of power and solidarity in Korean society is reflected in NP forms and verb forms used in interpersonal communication. For example, subject NP forms and verb forms in Korean vary depending on the relative social relationships among the referent of the subject, the speaker and the addressee, as shown in (62). The relative relationship among the participants of subject honorification can be explicitly represented in the input by using the feature honorification LEVEL. Three levels of honorification are represented by the integers 1–3.[32]

[31]The pattern of addressee honorifics is much more complex and dynamic than that of subject honorifics, which is in turn more varied than that of non-subject referent honorifics. A direct or indirect object can be honorified by means of a few words (i.e., *turi* 'give', *mut* 'ask', and *pwep* 'see/look at/meet') in modern Korean.

[32]In (62), CASE.HON and *-si* indicate the use of an honorific case form and an honorific subject verb form respectively while CASE represents the use of a nonhonorific (plain) case form and Ø a

(62) Table 6. Subject honorification in Korean (based loosely on Han (1991))

LEVEL	Social relationship	Subject NP	Verb form
3	a. **subject** > speaker,addressee	N.HON-CASE.HON	V-*si*
		N.HON-CASE	V-*si*
2	b. addressee > **subject** > speaker	N.HON-CASE	V-*si*
	c. speaker > **subject** > addressee	N.HON-CASE	V-Ø
		N-CASE	V-*si*
		N-CASE	V-Ø
1	d. speaker, addressee = subject	N-CASE	V-Ø
	e. speaker > **subject** = addressee		
	f. speaker, addressee > **subject**		

LEVEL 3 in (62a) corresponds to the context in which the subject referent is socially superior to both the speaker and the addressee.[33] In this context, the honorific form of the subject NP and the honorific verbal suffix -*si* are both used, with the honorific case marker being optional as in (63a). In the contexts (62b,c), where the subject referent is socially superior to either the speaker or the addressee, the use of the honorific subject noun form and the honorific verbal suffix are optional as in (63b,c,d,e). Word order freezing happens only when the honorific affix is present on the verb in the contexts (62a,b,c) above.

(63) a. Lee kyoswu**nim-i/-kkeyse** hakkyo-ey ka-**si**-ess-ta.
Prof. Lee-NOM/NOM.HON school-to go-HON-PAST-DECL
'Prof. Lee (honorified) went to school.' (LEVEL 3)

b. Lee kyoswu**nim-i** hakkyo-ey ka-**si**-ess-ta.
Prof. Lee-NOM school-to go-HON-PAST-DECL
'Prof. Lee (honorified) went to school.' (LEVEL 2)

nonhonorific (plain) subject verb form.

[33]As mentioned above, the use of honorifics is sensitive not only to vertical social statuses but also the horizontal solidarity dimension such as intimacy, ingroupness and formality. The feature LEVEL used here is to be understood to abbreviate 'distance' both social and psychological among the speaker, addresses and the subject referent.

c. Lee kyoswu**nim**-i hakkyo-ey ka-Ø-ess-ta.
Prof. Lee-NOM school-to go-Ø-PAST-DECL
'Prof. Lee (honorified) went to school.' (LEVEL 2)

d. Lee kyoswu-ka hakkyo-ey ka-**si**-ess-ta.
Prof. Lee-NOM school-to go-HON-PAST-DECL
'Prof. Lee (honorified) went to school.' (LEVEL 2)

e. Lee kyoswu-ka hakkyo-ey ka-Ø-ss-ta.
Prof. Lee-NOM school-to go-Ø-PAST-DECL
'Prof. Lee went to school.' (LEVEL 2 or 1)

As illustrated in the examples in (63a,b,e) above, honorific subject marking and honorific verbal morphology are typically either both present or both absent. For this reason subject honorification in Korean is often called 'honorific agreement' or 'pragmatic agreement'. Subject honorification, however, differs from subject-verb agreement found in various European languages in a fundamental way. The correlation between social contexts and honorific marking is probabilistic. For example, in the context where the referent of the subject, Prof. Lee, is superior to both the speaker and the addressee, the most preferred sentences are (63a) and (63b). However, the other sentences are not ungrammatical. Furthermore they also differ in the frequency of occurrence and inappropriateness in this particular context. While (63e) is most inappropriate and infrequent, 'disagreeing' sentences like (63c) and (63d) are intermediate in both frequency of occurrence and inappropriateness. Similarly, in certain contexts, (63c) and (63d) are more frequent and favored over other sentences in (63).[34]

Another important aspect of subject honorification is that the appearance of the honorific making on the subject and the verb is asymmetric and can be characterized as an implication of the following form: if 'disagreement' or 'optional' honorific

[34]Sentences like (63c) may be appropriate for example, in the context where the addressee is a sufficiently junior relative to the speaker whose social status is more or less equal to that of the referent of the subject. As Han (1991) points out, this means that 'disagreeing' sentences can be exploited for certain pragmatic effects, to achieve a playful or sarcastic tone, for example.

agreement is allowed at all, the verb can be honorifically marked if and only if the subject is also allowed to be honorifically marked. Thus, there are speakers of Korean who accept all of three sentences in (63b,c,d), speakers who accept only (63b), and speakers who occasionally accept disagreeing sentences as in (63c,d). Crucially, there are no speakers who accept (63d) without accepting both (63b) and (63c). I will provide an analysis of this linguistic honorification fact after characterizing the input representation and OT constraints needed to derive the inventories of honorific morphology in a language.

Honorific information about the subject of the clause can be represented by the feature HON, indicating the speaker's intention that he/she honors the subject's referent. [HON+] information is contributed morphologically by three sources: the honorific verbal suffix -*si*, the honorific form of case markers, and the nominal affix -*nim*. The nonhonorific forms indicate that honor is not owed to the subject's referent, and are assumed to be unspecified for the feature [HON]. It must be emphasized that the feature [HON] is independent of the feature [LEVEL], indicating the relative relationship among the referent of the subject, the speaker and the addressee, although it is generally true in the pattern of honorifics that social distance correlates with deference.[35] For example, if the speaker does not owe honor to the subject's referent, the honorific forms are not used in any utterance context (even when the subject's referent is socially superior to both the speaker and the addressee). This suggests that honorific verbal morphology and nominal morphology share the [HON+] information but they do not have the [LEVEL] information as part of their content. Rather, the [LEVEL] information comes from a larger utterance context, and the correlation between social distance and the honorific forms can be treated via positive markedness constraints, as I will demonstrate below.

Honorific verbal morphology and nominal morphology are further classified as in (64) according to the honorification LEVEL information they express.

(64) a. Honorific morphology which is used in the context in which the subject's referent is socially superior to both the speaker and the addressee (LEVEL

[35]The linkage of deference and distance and of condescension and intimacy in sociolinguistic expressions is universal across cultures (Brown and Levinson 1987).

3): Honorific case forms.

b. Honorific morphology which is used in the context in which the subject's referent is socially superior to either the speaker or the addressee (LEVEL 3, 2): Honorific verbal affix and noun forms.

With this classification of honorific morphology we can now formulate three markedness constraints, which apply to the form-content pairings, shown in (65):[36]

(65) HARMONY:

a. $\text{HON}_{CASE} \Leftrightarrow$ LEVEL 3: Honorific case forms express honorification LEVEL whose value is 3.

b. $\text{HON}_{V} \Leftrightarrow$ LEVEL $2 \vee 3$: Honorific verb forms express honorification LEVEL whose value is 2 or higher.

c. $\text{HON}_{N} \Leftrightarrow$ LEVEL $2 \vee 3$: Honorific noun forms express honorification LEVEL whose value is 2 or higher.

The harmony constraints in (65) check the correspondence relations (or harmony relations) between types of nominal and verbal forms and the LEVEL information they are associated with. These constraints are violated by a candidate representation whenever the LEVEL information in the f-structure and the honorific marking of the subject and that of the verb in the c-structure make conflicting indications about the facts of the social relationship among the participants of honorification. This point is illustrated in the table in (66) which contains four sentences with the same sentential content 'Prof. Kim left'.

[36]The idea of form-function harmony constraints here is drawn from Bresnan (2001a), who has demonstrated convincingly that the pronominal inventories of a language can be derived from interactions of harmony constraints on possible pairings of the pronominal forms and the functional content, faithfulness constraints and markedness constraints on pronominal forms.

(66)

INPUT: [LEVEL 3]		OUTPUT	Constraint violations
a. #Kim kyoswunim-i Prof. Kim-NOM 'Prof. Kim left.'	ttena-Ø-ss-ta. leave-Ø-PAST-DECL	LEVEL 3	(55a,b)
b. #Kim kyoswu-ka Prof. Kim-NOM	ttena-si-ess-ta. leave-HON-PAST-DECL	LEVEL 3	(55a,c)
c. #Kim kyoswunim-kkeyse	ttena-Ø-ss-ta.	LEVEL 3	(55b)
d. #Kim kyoswu-ka	ttena-Ø-ss-ta.	LEVEL 3	(55a,b,c)

Thus the harmony constraints in (65) mark disagreeing candidates like (66a,b,c) or candidates like (66d), in which both the honorific marking of the subject and that of the verb do not correctly indicate the facts of the social context. Candidates like (66d), in which no honorific expressions are present, also violate faithfulness constraints in (67), which require the input feature structures (here the features HON and LEVEL) to correspond to the candidate feature structures to ensure the expressibility of content. The following IDENT(ITY)(FEATURE) constraints penalize candidates which have values of features (here HON and LEVEL) differing from those present in the input.[37]

(67) Faithfulness constraints

a. IDENT-IO(HON)$_N$, IDENT-IO(HON)$_V$: The value of the feature HON in the input is preserved in the output.

b. IDENT-IO(LEVEL)$_N$, IDENT-IO(LEVEL)$_V$: The value of the feature LEVEL in the input is preserved in the output.

As noted out in Chapter 1, the universality of constraints in OT is relativized so that language-specific elements may occur in the constraints of universal schemata. This

[37]Originally, Prince and Smolensky (1993) proposed two types of faithfulness constraints: FILL and PARSE. In the context of the 'Correspondence Theory of reduplication', McCarthy and Prince (1994, 1995) argue for a richer set of faithfulness constraints: IDENT(ITY), MAX(IMALITY) and DEP(ENDENCE) constraints. The MAX and DEP types of constraints will be introduced in the next chapter.

option is typical for 'alignment constraints', discussed in section 2.2, which match up the edges of morphosyntactic categories and specific morphemes/words. The universality of faithfulness constraints may be relativized by allowing faithfulness constraints of otherwise universal formats to be indexed to various morphosyntactically defined domains (Benua 1995; Urbanczyk 1996; Bresnan and Deo 2001). I will be concerned here only with faithfulness constraints in the domain of honorific expressions. Furthermore, the subscripted faithfulness constraints in (67) are indexed to the word class domains of nominal expressions and verbal expressions. (I leave aside the constraints indexed to the case domain here.) I abbreviate these IDENT-IO(HON, LEVEL)$_N$ and IDENT-IO(HON, LEVEL)$_V$ respectively.

Of course, not all languages have an extensive set of honorific forms, so further constraints are required. The constraints in (68) impose marks against the realization of nominals and verbs as honorific forms.

(68) Structural markedness constraints (*FEATURE)

a. *HON$_N$: Avoid an honorific form of a nominal.

b. *HON$_V$: Avoid an honorific form of a verb.

It would be more desirable if the honorification pattern follows from interactions of faithfulness constraints, which are assumed to be indexed to word classes, and a small set of general markedness constraints of universal formats. But since the word order pattern in Korean crucially depends on the presence or absence of honorific verb morphology, I postulate markedness constraints against honorific forms, indexed to the word class domains of nominal and verbal expressions. This way of relativizing markedness constraints, however, should be limited in order to avoid a vast increase in the amount of constraint interaction, and I do not assume that all markedness constraints may be instantiated for morphosyntactically defined domains.

The three families of constraints introduced above are ranked in Korean as shown in (69):

(69) Ranking for Korean:
Harmony $\gg$ IDENT-IO(HON)$_N$, IDENT-IO(LEVEL)$_N$ $\gg$ IDENT-IO(HON)$_V$, IDENT-IO(LEVEL)$_V$ $\gg$ *HON$_N$, *HON$_V$

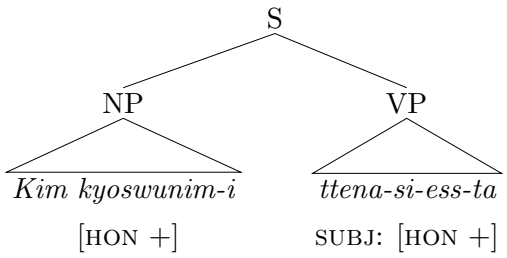
The ranking of the faithfulness constraints above the structural markedness constraints yields an honorific language like Korean, in which specifications for HON and LEVEL in the input are realized at the surface. Conversely, the ranking of the structural markedness constraints above the faithfulness constraints would yield a language like English limited in its expressibility by the absence of honorific expressions. The effects of the relative ranking of the harmony constraints and the faithfulness constraints can be illustrated through competition among four representative candidate types in (71). These candidates are examples of a set of possible analyses of the input shown in (70):

(70)
$$\begin{bmatrix} \text{GF}_1 & \begin{bmatrix} \text{PRED} & \text{`Prof. Kim'} \\ \text{HON} & + \\ \text{LEVEL} & 2 \end{bmatrix} \\ \text{TNS} & \text{PAST} \\ \text{PRED} & \text{`go}\langle\ \text{PP}_1\ \rangle\text{'} \end{bmatrix}$$

As I discussed in Chapter 1, following Kuhn (1999, 2000, 2001a,b), I assume that candidate f-structures are subsumed by the underspecified input f-structure, hence GEN can be modeled by monotonically adding information to the input. Morpholexical choices are optimized in parallel, so that the form of the subject and the verb of a sentence, for example, must be optimized against the input features [HON] and [LEVEL] belonging to the argument that gets linked to the SUBJECT function in the candidates. Kuhn (1999, 2000, 2001a,b) argues that within this restrictive conception of GEN, the faithfulness violations can be captured by regarding unfaithfulness as a tension between f-structure and the lexical realization. This is illustrated by the following examples in (71). As can be seen by comparing the input f-structure in (70) and candidate f-structures in (71), the syntactic input and output f-structures are almost identical. That is, semantic information expressing the logical meaning

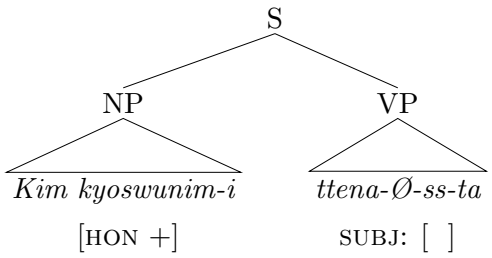
of the sentence has been neither added nor dropped in the candidate f-structures. At c-structure, on the other hand, material with no correspondent in the input (e.g. case morphemes) may be realized, or material having an f-structure reflex may be left morphologically unrealized (e.g. honorific morphology in candidates (b), (c) and (d)). That is, different morpholexical expressions in the terminal (lexical) string of the c-structure may differ from the input in their featural specifications.

(71) a.



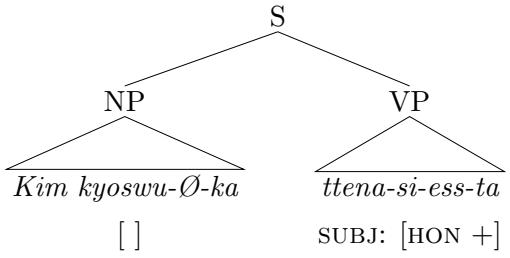
$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{'Prof. Kim'} \\ \text{HON} & + \\ \text{LEVEL} & 2 \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{TNS} & \text{PAST} \\ \text{PRED} & \text{'go}\langle\ \text{PP}_1\ \rangle\text{'} \end{bmatrix}$$

b.



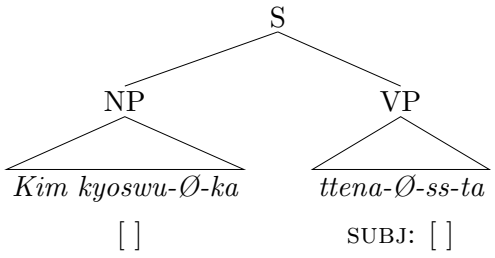
$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{'Prof. Kim'} \\ \text{HON} & + \\ \text{LEVEL} & 2 \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{TNS} & \text{PAST} \\ \text{PRED} & \text{'go}\langle\ \text{PP}_1\ \rangle\text{'} \end{bmatrix}$$

c.



$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{'Prof. Kim'} \\ \text{HON} & + \\ \text{LEVEL} & 2 \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{TNS} & \text{PAST} \\ \text{PRED} & \text{'go}\langle\ \text{PP}_1\ \rangle\text{'} \end{bmatrix}$$

d.



$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{'Prof. Kim'} \\ \text{HON} & + \\ \text{LEVEL} & 2 \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{TNS} & \text{PAST} \\ \text{PRED} & \text{'go}\langle\ \text{PP}_1\ \rangle\text{'} \end{bmatrix}$$

The constraint ranking in (70) prefers candidate (a), in which the honorific marking is

present both on the subject NP and the verb. Furthermore, the proposed constraint ranking also captures the implicational generalization about noted earlier preference in the honorific marking on nominal and verbal expressions constant across dialects. In particular, the asymmetrical pattern in the appearance of honorific morphology on nominal and verbal expressions arises from the hierarchy of the faithfulness constraints, in which IDENT-IO(HON)$_N$ dominates IDENT-IO(HON)$_V$.[38] Under this ranking, preservation of input values of [HON] in nominal expressions takes priority over having correspondents of the input HON feature values in verbal expressions. Hence candidate (b) is preferred over candidate (c).[39]

To summarize, I have shown that the ranking of markedness and faithfulness constraints and the hierarchy of faithfulness constraints derives the pattern of subject honorification in Korean and the implicational generalization underlying it. Recently, Bresnan and Deo (2001) have suggested a novel approach to subject-verb agreement in English, based the hierarchy of the constraints on faithfulness to the features of person and number. It is interesting to observe that the general pattern in subject honorification in Korean can be captured in a way analogous to the subject-verb agreement phenomenon, although further empirical work is required to show the generality of the hierarchy-based approach as a coherent theory of agreement.

2.4.2 Constraint Interaction in Word Order Freezing in Korean

We are now in a position to combine the rankings of the constraints governing honorification and word order constraints for a full picture of the interaction of two systems

[38]This idea of the hierarchy of the faithfulness constraints, suggested by Bresnan and Deo (2001) for subject-verb agreement in English, is motivated by crosslinguistic considerations. The features of social distance and honor are typical properties of nominals, as is evident in the pronominal systems of southeast Asian languages (Cooke 1968) and Indonesian languages (Geertz 1960), in which elaborate distinctions of social distance and deference are marked by different pronominal forms. But there seems to be no language in which these distinctions are marked exclusively on the verb, although further work is required to verify this.

[39]A structure like candidate (c), in which only the verb is honorifically marked, is not excluded by the present set-up. Rather, it is treated here as the more marked option which is only chosen in case it is required in a particular social or utterance context. Such details of contextual appropriateness are not captured by the small set of grammatical constraints proposed here.

governing word order in Korean. Recall from section 2.1.2 that in Korean a dative subject triggering honorific agreement on the verb cannot be in noninitial position. To derive this result we can apply harmonic alignment to the grammatical function scale (72a) and the case scale in (72b).

(72) Universal Scales:

a. GF: SUBJ > Non-SUBJ

b. Case: NOM > Non-NOM

The harmony scale in (73), derived through harmonic alignment, expresses the relative markedness of particular associations, e.g., the fact that a nominative-marked subject is more harmonic (less marked) than a non-nominative subject. The constraints that are derived by inverting the rankings of SUBJ/NOM over SUBJ/∼NOM in (73) and prefixing the Avoid operator "*" are given in (74).[40] For instance, the ranking of *SUBJ/∼NOM over *SUBJ/NOM in (74) means that in the absence of any relevant higher ranking constraint, a clause with a non-nominative subject will lose out in direct competition to a clause with a nominative subject.

(73) Harmony Scale derived through Harmonic Alignment:
H_3: SUBJ/NOM ≻ SUBJ/∼NOM

(74) Constraint Subhierarchy:
*SUBJ/∼NOM ≫ *SUBJ/NOM

The case hierarchy in (72b) encapsulates two specific hierarchies:

(75) NOM > NonNOM
— NOM > OBL
— NOM > ACC

[40] In addition to the harmony scale on subjects in (73), harmonic alignment of the two scales in (72) also yields one for nonsubjects. I do not consider these constraints on nonsubject case, as their effect is irrelevant here.

Hence, decomposition of non-nominative into oblique and accusative yields two constraints *SUBJ/OBL and *SUBJ/ACC in (77). These constraints are ranked independently, and at the same time are both ranked above *SUBJ/NOM. How these more expanded set of constraints plays a role in the overall case system will be discussed in detail in section 3.3. For now, let us focus on the contrast between nominative and oblique subject.

(76) Harmony Scales:
SUBJ/NOM $\succ$ SUBJ/$\sim$NOM
H_4: SUBJ/NOM $\succ$ SUBJ/OBL
H_5: SUBJ/NOM $\succ$ SUBJ/ACC

(77) Constraint Subhierarchies:
*SUBJ/$\sim$NOM $\gg$ *SUBJ/NOM
C_4: *SUBJ/OBL $\gg$ *SUBJ/NOM
C_5: *SUBJ/ACC $\gg$ *SUBJ/NOM

Once again, we can use local conjunction of already existing constraints to capture the idea that if the oblique subject triggering honorific marking on the verb occurs in a noninitial position, it is the worst of the worst. Conjunction of the subhierarchy C_4 in (77) with SUBJ-L results in the new constraint subhierarchy in (78).

(78) Conjoining C_4 with SUBJ-L:
C_6: *SUBJ/OBJ & SUBJ-L $\gg$ *SUBJ/NOM & SUBJ-L

The high-ranked constraint in (78) expresses the basic idea that if the subject is in a marked case (oblique case), it should not be in a marked non-leftmost position. However, not every Korean construction with such a highly marked subject is excluded: such a construction is excluded only when the subject co-occurs with honorific agreement on the verb. What remains, then, is to make the constraints in (78) apply to the specific construction involving honorification. This is done through the conjunction of the markedness constraint *HON_V with the subhierarchy in (78), as shown in (79).

(79) Conjunction of *HON$_V$ with C$_6$:
C$_7$: a. *HON$_V$ & [*SUBJ/OBL & SUBJ-L] ≫ b. *HON$_V$ & [*SUBJ/NOM & SUBJ-L]

For the current discussion, what is needed to rule out the ungrammatical sentences like (80a)) and (80b) is the topmost constraint in (79a). This constraint expresses the idea that in case the verb is realized as an honorific form, the most marked configuration obtains when the subject is in oblique case and in the noninitial position of a clause. This is the only situation in which word order is frozen, and less marked configurations that are penalized by the low-ranked constraints are tolerated in the dative subject construction in Korean. This point is illustrated in the table in (80) containing four sentences with the same sentential content 'Prof. Lee (honorified) needs a dog.'

(80)

	CANDIDATES:			Constraint violations
a.	*Kay-ka	Lee kyoswunim-kkey	philyoha-si-ta.	(79a)
	dog-NOM	Prof. Lee.HON-DAT.HON	need-HON-DECL	
b.	*Kay-ka	Lee kyoswunim-hanthey	philyoha-si-ta.	(79a)
	dog-NOM	Prof. Lee.HON-DAT	need-HON-DECL	
c.	Kay-ka	Lee kyoswunim-kkeyse	philyoha-si-ta.	(79b)
	dog-NOM	Prof. Lee.HON-NOM.HON	need-HON-DECL	
d.	Kay-ka	Lee kyoswunim-hanthey	philyoha-Ø-ta.	(neither)
	dog-NOM	Prof. Lee.HON-DAT	need-DECL	

The constraints introduced so far are ranked in Korean as shown in (81).

(81) Ranking for Korean: *HON$_V$ & [*SUBJ/OBL & SUBJ-L] ≫ HARMONY constraints ≫ TOP-L, IDENT-IO(HON, LEVEL)$_N$ ≫ IDENT-IO(HON, LEVEL)$_N$ ≫ ALIGN$_{GF}$

The higher ranking of the topmost conjoined constraint in (81) over the information structuring constraint TOP-L has the effect of restricting the word order freedom motivated by the topicality of arguments. There is no crucial ranking between the two

faithfulness constraints and TOP-L. What this ranking predicts is that in a clause with a highly marked honorific oblique subject in a noninitial position, scrambling of the object over the subject will not be possible as it results in violation of the top-ranked constraint *HON$_V$ & [*SUBJ/OBL & SUBJ-L], thus capturing the generalization that marked subject types must occur in unmarked positions in the clause.

In a discourse context in which the theme is a topic, that is, [PROM+, NEW–] and the experiencer is nonsalient background information, the input is as (82). This results in the optimal output (83a) with canonical SOV order. (83) schematically represents only candidates which are faithful to [LEVEL] information in the input, and contain at least one element that expresses [HON+] and hence satisfy either IDENT-IO(HON)$_N$ or IDENT-IO(HON)$_V$. Also, only candidates with dative subjects are represented. Though they compete against each other in the universal candidate set, sentences with dative subjects and those with nominative subjects differ in the information status of their arguments, and each is more faithful to a different input.[41]

(82) Input:

$$\begin{bmatrix} \text{GF}_1 & \begin{bmatrix} \text{PRED} & \text{`Prof. Lee'} \\ \text{HON} & + \\ \text{LEVEL} & 2 \end{bmatrix} \\ \text{TOP} & \\ \text{GF}_2 & \begin{bmatrix} \text{PRED} & \text{`dog'} \end{bmatrix} \\ \text{TNS} & \text{PRES} \\ \text{PRED} & \text{`need}\langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

[41] I will discuss the dative-nominative alternation for subjects in detail in Chapter 3.

(83) Tableau 4. Word order freezing in Korean

	CANDIDATES:	*HON$_V$ & [*SUBJ/OBL & SUBJ-L]	HARMONY	TOP-L,	IDENT-IO(HON)$_N$	IDENT-IO(HON)$_V$	ALIGN$_{GF}$
☞	a. S.HON-DAT O-NOM V-HON			*			
	b. S.HON-DAT O-NOM V-Ø		*	*		*	
	c. S-DAT O-NOM V-HON		*	*	*		
	d. S-DAT O-NOM V-Ø		**	*	*	*	
	e. O-NOM S.HON-DAT V-HON	!*					*
	f. O-NOM S.HON-DAT V-Ø		*			*	*
	g. O-NOM S-DAT V-HON	!*	*		*		*
	h. O-NOM S-DAT V-Ø		**		*	*	*

Violations of the top-ranked markedness constraint, which penalizes a highly marked subject, cause ungrammaticality in a strong sense, as indicated in (83e,g) (which are never optimal in any kind of context). On the other hand, examples involving violations of the HARMONY constraints are generally infelicitous: they could be uttered, but only in certain contexts. Among the candidates violating the HARMONY constraints, the candidates (b), (c), (f) and (g) are instances of 'disagreement' because the honorific markers are present only on the subject NP or on the verb, not on both.[42] Hence, the candidate (a) is the best; it satisfies more higher-ranking constraints than any other candidate. As was the case of Hindi, the violation pattern for the top-ranked conjoined constraint for each candidate remains the same for all the other tableaux provided by different inputs, because this constraint is not sensitive to the discourse context.

[42]When the subject is in the dative case, there is a clear difference in acceptability between 'disagreeing' sentences: sentences in which only the verb is honorifically marked (e.g., candidates (b), (f)) are highly marginal, whereas sentences in which the honorific marking is present only on the subject (e.g., candidates (c), (g)) are acceptable.

In summary, markedness constraints derived through harmonic alignment and local conjunction in OT provide interesting analyses of word order freezing in Hindi and Korean, a phenomenon which has remained hitherto unexplained in generative approaches to syntax. In the current OT account the generalizations about constituent order emerge naturally from interactions among the markedness constraints derived through harmonic alignment and local conjunction, and constraints on the realization of information structure and canonical ordering.

2.5 Summary and Implications

This chapter has presented an OT account of the phenomenon of word order freezing, one that succeeds in subsuming both the free ordering and fixed ordering of constituents under markedness. The current OT approach to word order variation can easily be extended to languages in which the freedom of word order is sensitive to other properties of arguments that are not considered here (e.g., animacy and definiteness). Yet this result cannot be achieved in most pre-OT generative approaches to word order variation, because they give no theoretical role to markedness, as opposed to purely structural aspects of syntax (e.g., transformational derivations). Before closing this chapter, let us briefly consider how the basic constraint ranking schema developed here can be employed to explain markedness reduction in the systems of contrast found in other parts of the grammar.

Pronouns are one domain of topicality contrast in which tendencies of avoidance of 'the worst of the worst' and markedness reduction in marked contexts have been extensively documented. In particular, it has long been noted in various studies on Bantu languages (e.g., Morolong and Hyman 1977; Hyman and Duranti 1982; Duranti and Byarushengo 1977; Bresnan and Moshi 1990) that certain types of object cannot be expressed as a pronominal object marker in a passive verb form. For example, in Kichaga (Bresnan and Moshi 1990) a passive construction is ungrammatical when a passivized inanimate subject cooccurs with a human object marker which is pronominal. However, an object can be expressed by a bound pronominal prefix incorporated into the passive form of the verb when the subject is higher in animacy than the

object or when the animacy of the two arguments is equal.

Donohue and Lee (2000) and Lee (2001a) propose to account for animacy-based gaps in the appearance of pronominal object markers in several Bantu languages in terms of the relative ranking of the markedness constraints derived through harmonic alignment of hierarchies in (84) with respect to constraints in (85).

(84) a. GF Scale: SUBJ > OBJ

b. Animacy Scale: Hum(an) > Anim(ate) > Inan(imate)

c. Topicality Scale: TOP(IC) > Non-TOP(IC)

The constraint in (85a), proposed by Bresnan (2001a), is one instance of constraints on faithfulness to pronominal features in the input (PRO, AGR, TOP), which require these features to be preserved in the output pronominal expression. Opposing this faithfulness constraint is the markedness constraint in (85b), also taken from Bresnan (2001b). This constraint expresses the syntactically marked status of reduced pronominals (zero, bound, clitic or weak) from the point of view of iconicity and the avoidance of allotaxy.

(85) a. FAITH(TOP): Pronominal topicality feature in the input must be expressed by pronominal forms specified for topic anaphoricity in the output form.

b. *RED[PRO]: Avoid reduced expression of pronominals.

Building on the theory of hierarchy alignment (Aissen 1999, 2000) and on the theory of pronominal markedness (Bresnan 1998a, 2001b) in OT, Donohue and Lee (2000) and Lee (2001b) propose that the pattern of differential pronoun incorporation in Kichaga follows from the constraint ranking in (86).

(86) *S/∼TOP<O/TOP(Anim) ≫ FAITH(TOP) ≫
RED[PRO], *S/∼TOP≥O/TOP(Anim)

*S/∼TOP<O/TOP(Anim) and *S/∼TOP≥O/TOP(Anim) are abbreviations for the groups of markedness constraints derived through local conjunction of the simple

markedness constraints formed by harmonically aligning the scales in (84) above. The former set of constraints penalizes a clause with a topical object higher in animacy than a subject, which is nontopical, whereas the latter set penalizes the less marked situation in which the subject is nontopical but is equal to or higher in animacy than the topical object.

The ranking of FAITH(TOP) above *RED[PRO] yields a pronominal inventory consisting of both reduced and free pronouns. Under this ranking the reduced form will be optimal for expressing topical content; the free pronoun remains optimal elsewhere (Bresnan 1998a, 2001b). However, due to the high ranking markedness constraints, the contrast of free/reduced pronouns, even if preferred in the language elsewhere, will be avoided in highly marked objects (human objects) in the maximally marked clause types (clauses with nontopical inanimate subjects).

Further, this OT theory of markedness captures some fundamental similarities in the way contrasting prominence is expressed in morphosyntax and phonology. An example from phonology parallel to the case of word order freezing and differential object marking discussed here is contextual neutralization often observed in phonology. In some languages nasality is contrastive in vowels, except in the context before a nasal consonant, where all vowels are nasal (Kager 1999). This situation is produced by ranking in (87), where the contextual markedness constraint *$V_{ORAL}N$ dominates the faithfulness constraint IDENT-IO(nasal), which in turn dominates the context-free markedness constraint *V_{NASAL}. This ranking states that nasal realization of vowels before nasal consonants takes priority over preservation of input values of [nasal], which in turn takes priority over the total orality of vowels. In sum, the nasality contrast in vowels is avoided in the marked position, i.e., before a nasal consonant.

(87) Contextual neutralization of nasality in vowels (taken from Kager 1999: 38–39)
Contextual markedness $\gg$ Faithfulness $\gg$ Context-free markedness
*$V_{ORAL}N$ $\gg$ IDENT-IO(nasal) $\gg$ *V_{NASAL}

This situation of neutralization of phonological contrasts in the marked position finds an interesting parallel in the domain of clausal syntax—word order freezing. In languages with fairly free word order, noncanonical orderings are preferred options

to mark a special information structure. However, as we have seen in the previous sections, under the special circumstances of markedness, they are replaced by the less marked, canonical order. This has been shown to be due to the ranking of the markedness constraints banning marked argument types in marked positions and the information structuring constraints, which favor realization of contrasting prominence of arguments. The overriding of the information structuring constraints such as TOP-L gives rise to contextual neutralization in word order: realization of contrasts in discourse prominence, even if otherwise preferred in the language, is avoided in the most marked argument types. Under the uniform framework of constraint interaction in both phonology and syntax, this striking parallel can be predicted from the constraint schema of the form 'conjoined context-sensitive markedness constraints (penalizing marked types of linguistic categories) $\gg$ faithfulness or alignment constraints (which favor the surface expression of contrast) $\gg$ simple markedness constraints' and hence given a unified markedness explanation.

I believe that the tendencies of avoiding 'the worst of the worst' and reducing markedness in word order and object marking discussed in this chapter represent the tip of a largely undiscovered iceberg, and that as we come to investigate grammatical systems more thoroughly, we will need to expand our theories in a way that accounts for some fundamental similarities in the way contrasting prominence is expressed in different parts of the grammar in a unified way.

Chapter 3

Bidirectional Optimality, Word Order and Recoverability

The previous chapter investigated word order freezing occurring in clauses which contain highly marked argument types. As noted, in Hindi and Korean word order freezing also occurs in sentences where nominal arguments of a single predicate bear identical case marking, as in sentences like (1).

(1) a. Patt^{h}ar ṭ^{h}elaa toḍegaa. [Hindi]
stone-NOM cart-NOM break-FUT
(i) 'The stone will break the cart.'
(ii) *'The cart will break the stone.'

b. Ṭ^{h}elaa patt^{h}ar toḍegaa.
cart-NOM stone-NOM break-FUT
(i) 'The cart will break the stone.'
(ii) *'The stone will break the cart.'

By reversing the order of nominal constituents in (1a) (shown in (1b)), a different meaning is generated. This contrasts with the sentence in (2), which allows all six possible orderings of subject, object and verb. All six word order variants of (2) have the basic meaning 'Ila wrote this letter'.

(2) Ilaa-ne yah k^{h}at lik^{h}aa.
Ila-ERG this-NOM letter-NOM write-PERF
'Ila wrote this letter'

This difference in word order flexibility between the two types of Hindi sentences above reflects a well-known crosslinguistic generalization: languages with rich morphological resources for grammatical function specification (case marking in dependent-marking languages and pronominal incorporation in head-marking languages) tend to make less use of fixed phrase structures, whereas languages poor in morphology overwhelmingly tend to have rigid phrase structures. The purpose of this chapter is to develop a formal account of the manifestation within particular languages of the 'inverse' relation between the amount of information about grammatical function expressed by case marking and the amount expressed by phrase structure.

The structure of this chapter is as follows: Section 3.1 outlines data illustrating word order freezing effects in Hindi and Korean under the circumstances of morphological ambiguity and briefly reviews previous approaches to accounting for word order variation within (pre-OT) generative syntax. Section 3.2 presents a possible account of interaction of case and word order within the standard form of OT. However, the design of OT assumed in the previous chapter, in which syntactic structures are optimized with respect to a semantic input, is insufficient to deal with word order freezing effects. As discussed in Chapter 1, the problem with this production-based view of candidate generation in OT phonology and syntax is that there are cases where EVAL selects as the optimal output candidate structures that do not coincide with the intuitively preferred reading. Following proposals by Smolensky (1998) and Wilson (2001), in section 3.3 I argue for a bidirectional view of syntax, and demonstrate that the word order freezing found in sentences with ambiguous case marking in languages having a high degree of word order flexibility can be explained when the constraint system allows an extension to bidirectional competition. Section 3.4 discusses contextual effects on word order variation and recovery of grammatical functions of ambiguously case-marked arguments. It is pointed out that the form of the bidirectional OT that has been proposed in recent work on bidirectional optimization is still insufficient to deal with the context dependency of syntactic interpretation for

reasons having to do with the nature of the input. I propose to model the input for both directions of optimization as a richer representation of the contextual and semantic information, and show how this refinement of the model captures the recovery of the marked interpretation of a potentially ambiguous string. The conclusion of this chapter is that word order freezing effects within particular languages are constrained by the same constraints that characterize crosslinguistic variation in the expression of grammatical relations (section 3.5).

3.1 Case Marking and Word Order Flexibility

In this section, I will first present data from Hindi and Korean demonstrating a loss of word order freedom in clauses which contain ambiguously case-marked arguments (sections 3.1.1 and 3.1.2). I then go on to review previous accounts of word order variation within (pre-OT) generative syntax (section 3.1.3).

3.1.1 Hindi

In addition to the double nominative construction discussed above and in Chapter 1, word order freezing occurs in various other kinds of constructions in Hindi. This is not surprising given the fact that many of the case markings are used with more than one meaning.

The marking *-se* in Hindi is used with more meanings than any other case marking. It indicates instrument, source, path, the demoted subject of a passive, and so on. In (4), the passive of (3), both the demoted agent and the source bear the case marker *-se*.

(3) Coor-ne kal Ravii-se paise curaae.
thief-ERG yesterday Ravi-from money-NOM steal-PERF
'The/a thief stole money from Ravi yesterday.' (Mohanan 1992)

(4) a. Coor-se kal Ravii-se paise curaae gae.
thief-INST yesterday Ravi-from money-NOM steal-PERF go-PERF
(i) 'Money was stolen from Ravi yesterday by the/a thief.'
(ii) *'Money was stolen from the thief yesterday by Ravi.' (Mohanan 1992)

b. Ravii-se kal coor-se paise curaae gae.
Ravi-INST yesterday thief-from money-NOM steal-PERF go-PERF
(i) 'Money was stolen from the/a thief yesterday by Ravi.'
(ii) *'Money was stolen from Ravi yesterday by the thief.' (Mohanan 1992)

Grammatical function and thematic role are often closely aligned in Hindi. Therefore, it is difficult to distinguish which of the two influences ordering. However, the examples in (4) provide justification for the proposal made by Mohanan (1992, 1994a) and others that it is in fact thematic role, rather than grammatical function, that determines canonical order. In spite of the fact that the initial *-se* marked NP in (4a) and (4b) is a passive agent and hence an ADJUNCT function, which is lower on the grammatical function hierarchy (i.e., SUBJ > OBJ > SEC.OBJ > OBL > ADJ (Bresnan 1994, 2001b; Mohanan and Mohanan 1994)) than the nominative subject, it canonically precedes the subject. As indicated by the glosses, the initial *-se* marked NP is considered an agent, and the second a source OBLIQUE in accordance with the thematic role hierarchy.

Therefore, following Mohanan (1992, 1994a) and also Sharma (1999), I assume that the canonical or unmarked word order in Hindi conforms to the thematic role hierarchy:

(5) Thematic Role Hierarchy (Bresnan and Kanerva 1989; Bresnan and Zaenen 1990)
agent > beneficiary > experiencer/goal > instrument > patient/theme > locative

Another case marker in Hindi relevant for our discussion of word order freezing is *-ko*. Recall that the animate primary object and the 'goal/experiencer' of a 'give'-type verb and a psych verb are both marked with *-ko*. If a verb is ditransitive, with a goal object and a theme object, the theme object, even if animate, is systematically

nominative. The goal object is invariantly associated with the marking -*ko*. Masica (1982:20) describes this phenomenon informally as follows: "In the case of verbs taking both direct and indirect object, the latter has priority and precludes the use of -*ko* with the direct object." Recall also that some complex predicates involving main verb+modal sequences require a dative subject (see fn. 3 of Chapter 2). For example, the main verb *sik*^{h} 'teach' in (6), when it is on its own, takes ergative or nominative case on the subject, depending on whether or not the verb is in perfective aspect. When the verb is combined with an indirect case inducing modal, however, the subject takes dative case, as shown by (6).

(6) Raam-ko ilaa-ke bacce-ko gaanaa sik^{h}aanaa hai.
Ram-DAT Ila's child-ACC music-NOM teach-NF be-PRES
(i) 'Ram has to teach music to Ila's child.'
(ii) *'Ila's child has to teach music to Ram.' (Mohanan 1992)

In (6) the dative subject *Raam* canonically precedes the two nonsubject arguments, the accusative goal object and the nominative theme object. That is, the initial -*ko* marked NP is interpreted as the agent but not as the goal fronted to the clause-initial position.[1]

To repeat, the Hindi examples above reveal the following generalizations, based on Mohanan (1992):

(7) Generalization: Canonical word order determined by the thematic role hierarchy becomes fixed if the case markings on two nominal arguments of a single predicate are identical under two alternative thematic role interpretations of the nominals.

As stated in (7), this generalization does not cover cases like (8), where only one thematic role interpretation is pragmatically more plausible:

[1]Mohanan (1994b) has proposed a case OCP principle, a constraint that disfavors identical case marking on more than one nominal in Hindi. As I mentioned in Chapter 1, the unavailability of the readings (4ii) and (6ii) is not due to violation of the case OCP principle, because the two nouns with identical case endings are not adjacent: these nouns are separated by an adjunct in (4) and the modifier of the second noun in (6). Note also that Mohanan's (1994b) case OCP principle is formulated in terms of case endings or formatives, not in terms of case features. This predicts that adjacent nouns without case endings in (1) will not create a violation of this constraint.

(8) a. Raam aam k^{h}aayegaa.
Ram-NOM mango-NOM eat-FUT
'Ram will eat the mango.' (Mohanan 1992)

b. aam Raam k^{h}aayegaa.
mango-NOM Ram-NOM eat-FUT
'Ram will eat the mango.'

Unlike in the other examples which contain two arguments with identical case markings, in (8) no ambiguity arises in the thematic role interpretation of the two nominative arguments, and all six word orders of subject, object and verb are possible, with the same meaning. Because of the limited scope of the morphosyntactic constraint set to be developed in the subsequent sections, this work can not cover all issues relevant to the relationship between the ambiguity and word order. My focus, rather, is on how case and word order interact in recovery of grammatical relations in sentences which are potentially ambiguous, both morphologically and semantically. The issue of the relationship between word order variation and the pragmatic properties of nominal arguments is interesting in its own right, and bears on some aspects of the present study, but will not be dealt with in any detail here.

3.1.2 Korean

In section 2.1.2, the difference in case marking patterns between Korean dyadic stative verbs and the verbs that have agentive (or external) arguments was briefly discussed. To repeat, the experiencer, goal or location argument of psych predicates (9), existential-possessive predicates (10) and locative predicates (11) can appear in either the dative case or in the nominative case (Gerdts and Youn 1988; Kim 1990; Hong 1991; Lapointe 1998; Yoon 1996):[2]

[2]The nominative marker is -*ka* after a vowel and -*i* after a consonant.

(9) Psych predicates

a. John-eykey/i paym-i kacang mwusep-ta.
John-DAT/NOM snake-NOM most be fearful-DECL
'John is afraid of snakes.'

b. Mary-eykey/ka koyangi-ka coh-ta.
Mary-DAT/NOM cat-NOM like-DECL
'Mary likes cats.'

(10) Existential-possessive predicates

a. Mary-eykey/ka yenge kyosa-ka philyoha-ta.
Mary-DAT/NOM English teacher-NOM need-DECL
'Mary needs an English teacher.'

b. Wuli ay-eykey/ka chinkwu-ka manh-ta.
our kid-DAT/NOM friend-NOM have.many-DECL
'Our kid has many friends.'

(11) Locative predicates

a. I kongjang-eyse/i pwul-i na-ss-ta.
this factory-LOC/NOM fire-NOM break.out-PST-DECL
'In this factory fire broke out.'

b. Ku hakkyo-eyse/ka sako-ka na-ss-ta.
that school-LOC/NOM accident-NOM occur-PST-DECL
'In that school an accident happened.'

As has long been noted in the literature on Korean sentence structure, a number of basic constructions in Korean, including the double nominative constructions exemplified above, manifest the discourse structural relation of topic-comment (Li and Thompson 1976) or theme-predication (Dik 1978; Sohn 1980). While many studies on the 'topic-prominence' of Korean sentence structure within generative syntax

have been generally oriented toward *structural* or *positional* licensing of discourse functions such as topic and focus, discourse functions can also be encoded via morphological marking independently of positional licensing. For instance, topichood and contrastive focushood may be encoded by the marker -*nun*.[3] In addition, case markers in Korean, which normally mark subject and object, also have the function of adding the features of prominence, exclusiveness and focus to their host NPs. For instance, the nominative case marker -*i/ka*, in contrast to -*nun*,[4] may indicate exclusive focus or the marked, specific topic.[5]

The interaction between word order and discourse marking can be seen clearly in the following four sentences, which all have the basic meaning 'Mary needs an English teacher':

(12) a. Mary-nun yenge kyosa-ka philyoha-ta.
Mary-TOP English teacher-NOM need-DECL
'As for Mary, she needs an English teacher'.

b. Mary-nun yenge kyosa-nun philyoha-ta.
Mary-TOP English teacher-TOP need-DECL
'As for Mary, she needs an English teacher (but not other teachers).'

c. Mary-ka yenge kyosa-ka philyoha-ta.
Mary-NOM English teacher-NOM need-DECL
'It is Mary who needs an English teacher.'

d. Mary-ka yenge kyosa-nun philyoha-ta.
Mary-NOM English teacher-TOP need-DECL
'It is Mary who needs an English teacher (but not other teachers).'

The variant in (12a) is the most natural sentence pattern, according to the general ordering principle in Korean (topic-focus-predicate) and the maximum opposition

[3]The fact that a single marker -*nun* can mark two different discourse functions, i.e., topic and contrastive focus, has been a source of controversy in the literature. For analyses of the double function of -*nun*, see Choi (1986); Lee (1989); Han (1995), and Choi (1999), among others.

[4]The initial *n* of -*nun* is elided when it immediately follows a consonant.

[5]More precisely, nominals with the the nominative case marker -*i/ka* allow two readings in Korean: a neutral reading and an exhaustive focus reading. See Song (1997) for a detailed semantic analysis.

principle (general topic (indicated by -*nun*) vs. exclusive/specific focus (indicated by -*ka*)) (Jakobson 1971; Robertson 1982; Choi 1986). The reverse order of -*nun*- and -*ka*-marked constituents or the repetition of the markers for both the subject and object manifest varying degrees of markedness relations of their host NPs, with the sentence pattern (12d) being most marked.

It has been shown that the degree of intuitive markedness that speakers perceive for the four sentence patterns in (12) match actual frequencies observed in texts. For instance, in his discourse study of the distribution pattern of -*nun* and -*ka* for topic and subject, Choi (1986) finds that the sentence pattern in (12a) is the most common of all the cases of the sentence pattern NP-NP-verb$_{stative}$, the next is (12b), and those in (12c,d) are least common. The result of Choi's text analysis is shown in Table 1 in (13) (adapted from Table 2 of Choi 1986:364). The frequencies shown here confirm the fact that -*nun* is the general topic marker in Korean and -*ka*-marked subject is only used in more restricted contexts.[6]

(13) Table 1. Textual frequency of Korean sentence pattern

Korean sentence pattern	Cases	%
NP-*nun* + NP-*ka* + Verb	66	89
NP-*nun* + NP-*nun* + Verb	5	7
NP-*ka* + NP-*ka* + Verb	2	3
NP-*ka* + NP-*nun* + Verb	1	1
Total	74	100

[6]—In contrast to what Choi (1999) claims. Choi writes:

> The subject phrase marked with the nominative case marker -*ka* is 'neutral' in the sense that it is not informationally restricted. ... On the other hand, the subject phrase marked with -*nun* is interpreted as the 'topic' or 'theme' of the sentence (or the subject of predication). The subject [marked with -*nun*—HL] is presented as a distinct entity from the rest of the sentence: it is what the sentence is about, and what the remaining part of the sentence is commenting on (1999:166).

Choi (1999) focuses only on transitive clauses with agentive subjects. As Choi (1986), Hong (1990) and others have shown, however, the function as the 'theme' of the sentence is not limited to the -*nun* marked NPs, and the initial -*ka* marked NP in the multiple nominative construction may serve this function. I'll return to the discourse properties of the double nominative construction below.

Returning to the main issue, i.e., word order variation, we see that in sentences like (12b,c), where the case markings or discourse markings on both the subject and object NPs are identical, their order is fixed as SO (though it is possible to get other orderings under a marked stress pattern or in an appropriate context): the examples (12b,c) are only grammatical when interpreted as an SO order, and reversing the order of the two arguments yields new sentences (14a,b) in SO order. Note further that reversing the order of subject and object changes not only their grammatical function but also topic/focus interpretation.

(14) a. Yenge kyosa-nun Mary-nun philyoha-ta.
English teacher-TOP Mary-TOP need-DECL
(i) 'As for the/an English teacher, he/she needs Mary (but not others).'
(ii) *'As for Mary, she needs the/an English teacher (but not others).'

b. Yenge kyosa-ka Mary-ka philyoha-ta.
English teacher-NOM Mary-NOM need-DECL
(i) 'It is the/an English teacher who needs Mary (exclusively).'
(ii) *'It is Mary who needs the/an English teacher (exclusively).'

In the case of sentences like (12a,d), where the two arguments of *philyoha-* 'need' bear distinct discourse markings, either order of subject and object is available, with different meanings. My inquiry with native speakers suggests that different word order acceptibility is *highly* sensitive to context, the semantic relation that holds between the referents of the two arguments of the verb, and also intonation. Grammaticality judgements are rarely clear-cut. According to my investigation, effects of structural factors, i.e., the requirement of the canonical SO order, appear strongest when the subject is higher in the definiteness scale (Definite > Indefinite) than the object, as in (15), or when the two arguments are equal in relative definiteness as in (16) (in examples (15)-(17) below, 'A > B' means the interpretation A is preferred to that of B).

(15) a. Mary-nun chinkwu-ka philyoha-ta.
Mary-TOP friend-NOM need-DECL
(i) 'As for Mary, it is a friend that she needs.' >
(ii) 'As for Mary, it is a/the friend who needs her.'

b. Mary-ka chinkwu-nun philyoha-ta.
Mary-NOM friend-TOP need-DECL
(i) 'It is Mary who needs a friend (but not others).' >
(ii) 'It is Mary that the/a friend needs.'

(16) a. Fred-nun Mary-ka philyoha-ta.
Fred-TOP Mary-NOM need-DECL
(i) 'As for Fred, it is Mary that he needs.' >
(ii) 'As for Fred, it is Mary who needs him.'

b. Fred-ka Mary-nun philyoha-ta.
Fred-NOM Mary-TOP need-DECL
(i) 'It is Fred who needs Mary (but not others)' >
(ii) 'As for Mary, it is Fred that she needs.'

When the argument appearing in the clause-initial position is lower in relative definiteness than the second argument, however, the object-subject interpretation emerges and is preferred to the subject-object interpretation:

(17) a. Chinkwu-nun Mary-ka philyoha-ta.
friend-TOP Mary-NOM need-DECL
(i) 'As for friends, it is Mary who needs them' >
(ii) 'As for friends, it is Mary that they need'

b. RA-ka Kim kyoswu-nun philyoha-ta.
RA-NOM Prof. Kim-TOP need-DECL
(i) 'As for Prof. Kim, it is an RA that he/she needs.' >
(ii) 'It is an RA who needs Prof. Kim (but not others).'

It should also be noted that the relative strength of the two readings to some degree depends on the speaker's ability to make up plausible contexts and inferences that he/she draws about the semantic relations between the referents of two arguments. This suggests that comprehending sentences is closely integrated with information about the context and the world as well as syntactic factors. Speakers bring knowledge of such information to bear in comprehending sentences. Given the fact that the

mainstream position within generative syntax is that competence is merely a matter of grammaticality of word strings in isolation, this raises the following issues: can knowledge of plausible contexts be considered a matter of grammar? If so, on what grounds? Of course, it is not necessary to adopt traditional grammaticality-focused competence grammars for doing linguistic analysis of disambiguation preferences. But even if one takes a more inclusive view of what grammar is a model of, along the lines of 'performance-plausible' models of grammar (e.g., Bresnan 1978; Bresnan and Kaplan 1982b; Hawkins 1994; Pollard and Sag 1994, among others), there are still questions that need to be addressed: how can the two processes of selecting the most plausible context for a given sentence and drawing grammaticality judgements about it be compatible in a single model of grammar? By what formal mechanism can intuitions about disambiguation preferences be best captured (e.g., constraint ranking vs. constraint weighting)? I will address these issues in section 3.4 and Chapter 4.

Another environment to be considered here where word order freezing occurs in Korean is when the grammatical function of argument roles of a single predicate cannot be distinguished by morphological means due to case marker drop. Nominative and accusative case markers in Korean are generally droppable in informal colloquial speech, unless their host NPs fall under the domain of 'assertion'.[7] Examples in (18) show that sentences are usually interpreted as SOV when case markers are dropped.

(18) a. Mary Jane manna-ss-e.
Mary Jane meet-PST-DECL
(i) 'Mary met Jane.'
(ii) *'Jane met Mary.'

b. Jane Mary manna-ss-e.
Jane Mary meet-PST-DECL
(i) 'Jane met Mary.'
(ii) *'Mary met Jane.'

While these facts do not exhaust the data concerning word order freezing in Korean, they constitute the core cases that need to be addressed by any analysis of the

[7]Differences in definiteness and animacy between nominal arguments affect their semantic interpretation, but they do not seem to have any clear influence on omissibility of case markers.

relationship between case marking and word order variation, and they are the ones that I will attempt to account for here. The word order patterns in Korean described above reveal the following generalization:[8]

(19) Generalization: Canonical word order determined by the grammatical function hierarchy becomes fixed if the case markings or discourse markings on two nominal arguments of a single predicate are identical under two alternative thematic role interpretations of the nominals.

Before going further, I must point out that although the generalization (19) is stated only in terms of grammatical function, this is not to suggest that it is the only kind of information relevant to restricted word order variation under morphological ambiguity. Rather, (19) is only meant to account for cases like the ones exemplified in (9) and (10) above where two alternative thematic role interpretations of arguments of a predicate are in principle possible, and clearly does not hold for all cases of fixed word order phenomena found in constructions which allow identical case marked nominals. It might be useful for the reader to briefly consider a few examples of such constructions here.

As is well-known, Korean has two major types of multiple nominative constructions. We have already seen examples of the first type: in the type exemplified in (9), (10) and (11), the argument which canonically appears clause-initially takes a non-agentive role (e.g., experiencer, location, source, goal, etc.), while the other is a theme. Subjecthood tests in Korean such as honorification and equi control pick up the experiencer argument as the subject, but which argument is the grammatical subject in the location/goal-type multiple nominative construction is a matter

[8]As mentioned before, the nominative case marker and the topic marker in Korean have two different formatives:

(i) Nominative: -*ka* after vowels; -*i* after consonants

(ii) Topic: -*nun* after vowels; -*un* after consonants

I assume that nominals with different formatives of the same case morphemes or discourse markers bear identical case markings or discourse markings. I make a further assumption that nominals without case endings like those in (18) above also bear identical case markings: they both carry no marking.

of controversy. Further examples of the location/goal-type multiple nominative construction, adapted from Hong (1990), are given in (20):

(20) a. LA-eyse/ka motun sosik-i ceyil mence nao-n-ta.
LA-from/NOM every news-NOM most first come out-PRES-DECL
'The most recent news comes from LA.'

b. Mary-eykey/ka phyenci-ka ceyil manhi o-n-ta.
Mary-DAT/NOM letter-NOM most a lot come-PRES-DECL
'Mary receives more letters than any other.'

When nominative, the order of the two argument NPs in this construction is much more rigid than in transitive clauses with agentive subjects: there is a very strong tendency for the location/source/goal argument NP to precede the theme. This unmarked order does not conform to the thematic role hierarchies proposed in the literature:

(21) a. agent > beneficiary > experiencer/goal > instrument > patient/theme > locative (Bresnan and Kanerva 1989)

b. Actor > Patient/Beneficiary > Theme > Location/Source/Goal (Jackendoff 1990)

I am convinced that the unmarked order can be best understood in terms of the discourse function of the multiple nominative construction expressing a theme-predication structure rather than the grammatical functions or semantic roles of the argument NPs (see Hong (1990) for a detailed discussion of this point). As I mentioned briefly in the discussion of Hindi word order, it is not uncommon for languages to have multiple grammatical factors that do not necessarily coincide in their predictions. While the fact that there are several conflicting linearization factors affecting the word order of a language is not a problem for the current competition-based account of word order, a detailed articulation of an account for word order patterns of nominative arguments of different semantic role types is far beyond the present study.

In the second type, the preceding nominative NP is interpreted as a whole to which the referent of the following nominative NP belongs as in (22).[9]

(22) a. Ku nongcang-i sakwa-ka mas-i coh-ta.
the farm-NOM apple-NOM taste-NOM good-DECL
'As for the farm, the taste of the apples is good.' (Hong 1990: 218, ex. (15a))

b. John-i nwun-i khu-ta.
John-NOM eyes-NOM big-DECL
'As for John, (his) eyes are big.'

While there has been a great deal of controversy as to which nominative NP is the real subject of the predicate, multiple nominative NPs in the part-whole construction generally exhibit a uniform word order pattern: they tend to appear in the whole-part order. However, since not all multiple nominative NPs in the part-whole construction have to be arguments of the same predicate, their word order pattern is not captured by (19), and is orthogonal to the issue at hand.

3.1.3 Limitations of Pre-OT Generative Syntactic Theories

The word order freezing effect under morphological ambiguity illustrated above is a recurrent pattern in languages having a high degree of word order flexibility. This section discusses pre-OT treatments of the relationship between word order variation and case marking, bearing in mind the problem of arriving at a unifying solution for word order variability across languages and within a particular language.

[9]There are also cases where the preceding nominative NP denotes the supersort of the denotation of the following one as in (i):

(i) Sayngsen-i chamchi-ka mas-iss-ta.
fish-NOM tuna-NOM delicious-DECL
'Among fish, tuna is delicious.'

3.1.3.1 Movement-Based Theories

In a model of grammar that employs transformational movement, the word order variability between languages has been captured by postulating a universal template which encodes hierarchical relationships between elements in phrase structure, while subjecting the particular orderings of head, complement, and specifier positions to parametric variation (Kayne 1994). Word order variation within a particular language has traditionally been captured by movement (e.g., adjunction, topicalization, *wh*-movement, head-movement, etc.) from an underlying position.

Lee (1993) has offered an analysis of word order variation in Korean within the Principles and Parameters framework (Chomsky 1981, 1986). As part of a larger treatment of case and word order variation, Lee argues that scrambling is a consequence of case-driven A-movement (specifically, case-driven adjunction to IP), contrary to the widely accepted view that adjunction is A′-movement (Chomsky 1986). As discussed briefly in section 2.1.2, assuming the case licensing conditions in (23), Y. Lee argues that all arguments have to move out of VP and are adjoined to IP to be assigned case. Under this view, scrambling is due to the fact that arguments can be arranged in any order for the purposes of case assignment since both nominative and accusative case assigners are in the same position after verb raising to I, which is motivated by accusative case licensing.

(23) a. Nominative case is licensed (via head government) by a functional head.

b. Accusative case is licensed (via head government) by a complex category consisting of a lexical head with the feature [−stative] and a functional head.

Y. Lee goes into much less detail about how the nominative case on objects of Korean dyadic stative predicates such as *mwusep* 'be afraid' in (24) and *coh* 'be fond' in (25) is licensed. Lee only suggests in a footnote (fn. 20 of chapter 4) that it is assigned by INFL just like the nominative case borne by subjects. In analogy to transitive adjectives in English like *be afraid* and *be fond* which do not have a case-assigning ability, Y. Lee assumes that Korean dyadic stative predicates do not have

a case-assigning ability and that nominative case is assigned to their complements under government by INFL.

(24) Mary-ka citokyoswu-ka/*lul mwusep-ta. [Korean]
Mary-NOM advisor-NOM/ACC be afraid-DECL
'Mary is afraid of her advisor.'

(25) Kim kyoswu-ka haksayng-tul-i/*lul coh-ta. [Korean]
Prof. Kim-NOM student-PL-NOM/ACC like-DECL
'Prof. Kim likes students.'

These assumptions about nominative case licensing lead to some difficulty in explaining the word order freezing effect that occurs in sentences like (24) and (25): the order of the two nominative arguments of a single dyadic stative predicate is predicted to be free, because nominative case is assigned to them by the same licenser INFL in any order. Lee circumvents this problem by saying that the apparent blocking effect on nominative argument scrambling is due to the 'anti-ambiguity' condition, which is stated as (26).

(26) In general, the greater the likelihood of ambiguous interpretation, the more difficult it is to switch the word order of two NPs marked with the same grammatical formative (e.g., particle).

Appealing to the 'anti-ambiguity' device amounts to saying that the word order freezing effect does not reflect syntactic principles and is merely due to a grammar-external parsing strategy. In order to accommodate exceptions to the syntactic principles which yield free word order in frameworks with inviolable principles, something extra such as a preference mechanism like a parsing constraint must be added to normal generative grammar. Of course, this is not a specific problem with Lee's analysis, but rather an instance of the problem of accounting for an 'emergence of the unmarked' in generative grammar. Other movement-based approaches to case and word order variation (e.g., Miyagawa 1991; Whitman 1997) suffer from a similar problem of having to deal with the 'violability' of syntactic ordering principles by means of additional stipulations.

In sum, Lee's derivational account of word order can easily account for word order variation, but it has to say something extra whenever word order is fixed, or when certain word orders are ruled out by a language, using special constraints that are not independently motivated in the grammar.

3.1.3.2 Lexical-Functional Grammar

In theories which do not employ explicit movement from an initial phrase structure configuration, the different base-generated word orders are related to a different level of representation in some systematic way. In particular, in LFG, c-structures, which encode surface precedence and dominance relations, are constrained by structure-function mapping principles as well as X′ theory. The principles of structure-function association are outlined in (27).

(27) Principles of structure-function correspondence (Bresnan 2001b: 102)

a. C-structure heads are f-structure heads (annotated with $\uparrow = \downarrow$).

b. Specifiers of functional categories are the syntacticized discourse functions (i.e., TOP, FOC, SUBJ).

c. Complements of functional categories are f-structure co-heads (annotated with $\uparrow = \downarrow$).

d. Specifiers of lexical categories are the non-discourse argument functions (i.e., OBJ, OBJ_θ, OBL_θ, COMPL).

e. Constituents adjoined to maximal projections are non-argument functions (i.e., ADJUNCT, TOP, FOC).

Radically configurational languages like English have strict endocentric, configurational phrase structure such that all information about grammatical relations is encoded in the phrase structure according to the principles of structure-function correspondence in (27a–e). Since constituents are largely dependent on phrase structure for the assignment of functions, word order in English is predominantly fixed. In

contrast, radically nonconfiguratiional languages, such as Warlpiri and many other Australian languages, make little use of configurational structure. In these languages, there is no basic order in which the different grammatical relations are associated with particular positions in the phrase structure. Instead, information about subject, object and other grammatical functions is specified solely from the morphology.[10]

Languages can also encode information about grammatical relations in more than one place in the grammar. Scrambling languages like German, Hindi and Korean have a mixture of configurational and lexocentric properties. Unlike fully nonconfigurational languages, these languages generally show evidence for a VP-type configurational structure[11] and have a basic or canonical order by which grammatical relations can be defined.

In Korean the canonical word order of subject and object can be represented by the following two phrase structure rules, where S is a nonprojective category which can dominate multiple constituents not bearing the typical branching relations in endocentric structures.

(28)

a. S	$\longrightarrow$	NP	VP	
		$(\uparrow \text{SUBJ}) = \downarrow$	$\uparrow = \downarrow$	
b. VP	$\longrightarrow$	NP	V	
		$(\uparrow \text{OBJ}) = \downarrow$	$\uparrow = \downarrow$	

The annotations $(\uparrow \text{SUBJ}) = \downarrow$ and $(\uparrow \text{OBJ}) = \downarrow$ indicate that the functional information associated with a given node is the SUBJ or OBJ value of the mother's f-structure; the annotation $\uparrow = \downarrow$ (head relations) indicates the functional information associated with a given node is the same as the functional information of the mother node.

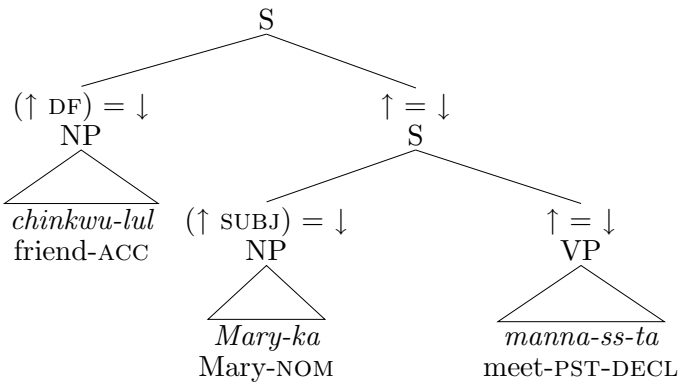
However, scrambling languages differ from fully configurational languages like English in also making use of morphological means of function specification, allowing grammatical function identification to be made in the case morphology as well as in the phrase structure. That is, because grammatical function specification is not

[10] A detailed discussion of the typology of expression of grammatical relations and the nature of nonconfigurationality can be found in Bresnan (2001b, Ch. 6) and Nordlinger (1998).

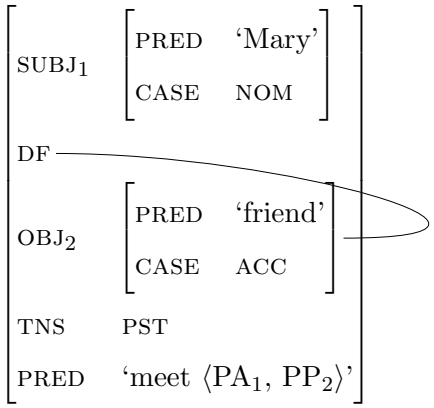
[11] As discussed in Chapter 2, however, there is little evidence for the existence of VP consisting of the verb and its object in Hindi.

solely dependent on phrase structure, constituents can appear in non-canonical, non-argument positions with certain discourse effects. This general point is illustrated by the scrambled structure in Korean, illustrated in (29).

(29)



According to (27e), constituents adjoined to maximal projections, such as the higher NP in (29), have a non-argument function—either ADJUNCT or a discourse function; the accusative case morphology indicates that it also has the OBJECT function, assuming the *Constructive Case* of Nordlinger (1998). If it is assigned the ADJUNCT function then two non-discourse functions, OBJ and ADJ, will have the same value. This is ruled out by the Argument-Function Uniqueness principle (Bresnan 1980; Alsina 1993), which requires that each non-discourse function—i.e., argument functions and ADJUNCT—have a distinct value from each other. Thus, the higher NP in (29) has two functions in the f-structure (30): a discourse function, DF, assigned by the phrase structure, and an argument function, OBJ, indicated by the case morphology.

(30)


Hence, in the framework of LFG, the same type of information about grammatical relations can be encoded in the morphology as well as in the syntax. In her study of nonconfigurationality in Australian languages, Nordlinger (1998) proposes that the function of case morphology in specifying grammatical relations can be formally captured with the use of 'inside-out' function application in LFG, a formal mechanism independently motivated in the areas of topicalization Bresnan (2001b) and anaphoric binding Dalrymple (1993):

(31) Inside-out function application (Bresnan 2001b: 65)
For an f-structure f' and attribute a, $(a\ f')$ designates the f-structure f such that $(fa) = f'$.

Inside-out function application works in the opposite direction from standard function application. In regular designators, such as (f SUBJ), f designates the outer f-structure containing the SUBJ f-structure. Under inside-out function application, f designates the f-structure contained in the outer f-structure. In other words, (SUBJ f) designates a path from f outwards to the f-structure in which f is the value of the SUBJ attribute.

Nordlinger (1998) proposes that case morphemes in dependent-marking Australian languages and scrambling languages carry an inside-out designator specifying the grammatical function of the nominal bearing that morphological ending. For instance, the nominative case marker *-i/ka* in Korean would have the following lexical entry:

(32) (↑ CASE) = NOM
(SUBJ ↑)
...

The entry in (32) specifies that the f-structure to which the morpheme belongs contains the attribute-value pair CASE NOM and, through inside-out function application, that the f-structure to which the morpheme belongs is the SUBJ value of the f-structure that immediately encompasses it. Thus, the lexical entry in (32) licenses the f-structure in (33).

(33) $f{:}\left[\text{SUBJ} \quad f'{:}\left[\text{CASE} \quad \text{NOM}\right]\right]$

As noted above, in Korean the nominative case marks both the subjects of all types of predicates and the objects of dyadic stative predicates. This can be captured by modifying the lexical entry in (32) to include an alternative inside-out (IO) chain, i.e., (OBJ ↑), as in (34). Thus, the nominative case marker in Korean can construct more than one grammatical relation.[12]

(34) (↑ CASE) = NOM
(SUBJ ↑) ∨ (OBJ ↑)
...

The accusative marked objects, on the other hand, are often (but not always) restricted to non-stative clauses. This can be captured by encoding the aspectual restriction into accusative case marker, as in (35).[13]

(35) (OBJ ↑)
(↑ CASE) = ACC
((OBJ ↑) ASP) = ¬STATIVE
...

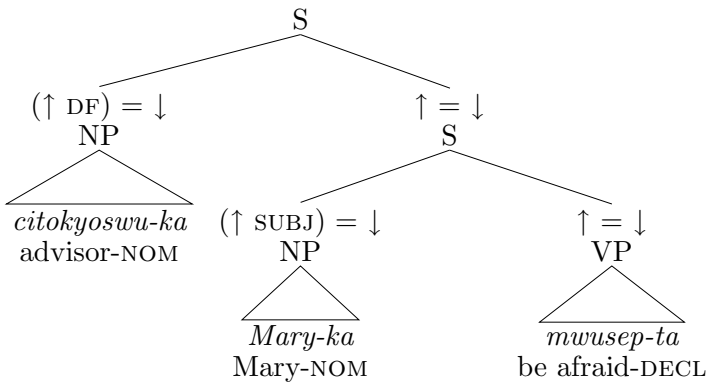
[12]Nominative and accusative case markers in Korean can be used to mark certain classes of adverbials (Maling 1989; Wechsler and Lee 1996; Lee 1999a,b). In this work I do not discuss adverbial case.

[13]This lexical entry will be revised in section 3.3 below.

Thus, in this model, in scrambling languages such as Hindi and Korean, information about grammatical functions comes from two sources: case morphology and the annotations in the phrase structure. Application of this system to modeling a scrambled structure like that in (29) is relatively straightforward. The IO designators (SUBJ ↑) and (OBJ ↑) associated with the nominative and accusative markers construct the subject and object relations respectively. The (↑ SUBJ) = ↓ annotation in the c-structure likewise identifies the f-structure for the NP with the subject function of the clause. The NP in the noncanonical DF position must then be identified with the object function of the clause in order to satisfy the Argument-Function Uniqueness principle and the Extended Coherence principle. In this way, a language can encode information about grammatical relations in more than one place in the grammar, just as long as the information is compatible under unification.

A problem arises, however, when we attempt to apply the same unification-based approach to the expression of grammatical relations to clauses like (24) and (25) above, where the subject and object bear an identical case ending. The obvious problem is overgeneration of ungrammatical scrambled structures like the one in (36) below: the c-structure tree (36) is produced by principles in (27) and the phrase structure rules in (28) in the same way that we have seen for the non-stative clause discussed above. The f-structure in (37), corresponding to (36), would satisfy all the general well-formedness principles and morpholexical constraints contributed by the case morphology, because the grammatical information projected from the two components of the grammar—morphology and the phrase structure—is perfectly unifiable.

(36)



(37)
$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{`Mary'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{DF} & \\ \text{OBJ}_2 & \begin{bmatrix} \text{PRED} & \text{`advisor'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{TNS} & \text{PRES} \\ \text{ASP} & \text{STATIVE} \\ \text{PRED} & \text{`be afraid } \langle \text{PA}_1, \text{PP}_2 \rangle \text{'} \end{bmatrix}$$

In sum, the general architecture of LFG provides a highly flexible framework for modeling typological variation in the expression of grammatical relations. Yet, we have no real explanation for the manifestation within particular languages of the 'inverse' relation between the amount of information about grammatical function expressed by case marking and the amount expressed by phrase structure, a situation exemplified by the word order freezing effect in scrambling languages. As shown by Bloom (1999), it is certainly possible to account for this situation in LFG by adding to the classical LFG architecture further restrictions on the application of the structure-function mapping principles and morpholexical constraints that could filter out the large possibilities overgenerated by the formal model. But it is worth exploring a more explanatory alternative solution. Optimality Theory suggests a more general account of the relation between formally distinct but functionally equivalent structures.

3.1.4 Summary

Languages like Hindi and Korean make use of case marking as the primary means of specifying the grammatical function of argument roles. However, it is not uncommon to find cases where case morphology cannot clearly indicate the grammatical function of argument phrases in these languages. In such instances, it is the fixed word order that takes the role normally played by case morphology and determines which argument is the subject and which is the object.

This correlation between case marking and word order seems intuitive, but to date,

previous attempts to explain it within pre-OT generative syntax have not yet been successful. This is due to the basic architecture of pre-OT generative models of syntax, as pointed out in Chapter 1. In GB theories of syntax, the problem of accounting for surface orderings is handled by case and agreement. Such theories can easily account for word order variation within a particular language in terms of various movement processes, but lack any principled explanation of the coexistence of flexibility and invariance of word order within languages. The word order freezing effect widely observed in scrambling languages does not follow naturally from frameworks like LFG which do not employ explicit transformational movement, either. In order to capture formally the idea that 'morphology competes with syntax' in encoding grammatical functions both within and across languages formally, a mechanism like the candidate evaluation in OT (i.e., EVAL) is required.

3.2 Interaction of Case and Word Order in a Unidirectional OT

In this and the following sections, I develop an OT account of word order freezing effects in Hindi and Korean. The key to the successful account of this problem is how to formally explicate the relation between the two alternative means of encoding the same grammatical relations, i.e., word order and case morphology. I will show that the basic architecture of OT provides a natural way to capture the dynamic relation between formally distinct but functionally equivalent outputs, namely case morphology and word order. In this section, we consider some problems with unidirectional OT. The solution, based on bidirectional optimization, is proposed in section 3.3.

3.2.1 Case Selection and Output-to-Output Correspondence

This section provides an OT account of the distribution of case on subject. I limit the discussion here to Hindi and discuss Korean in section 3.3.2.

It is traditional to assume the classic distinction between "Structural" and "Inherent" (Chomsky 1981) or between "Grammatical" and "Semantic" Case (Kuryłowicz

1964) in many formal theories of case. Grammatical case refers to a case whose distribution depends on purely syntactic conditions, such as grammatical function or finiteness. Semantic case refers to cases which are sensitive to semantic factors such as thematic relations and aspectual affectedness and delimitedness. It is also well-known that there is a class of cases that pattern syntactically with grammatical cases but are sensitive to various semantic factors. The Hindi ergative is a particularly clear case of semantically conditioned grammatical case. Let us examine the distribution of the ergative case in Hindi in some detail.

As mentioned before, Hindi is a language with an aspectually-based split ergative case system, such that ergative case is restricted to the agentive subject in a perfective[14] clause. Otherwise, it is nominative.[15] As in most South Asian languages, ergative marking in Hindi is correlated with the semantic property of agency or volitionality. The verb *uṭʰaa* 'lift' in (38) takes only ergative subject, given the required aspectual condition. The action referred to by such verbs must be deliberate (Mohanan 1994a:73).

(38) a. Raam-ne bacce-ko uṭʰaayaa.
Ram-ERG child-ACC lift-PERF
'Ram lifted the/a child.'

b. *Raam bacce-ko uṭʰaayaa.
Ram-NOM child-ACC lift-PERF
'Ram lifted the/a child.'

In contrast, the action referred to by the class of verbs that take only nominative subjects is largely nondeliberate. Furthermore, when nominative subjects cooccur with verbs that can choose between nominative and ergative subjects, the action must be nondeliberate. The case marking contrast between (39a) and (39b) thus correlates with a semantic contrast, and suggests that ergative case may require that the argument be associated with a semantic property that may be termed **conscious** or **volitional participation in the action** (Mohanan 1994a).

[14]The use of the term perfective can be characterized as the denotation of "a single event with a well-defined result or end-state, located in the past" (Dahl 1985:78).

[15]—ignoring oblique case-marked subjects here.

As Mohanan (1994a: 70–74) notes, the distribution of ergative case cannot be consistently associated with transitivity in Hindi. The same verb, whether transitive or intransitive, can take a nominative or ergative subject depending on the semantic environment, as in (39) and (40): while the ergative subject in (39b) and (40b) carries the meaning of deliberate action, the nominative subject in (39a) and (40a) express non-voluntary participation in the action of the sentence.

(39) a. Raam-ko acaanak šer dik^{h}aa. Vah/*us-ne cillaayaa.
Ram-DAT suddenly lion-NOM appear-PERF. he-NOM/he-ERG scream-PERF
'Ram suddenly saw a lion. He screamed.' (Mohanan 1994a: 72, ex. (22a))

b. Us-ne/*vah jaanbuuj^{h}kar cillaayaa.
he-ERG/HE-NOM deliberately shout-PERF
'He shouted deliberately.' (Mohanan 1994a: 72, ex. (22b))

(40) a. Raam jaantaa t^{h}aa ki siitaa bahut bimaar hai.
Ram-NOM know-IMPERF be-PERF that Sita-NOM very ill be-PRES
'Ram knew that Sita was very ill.' (Mohanan 1994a: 74, ex. (23a))

b. Raam-ne jaantaa ki siitaa bahut bimaar hai.
Ram-ERG know-PERF that Sita-NOM very ill be-PRES
'Ram found out that Sita was very ill.' (Mohanan 1994a: 74, ex. (23b))

Therefore, based on these facts, I assume that ergative case is conditioned by the semantic property of volitional participation in the action,[16] not by transitivity.

Before we move on to the analysis of the ergative-nominative alternation on the subject, the distinction between the *case system* and the inventory of *case markers* (Wierzbicka 1981; Goddard 1982; Blake 1994; Mohanan 1994a) deserves clarification. A case system is the system of *case features* conventionally labelled as nominative, ergative, accusative, dative, and so on. These case features are entities drawn from

[16]The association of agentivity (e.g., volitionality and causer) with the ergative case is a crosslinguistically common tendency: agentivity also characterizes ergativity in many Australian languages, though the distribution of the ergative case in these languages is constrained by an additional factor, i.e., transitivity.

a universal inventory and crosslinguistically characterizable in terms of a set of properties. *Case markers* are the actual morphological realizations of the abstract case features. In Hindi, the features nominative, ergative, accusative and dative are associated with the following case markers:

(41) Table 2. Association between case features and case markers in Hindi (Mohanan 1994a: 66)

FEATURE	MARKING	SYNTAX AND SEMANTICS
NOM	ø	subject; inanimate primary object
ERG	-*ne*	agentive subject with verb in perfective aspect
ACC	-*ko*	primary object
DAT	-*ko*	goal

Within the conception of linguistic structure in this work, the universal case features are part of the subsystem of grammatical features represented by candidate f-structures, while the case markings associated with them belong to the morphophonological component of the grammar. In this chapter, I will be concerned only with case features, rather than with different realizations of them. For analyses of morphological case within OT, see Aissen (1999, 2000), Donohue (1999), Sharma (2001), and Deo and Sharma (2000), among others.

Let us now examine the different types of ergative languages that are predicted, based on the possible rankings of violable markedness and faithfulness constraints. First, the ergative-nominative alternation in Hindi can be understood as being due to the effect of a contextually restricted faithfulness constraint that holds for deliberate actions expressed in perfective contexts, which dominates the markedness constraints favoring default case assignment, i.e., nominative. Woolford (2001) suggests the universal subhierarchy in (42), which has the effect of favoring less marked structural cases (nominative, accusative) over more marked semantic cases (ergative, dative).

(42) *ERG(ATIVE), *DAT(IVE) $\gg$ *ACC(USATIVE) $\gg$ *NOM(INATIVE)

The situation in Hindi can be expressed by interpolating the contextually restricted faithfulness constraint and the general faithfulness constraint on VOL(ITIONALITY) in the subhierarchy (42) (Woolford 2001), as shown in (43):

(43) Aspectually-based split ergative case system
MAX(VOL)$_{perf}$ ≫ *ERG ≫ MAX(VOL), *ACC ≫ *NOM

The sandwiching of the constraint against ergative case between the contextual and general faithfulness constraints captures the case preemption pattern: when more than one case is available for one argument, indirect or semantic case takes priority over direct or structural case. As Woolford notes, the ranking in (43) makes the correct prediction that ergative case surfaces in perfective clauses due to the priority of the contextual faithfulness constraint MAX(VOL)$_{perf}$ (favoring semantic case) to *ERG; but outside that context, markedness takes over, and the subject is nominative, producing the aspectually-conditioned split ergative system.

In many Australian languages, on the other hand, the ergative-nominative alternation is governed by transitivity as well as agentivity. In this classic type of ergative language, ergative is restricted to the agentive subject of transitive verbs. There are also ergative languages called the active-stative type, where agentive subjects take ergative case in intransitives as well as transitives (e.g., Basque (Levin 1989)). These are other instances of contextual faithfulness. As Woolford (2001) suggests, we can capture the distribution of the ergative case with respect to transitivity by postulating a variant of the faithfulness constraint MAX(VOL)$_{trans}$, which requires the ergative in the transitive context. For example, if MAX(VOL)$_{trans}$ is ranked higher than *ERG, as in (44), the ergative must occur in transitives, because MAX(VOL)$_{trans}$ requires the use of ergative feature only in the transitive context. The relative ranking of *ERG with respect to the context-free faithfulness constraint MAX(VOL) and the remaining markedness constraints makes ergative case unavailable in intransitives. Therefore, in intransitives nominative is selected over ergative due to the ranking of the markedness constraints.

(44) Classic type of ergative languages
MAX(VOL)$_{trans}$ ≫ *ERG ≫ MAX(VOL)$_{perf}$ ≫ MAX(VOL), *ACC ≫ *NOM

Promotion of MAX(VOL) above *ERG as in (45) would yield the active-stative type ergative language, where the ergative surfaces in intransitives as well as transitives.

(45) Active-stative type ergative languages
$\textsc{Max}(\textsc{vol})_{trans} \gg \textsc{Max}(\textsc{vol})_{perf} \gg \textsc{Max}(\textsc{vol}) \gg *\textsc{erg} \gg *\textsc{acc} \gg *\textsc{nom}$

If *ERG dominates all other constraints under consideration here, as in (46), then the ergative will be eliminated from the inventory of abstract cases altogether.

(46) Non-ergative
*ERG $\gg$ all other constraints

The faithfulness constraints introduced above are analogous to those proposed in Woolford (2001), but there are two main differences between her approach and mine. First, Woolford's account assumes, along with much work in the Minimalist Program, a structural distinction between structural Case and inherent Case. Structural Case is assumed to be licensed on an argument in a purely configurational way, i.e., in the proper structural relationship with the licensing head, whereas inherent Case (also called lexical or quirky case) is assigned to arguments associated with a particular theta-role in possible dependence on the governing predicates' lexical properties. Thus, Woolford regards ergative (associated with agents), dative (associated with goals and experiencers), and accusative (associated with themes) as inherent Cases licensed by verbs that carry the specification of inherent Case licensing feature (called 'lex' in Woolford (2001)) in their lexical entry.

Woolford (2001) carries over this conception of lexically determined inherent Case to her OT approach to Case. Let me make a few brief remarks about the way the licensing of inherent Case works. In Woolford's system, licensing inherent Case involves faithfulness to lexical requirements, specifically inherent Case features of lexical items that are present in OT inputs. While it is true that the association of the ergative case with volitionality or conscious choice and of the dative case with sentience/perception, for example, is not absolute and exceptionless, the view that ergative and dative case as lexical cases are "quirky" and therefore must be specified in the lexical entry of each verb is problematic. It is clearly undesirable to lexically stipulate what is predictable from a general property of the language. Moreover, such an approach that relies on lexical stipulation is not extendable to other instances

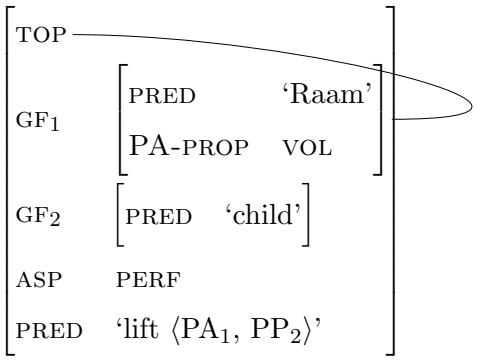
of semantic case that are sensitive to the aspectual property of the VP (e.g., the Finnish partitive), or to nominal properties such as the NP's animacy, definiteness or quantificational properties. The conception of lexically determined inherent Case somewhat also departs from the spirit of OT that the cross-linguistic variation in surface realization of underlying arguments must be derived (as much as possible) as an effect of constraint interaction.

In the alternative approach I develop here, a clear distinction is made between semantic case and quirky case. Only the latter kind of case is truly idiosyncratic in that its distribution is indeed completely unpredictable, and therefore must be lexically stipulated. Semantic case, in contrast, is viewed as having a semantics of its own, rather than being licensed by any particular feature or lexical item. Thus, while my approach involves similar types of constraints on case as Woolford's proposal, the faithfulness constraints I use to account for the distribution of semantic case refer to features designating substantive semantic content (e.g., VOLITIONALITY, SENTIENCE, CAUSER, etc.), not purely morpholexical features.

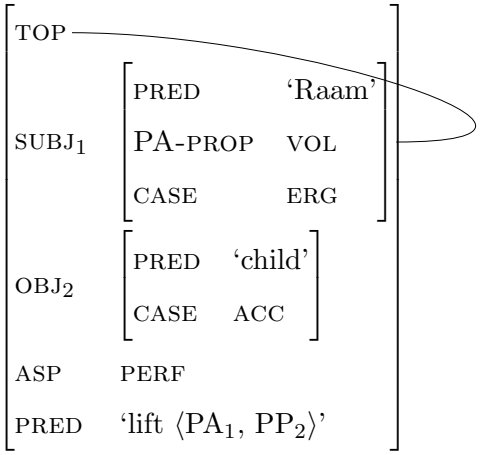
The second difference between Woolford's approach and mine is that in my system, case licensing, both semantic and grammatical, is formally accounted for in terms of correspondence between outputs rather than correspondence between inputs and outputs. We have already seen the application of output-to-output correspondence to honorific agreement in Korean (section 2.4.1). In what follows, I will show that case patterns, too, can be subsumed under the general notion of output-to-output correspondence.

As I discussed in Chapters 1 and 2, I assume that candidate f-structures are semantically subsumed by the input (Kuhn 1999, 2000, 2001a,b). This is illustrated by the input given in (47) and the two example analyses of this input in (48) and (49).

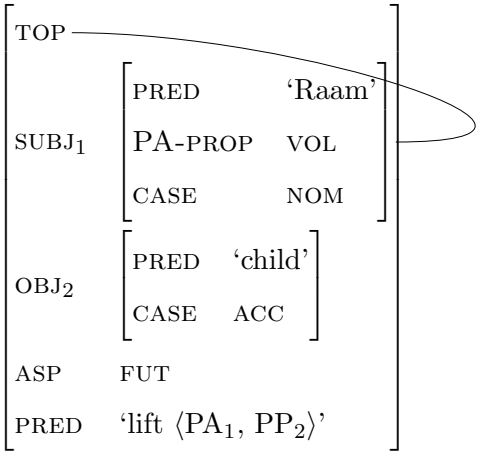
(47) Input:



(48) Candidate f-structure f^1



(49) Candidate f-structure f^2



As can be seen, the candidate f-structures contain the input together with additional morphosyntactic features such as case features provided by GEN. Choices of particular cases are optimized against the candidates' syntactic f-structures, as we will see shortly.

In LFG, the content of words and morphemes is modeled as sets of morpholexical annotations or 'morpholexical constraints' in Bresnan's (2000c) terminology. Where do these morpholexical constraints associated with case markers come from? In the model of Constructive Case developed by Nordlinger (1998), they are assumed to be provided by the lexical entries of case markers. For instance, the Hindi ergative case marker -*ne* contributes the overall set of f-descriptions by carrying the following semantic and morphosyntactic information:

(50) Morpholexical contribution by the ergative case marker:
(SUBJ ↑)
(↑ CASE) = ERG
(↑ PA-PROP) = VOL
((SUBJ ↑) ASP) = PERF
...

The ergative case marker carries four pieces of information: (i) information about the higher f-structure within which it is contained, i.e., SUBJ, via inside-out (IO) function application (Nordlinger 1998); (ii) information about the case feature, i.e., ERG, that the f-structure to which it belongs contains; (iii) the semantic property VOL(ITIONALITY) of the nominal to which it belongs,[17] and (iv) clause-level information about the clausal aspect (the equation ((SUBJ ↑) ASP) = PERF specifies the clause as having the aspect value PERF). The nominative case marker as the unmarked case, on the other hand, lacks the specification for the aspect value PERF:

(51) Morpholexical contribution by the nominative case marker:
(SUBJ ↑) ∨ (OBJ ↑)
(↑ CASE) = NOM
...

Thus, the ergative NP *Raam-ne* 'Ram-ERG' and the nominative NP *Raam-ø* 'Ram-NOM' project the following f-structures:

(52) Ergative NP

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'Ram'} \\ \text{PA-PROP} & \text{VOL} \\ \text{CASE} & \text{ERG} \end{bmatrix} \\ \text{ASP} & \text{PERF} \end{bmatrix}$$

(53) Nominative NP

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'Ram'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

[17] More precisely, (↑ PA-PROP) should be ($\uparrow_\alpha$ PA-PROP) (α is a projector defining a mapping from f-structure to a(rgument)-structure) and $\uparrow_\alpha$ represents an a-structural property associated with the f-structure denoted by ↑), as the semantic property of volitionality belongs to the a-structure.

What I am particularly interested in pointing out here is the function of lexical entries in the model of Constructive Case. As the lexical entries in (52) and (53) clearly show, they express generalizations across lexical items (here case morphemes) that in large part reflect tendencies observable within and across many languages. For example, assuming the analysis of the ergative case marker as the element that parses 'volitionality', the fact that the ergative in Hindi appears with subjects but not with nonsubjects is predictable from the subhierarchy of markedness constraints on argument linking, i.e., *$\sim$SUBJ/PA$_{vol}$ $\gg$ *SUBJ/PA$_{vol}$ (Asudeh 2001): under this ranking, in the absence of any relevant higher ranking constraints, a volitional subject will be always preferred to a nonvolitional subject. Similarly, the fact that the unmarked case for the subject is nominative, is predictable from the subhierarchy *SUBJ/$\sim$NOM $\gg$ *SUBJ/NOM (see section 2.4.2). In addition to the grammatical function that the case markers appear with, the morphosyntactic context in which case-marked nominals appear is also predictable: the fact that the ergative subject but not the nominative subject is restricted to a perfective context is predicted by the ranking given in (43). To the extent that language-particular case patterns reflect universal principles of markedness, it is undesirable to stipulate them lexically. But this seems unavoidable in pre-OT LFG, given its lexicalist architecture: an LFG theory of case has to appeal to the idea that morphology and syntax may contribute the same types of information to f-structure.

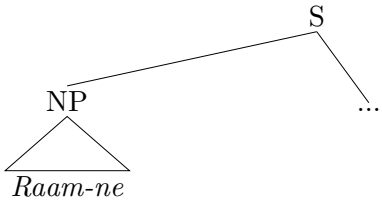
In OT-LFG, we can make headway on this front by taking the pre-OT LFG model of Constructive Case as the component of GEN, which generates the formal space of candidate *morpholexical* structures from which EVAL selects the typological space of structures. It is possible in this way to keep the insight of classical LFG that both morphological and syntactic constituents may contribute the same types of information to f-structure, while not lexically stipulating generalizations derivable from universal principles of markedness.

Returning to the OT analysis of case, I propose that the licensing of semantic case can be modeled as a faithfulness relation between the output morpholexical structure and the syntactic f-structure, which can be checked by comparing the relevant semantic feature in a candidate's syntactic f-structure and that in the morpholexical

structure of a case-marked NP. The idea is illustrated for the candidate analyses violating faithfulness constraints in examples (54a–c). As Kuhn (2000, 2001a) suggests, the MAX-OO-violating use of a lexical item can be modelled by assuming that some part of the output f-structure (subsumed by the input) is not contributed by any of its morpholexical constraints:[18] in (54a), the features [VOL] (lexically associated with the ergative case marker) and [CASE ERG] belonging to the SUBJ argument of the candidate f-structure both are present in the morpholexical structure of that argument; but we do not find the [VOL] specification in the lexical structure of (54b) and (54c). Further, (54c) incurs a violation of IDENT-OO(CASE), since the value of CASE in the syntactic f-structure does not match that in the lexical structure.

[18] DEP-IO violations are the opposite situation, where a morpholexical constraint is not used in the construction of the output f-structure (Bresnan 2000c; Kuhn 2000, 2001a).

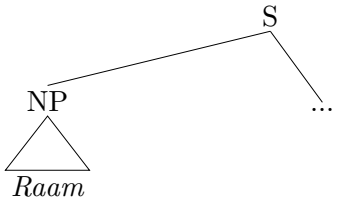
(54) a.



$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'Raam'} \\ \text{PA-PROP} & \text{VOL} \\ \text{CASE} & \text{ERG} \end{bmatrix} \\ \text{ASP} & \text{PERF} \end{bmatrix}$$

$$\begin{bmatrix} \text{TOP} & \\ \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{'Raam'} \\ \text{PA-PROP} & \text{VOL} \\ \text{CASE} & \text{ERG} \end{bmatrix} \\ \text{OBJ}_2 & [\ldots] \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{'lift } \langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

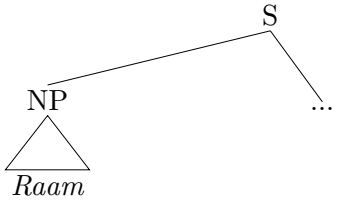
b. Violation of MAX-OO(VOL)$_{perf}$



$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'Raam'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

$$\begin{bmatrix} \text{TOP} & \\ \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{'Raam'} \\ \text{PA-PROP} & \text{VOL} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ}_2 & [\ldots] \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{'lift } \langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

c. Violation of MAX-OO(VOL)$_{perf}$ and IDENT-OO(CASE)



$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'Raam'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

$$\begin{bmatrix} \text{TOP} & \\ \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{'Raam'} \\ \text{PA-PROP} & \text{VOL} \\ \text{CASE} & \text{ERG} \end{bmatrix} \\ \text{OBJ}_2 & [\ldots] \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{'lift } \langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

Consequently, the lexicon is simplified considerably. In OT, it consists of a list of morphemes, each with their own lexical entry. Each lexical entry specifies language-particular form-meaning associations. For instance, subjects of certain transitive verbs in Hindi such as *bol* 'speak', and *la* 'bring' do not take ergative case. That these verbs take only the nominative subject must be stipulated in their lexical entries. However, systematic lexical properties, such as whether or not the ergative is in the inventory of case, which grammatical function case markers canonically appear with, or in which morphosyntactic context case-marked nominals appear, are not stipulated in the lexical entry of case markers. Instead, they are derived by constraint ranking (Smolensky 1996a; Bresnan 2000b).

For present purposes, I will assume the following simple lexical entries for the ergative and nominative case markers:

(55) a. ERG: [PA-PROP VOL]

b. NOM: [ ]

In the lexicon, the ergative case marker is specified for the feature VOL; the nominative case marker is left unspecified. In other words, the meaning of the ergative case is lexically fixed, whereas the meaning of the nominative arises out of constraint interaction. This accounts for the generalization that ergative is restricted to particular contexts (e.g., a perfective or transitive clause), whereas nominative occurs in a wider range of morphosyntactic contexts.

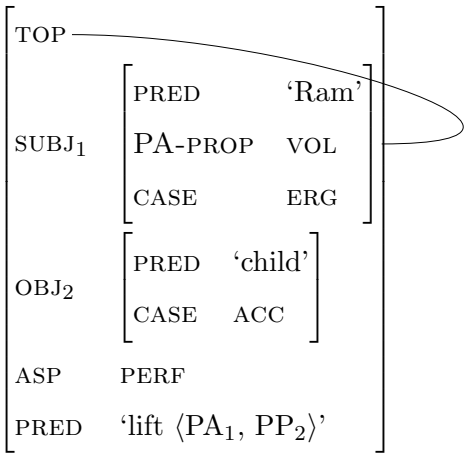
We are now in a position to combine the rankings in (44) and those proposed in the previous chapter for a full picture of the interaction of alternative morphosyntactic devices for specifying grammatical function information. The full array is presented in (56) and discussed in the next subsection.

(56) MAX(VOL)$_{perf}$ $\gg$ *ERG$\gg$ TOP-L $\gg$ SUBJ-L $\gg$ OBJ-L, MAX(VOL), *ACC $\gg$ *NOM

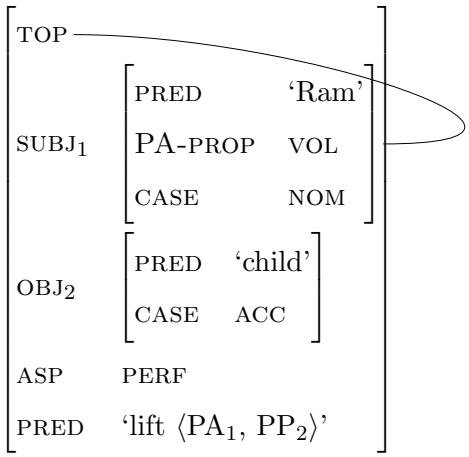
3.2.2 Limitations of Unidirectional OT

Now we are ready to see the OT analysis of word order freezing under morphological ambiguity. Let us begin with an example of a perfective clause. We first take an input in which the PA argument is specified as a TOPIC; the input information is shown in the top left corner of the tableaux. Tableau 1 in (59) below shows some competing candidates for perfective transitive clauses. Candidates (a) and (c) have an ergative subject, and they differ only in the relative order of the subject and the object, whereas in candidates (b) and (d) the subject is nominative. These are associated with the following syntactic f-structures, which contain the input together with case features.

(57) F-structures for (a) and (c)



(58) F-structures for (b) and (d)



In other words, the semantically interpreted parts of the input and candidate syntactic f-structures are identical. At the morpholexical level, on the other hand, candidates may differ from the input in their featural specifications: as discussed in the previous section, at the morpholexical level, the ergative case marker is specified for 'VOL', whereas the nominative case marker is left unspecified. In the tableaux that follow, I will indicate morpholexical featural specifications that are relevant to faithfulness evaluations within [ ].

As we are interested in the interaction between case marking and word order, we will consider only candidates which have a PA subject and a PP object; candidates with the opposite linking pattern would be ruled out by the higher ranking constraint

*$\sim$SUBJ/PA$_{vol}$ (Asudeh 2001; see also section 2.3.1); also, although I just list the candidates with accusative or nominative direct objects, we must assume that candidates with a dative object, plus many more, are generated by GEN.[19]

(59) Tableau 1. Generation of word order variants (perfective)

Input: [TOP; GF$_1$ [PRED 'Ram', PA-PROP VOL]; GF$_2$ [PRED 'child']; ASP PERF; PRED 'lift ⟨PA$_1$, PP$_2$⟩']	MAX-OO(VOL)$_{perf}$	*ERG	MAX-OO(VOL)	TOP-L	SUBJ-L	OBJ-L	*ACC	*NOM
☞ a. S$_{erg}$[VOL] O$_{acc}$ V$_{perf}$		*				*	*	
b. S$_{nom}$[ ] O$_{acc}$ V$_{perf}$	*!		*			*	*	*
c. O$_{acc}$ S$_{erg}$[VOL] V$_{perf}$		*		*!	*		*	
d. O$_{acc}$ S$_{nom}$[ ] V$_{perf}$	*!		*	*	*		*	*

In Tableau 1, due to the high ranking of the contextual faithfulness constraint MAX-OO(VOL)$_{perf}$, candidates (b) and (d) with the nominative subject are ruled out immediately, since the [PA-PROP VOL] part of the f-structure is not contributed by any of the nominal lexical items' morpholexical constraints.[20] This leaves candidates (a) and (c), and the relative high ranking of TOP-L favors (a) with the TOP (SUBJ)-OBJ order.

In case the PP is specified as a TOPIC in the input, then a different candidate is the winner: candidate (a) loses to the topic-initial candidate (c), as shown in Tableau 2 below:

[19]The accusative-nominative alternation on objects will be discussed in section 3.3.2.

[20]Candidates (b) and (d) also violate MAX-OO(ASP), since the value of the feature ASP value is not present in the morpholexical structure of the nominative subject NP.

(60) Tableau 2. Generation of word order variants (perfective)

Input: [GF$_1$ [PRED 'Ram', PA-PROP VOL], TOP, GF$_2$ [PRED 'child'], ASP PERF, PRED 'lift ⟨PA$_1$, PP$_2$⟩']	MAX-OO(VOL)$_{perf}$	*ERG	MAX-OO(VOL)	TOP-L	SUBJ-L	OBJ-L	*ACC	*NOM
a. S$_{erg}$[VOL] O$_{acc}$ V$_{perf}$		*		*!		*	*	
b. S$_{nom}$[ ] O$_{acc}$ V$_{perf}$	*!		*	*		*	*	*
☞ c. O$_{acc}$ S$_{erg}$[VOL] V$_{perf}$		*			*		*	
d. O$_{acc}$ S$_{nom}$[ ] V$_{perf}$	*!		*		*		*	*

If we add further alignment constraints (e.g., FOC-L and BACKGROUND-R, etc) to the constraint ranking and change the input specification of each argument's discourse status, we would make the correct prediction that all six orderings of subject, object and verb are possible expressions for the content 'lift⟨PA,PP⟩, ASP=PERF'.

Now let us move to a nonperfective clause. Tableau 3 and 4 below schematically represent only candidates with the future form of the verb *toḍ* 'break'. Though they compete against each other in the universal candidate set, perfective clauses and nonperfective clauses each are more faithful to different inputs (specifically, perfective candidates will be ruled out by MAX-OO(ASP), when the input is specified as [ASP FUT]). As Tableau 3 shows, the four candidates will have the same constraint profile for the contextual faithfulness constraint MAX-OO(VOL)$_{perf}$ (none of them violates MAX-OO(VOL)$_{perf}$), since they all have the future verb form. So the decision on case is made entirely by the markedness constraints, and candidates (b) and (d) with the nominative subject win because they survive after candidates with the more marked

ergative case are eliminated by *ERG. Of these, the O-S candidate (d) is eliminated by TOP-L, leaving (b) as the winner.

(61) Tableau 3. Generation of word order variants (future)

Input:	MAX-OO(VOL)$_{perf}$	*ERG	MAX-OO(VOL)	TOP-L	SUBJ-L	OBJ-L	*ACC	*NOM
[TOP —, GF$_1$ [PRED 'stone', PA-PROP CAUS], GF$_2$ [PRED 'cart'], ASP FUT, PRED 'break ⟨PA$_1$, PP$_2$⟩']								
a. S$_{erg}$[VOL] O$_{nom}$ V$_{fut}$		*!				*		*
☞ b. S$_{nom}$[ ] O$_{nom}$ V$_{fut}$						*		**
c. O$_{nom}$ S$_{erg}$[VOL] V$_{fut}$		*!		*	*			*
d. O$_{nom}$ S$_{nom}$[ ] V$_{fut}$				*!	*			**

When the PP is specified as a TOPIC in the input, however, candidate (d) is favored by the TOP-L constraint: object scrambling will incur no violation of TOP-L:

(62) Tableau 4. Generation of word order variants (future)

Input:	MAX-OO(VOL)$_{perf}$	*ERG	MAX-OO(VOL)	TOP-L	SUBJ-L	OBJ-L	*ACC	*NOM
[GF$_1$ [PRED 'stone', PA-PROP CAUS], TOP, GF$_2$ [PRED 'cart'], ASP FUT, PRED 'break ⟨PA$_1$, PP$_2$⟩']								
a. S$_{erg}$[VOL] O$_{nom}$ V$_{fut}$		*!		*		*		*
b. S$_{nom}$[ ] O$_{nom}$ V$_{fut}$				*!		*		**
c. O$_{nom}$ S$_{erg}$[VOL] V$_{fut}$		*!			*			*
☞ d. O$_{nom}$ S$_{nom}$[ ] V$_{fut}$					*			**

In effect, what this analysis predicts for word order variation in Hindi is that word order patterns in the double nominative construction are exactly same as ones in the perfective clause: all six possible orders of subject, object and verb are available for both cases. The general problem of this analysis is overgeneration of outputs which do not coincide with the intuitively preferred reading: as shown in Tableau 4, candidate (d), the OS analysis of the double nominative sentence, is predicted to be grammatical, even if the string part of it clearly has the SO interpretation as the preferred reading. But there is no way to compare these two readings under the standard production (or generation) based optimization model, because they do not belong to the same candidate set. In order to be grammatical, an analysis only needs to be optimal for some underlying input.

3.2.3 Summary

In this section, I proposed an account of the aspectually-conditioned split ergative case system in Hindi, based on the idea of 'output-to-output correspondence' in OT, specifically correspondence between output syntactic structures and morpholexical structures. This was reached by recasting the LFG model of Constructive Case as a component of GEN in OT. This account of case overcomes the problem inherent to lexicalist theories of syntax that the lexicon stipulates what are generalizations derivable from universal principles of markedness. We have also seen a possible account of interaction of case and word order in Hindi within the standard design of OT. Under the form of OT assumed in the previous chapter, in which syntactic structures are optimized with respect to a semantic input, all possible orderings of argument phrases, both unambiguously case-marked and ambiguously case-marked are generated, and hence no difference in word order flexibility between the two cases is predicted.

3.3 Bidirectional Optimization and Word Order Freezing

In the previous section, we saw that word order freezing does not yet follow from the standard generation-based OT grammar. Intuitively, if we are going to rule out winners in standard generation-based optimization associated with an interpretation that does not match the preferred reading of the string, then we need to have a formal method for allowing the output of generation-based optimization to be checked against the string corresponding to the syntactic parse. This can be achieved by extending optimization to comprehension (or parsing) as well as production (or generation) (Smolensky 1996b, 1998; Wilson 2001). This extended model of optimization is generally called the *bidirectional optimization* model. The relation between production-directed optimization and comprehension-directed optimization proposed in Smolensky (1998) is summarized in (63).

(63) Production/Comprehension Chain of /I/:
/I/—Prod → [S] — overt part ⟶ "O" — Comp →/I′/

/I/ is recoverable from "O", where /I/— Prod → [S], if "O" — Comp →/I/

Production-directed optimization starts with an input /I/ and gives the set of structural descriptions [S] of the input /I/ as an output, whereas comprehension-directed optimization starts out from an overt form "O", and gives all structural descriptions the overt part of which is "O" as an output. So, in syntax we can think of production as a function that takes an underspecified f-structure input to a set of fully specified (c- and f-structure) analyses, and comprehension as a function that takes the string part of the production output and gives a semantic content as an output (i.e., an underspecified f-structure).

The essential idea of bidirectional optimization is *recoverability* of the inputs from the outputs: grammatical outputs must have recoverable meanings. That is, if f_{prod} (production-based function) applied to a given input gives an optimal form-meaning pair $\langle f,\ m\rangle$, then f_{comp} (comprehension-based function) applied to the overt part of the optimal form, should return the same input. If a different input results from f_{comp}, then the original input is unrecoverable, and we can consider the candidate ungrammatical under *bidirectional* optimization.

Bidirectional optimization has been argued for variously in the computational OT literature (e.g., Kuhn 1999, 2000, 2001a,b; Jäger 2000) as well as in the theoretical OT literature (see, e.g., Blutner 2000; Boersma 1999; Lee 2000, 2001b; Smolensky 1996b, 1998; Wilson 2001; Zeevat 2000. Cf. Beaver 2000). Yet the notions of production/generation optimization and comprehension/parsing optimization are not new, and some form of bidirectional optimization has been assumed in the literature on formal pragmatics for quite some time (e.g., Horn (1984)'s I-principles (speaker economy) and Q-principles (hearer economy); see also Levinson (1987) on the competing forces of speaker economy and hearer economy in binding). Blutner (2000) has pioneered a version of bidirectional OT which integrates the interplay between generation optimization and parsing optimization into the overall framework of OT. In his conception of bidirectional optimality (that he calls 'superoptimality') there is a single

ordered set of constraints that regulates the relation between form and meaning. But the constraints are used twice: a pair ⟨*form, meaning*⟩ is superoptimal iff there is no better pair ⟨$form_1$, *meaning*⟩ and no better pair ⟨*form*, $meaning_1$⟩.

Human sentence processing is another area in which the notions of productive parsing and interpretive parsing have been assumed. Recently, Gibson and Broihier (1998) has proposed an optimality-based theory of sentence processing, arguing that garden path effects are predicted if optimal interpretive parses corresponding to some early input cannot be extended. The idea that the same constraints are used both in OT syntax and parsing has also been convincingly demonstrated by Fanselow *et al.* (1999). They have argued that major parsing preferences discussed in the psycholinguistic literature (e.g., garden path effects and late closure effects) can be derived from principles of OT grammar.

Bidirectional optimization has been argued to play a crucial role in learning as well. In the OT learning algorithm developed by Tesar and Smolensky (1998) a stabilized OT grammar can be characterized by the feature of recoverability or bidirectional optimality. Given the error-driven character of the OT learning algorithm, it is crucial that the learner recognizes the need for an adjustment in her constraint ranking, specifically constraint demotion.[21] This need arises whenever the structural description which has been assigned to the overt data (comprehension) is less harmonic than the learner's current grammar's output (production). Relevant constraints are then demoted minimally to make the comprehension output more harmonic. Thus, learning can be possible only when the learner is able to reconstruct the input from the output, and the assumption of bidirectional optimization seems very important to a uniform learning theory for both phonology and syntax.

In this work, I will argue that bidirectional optimization is necessary to account for the duality of argument expression systems that I described in Chapter 1: it reflects principles of grammar and can be explained in terms of the interactions of grammatical constraints and the direction of optimization. First, in the subsections that follow, I present a bidirectional OT account of word order freezing effects in

[21]For criticism of Tesar and Smolensky's learning algorithm, see Hale and Reiss (1998); for an improved learning theory, see Boersma and Hayes (2001).

Hindi and Korean, developing earlier ideas presented in Lee (1999c, 2001b). A similar account of word order freezing has been proposed by Kuhn (1999, 2001a,b), within a broader consideration of the development of a parsing and generation algorithm for OT-LFG. Kuhn (2000, 2001a) also provides an excellent discussion of the different formal options for combining two optimization models, and the general consequences for the character of the resulting combined model.

3.3.1 Case, Word Order and Recoverability in Hindi

Let us start with comprehension-based optimization for the string *Raam-ne bacce-ko uṭ^{h}aayaa* 'Ram lifted the/a child', the overt part of the winner in Tableau 1 in section 3.2.2. Observe the differences in competitor sets in production and comprehension. As shown in Tableau 1 above, in production, what competes are candidates that share the same semantic form or input. Hence, the candidates where *Raam* is the PP and *bacce* 'child' is the PA are not competitors as they do not share the same underlying input. In contrast, in comprehension of the string *Raam-ne bacce-ko uṭ^{h}aayaa* (i.e., the overt part of the production output), only the candidates which share the same string are competing structures and hence different interpretations of this string compete. In the tableaux given below each candidate labeled the same alphabetically (e.g., (a) and (a′)) shares the same string but differs in the semantic role interpretation and grammatical function realization of two argument roles. That is, candidates (a)-(d) mean 'Ram (S) lifted the/a child (O)', whereas candidates (a′)-(d′) mean 'The/a child (S) lifted Ram (O)'. Candidates which are not competitors in the optimization are shaded out in subsequent tableaux.

(64) Tableau 5. Comprehension-based optimization (perfective)

Input: *Raam-ne bacce-ko uṭ^{h}aayaa*	MAX-OO(VOL)$_{perf}$	*ERG	MAX-OO(VOL)	TOP-L	SUBJ-L	OBJ-L	*ACC	*NOM
☞ a. S/PA$_{erg}$[VOL] O/PP$_{acc}$[ ] V$_{perf}$		*				*	*	
b. S/PA$_{nom}$[ ] O/PP$_{acc}$[ ] V$_{perf}$	*!		*			*	*	*
c. O/PP$_{acc}$[ ] S/PA$_{erg}$[VOL] V$_{perf}$		*			*		*	
d. O/PP$_{acc}$[ ] S/PA$_{nom}$[ ] V$_{perf}$	*!		*		*		*	*
a′. O/PP$_{erg}$[VOL] S/PA$_{acc}$[ ] V$_{perf}$	*!	*	*		*		*	
b′. O/PP$_{nom}$[ ] S/PA$_{acc}$[ ] V$_{perf}$	*!		*		*		*	*
c′. S/PA$_{acc}$[ ] O/PP$_{erg}$[VOL] V$_{perf}$	*!	*	*			*	*	
d′. S/PA$_{acc}$[ ] O/PP$_{nom}$[ ] V$_{perf}$	*!		*			*	*	*

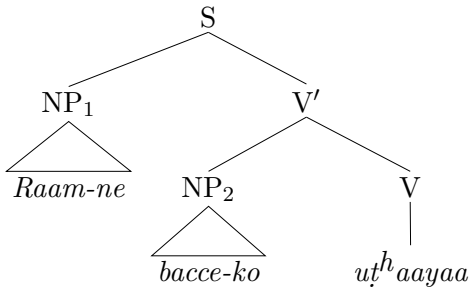
In comprehension-based optimization (64), candidates (a) and (a′) will have the same constraint profile for the markedness constraints on case, as they share the same surface expression.[22] But we do get differences in violations of the faithfulness and alignment constraints. Since MAX-OO(VOL) is the crucial constraint for the outcome here, I will explain how MAX-OO(VOL) violation is checked in comprehension shortly.

Consider the parallel syntactic c- and f-structures of candidate (a) and morpholexical feature structures projected from NPs. What MAX-OO(VOL) checks is the correpondence between the candidates' syntactic f-structure (i.e., the interpretation assumed as underlying in the candidates) and the morpholexical feature structures projected from the preterminal node in the candidates (that Kuhn (2001a) calls λ-projected structures). Note that the value [VOL] appears under the path SUBJ PA-PROP in the f-structure (65) (i.e., $\phi(\mathrm{NP}_1)$), and is present under the path SUBJ PA-PROP in the morpholexical feature structure projected from NP_1 (66a) (i.e., $\lambda(\mathrm{NP}_1)$)

[22]Of course, having identical morphological case is not synonymous with having identical case *features*, as is evident from case syncretism found in languages such as German and Russian, where certain featural distinctions are neutralized by different lexical subclasses of nouns. As argued in Mohanan (1994a), the distinct case markers in Hindi under discussion here (e.g., -*ne* (ergative), -*ko* (accusative) and zero (nominative)) correspond to distinct case features, and the choices among them are governed not by lexical subclasses of nouns but by their syntactic and semantic properties.

as well. Hence candidate (a) satisfies MAX-OO(VOL)$_{perf}$.

(65) Parallel c- and f-structures of candidate (a)



$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{`Raam'} \\ \text{PA-PROP} & \text{VOL} \\ \text{CASE} & \text{ERG} \end{bmatrix} \\ \text{OBJ}_2 & \begin{bmatrix} \text{PRED} & \text{`child'} \\ \text{CASE} & \text{ACC} \end{bmatrix} \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{`lift } \langle \text{PA}_1, \text{PP}_2 \rangle \text{'} \end{bmatrix}$$

(66) a. Morpholexical feature structure projected from NP$_1$ (λ(NP$_1$)):

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`Raam'} \\ \text{PA-PROP} & \text{VOL} \\ \text{CASE} & \text{ERG} \end{bmatrix} \\ \text{ASP} & \text{PERF} \end{bmatrix}$$

b. Morpholexical feature structure projected from NP$_2$ (λ(NP$_2$)):

$$\begin{bmatrix} \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`child'} \\ \text{CASE} & \text{ACC} \end{bmatrix} \end{bmatrix}$$

Now consider the f-structure of candidate (64a′) in (67) and the morpholexical feature structures projected from the NPs in (68) (the c-structure of candidate (a′) is identical to that of candidate (a)). This time the value [VOL] embedded under the path SUBJ PA-PROP in the f-structure (67), projected from NP$_2$ (i.e., ϕ(NP$_2$)) does not appear in the morpholexical feature structure projected from NP$_2$ (i.e., λ(NP$_2$)). Therefore candidate (a′) fails to satisfy MAX-OO(VOL)$_{perf}$. Candidate (a′) also incurs a DEP-OO(VOL) violation: the value [VOL] under the path SUBJ PA-PROP in the morpholexical structure projected from NP$_1$ (68a) (i.e., λ(NP$_1$)) does not correspond to anything in the f-structure (67) (i.e., ϕ(NP$_1$)). Note further that the grammatical function information in the morpholexical feature structures does

not match that in the syntactic f-structure. This situation, too, can be understood as an instance of a DEP-OO violation: the SUBJ feature in the morpholexical structure of the ergative nominal is not integrated into the syntactic f-structure.

(67) F-structure of candidate (a′)

$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{`child'} \\ \text{PA-PROP} & \text{VOL} \\ \text{CASE} & \text{ACC} \end{bmatrix} \\ \text{OBJ}_2 & \begin{bmatrix} \text{PRED} & \text{`Raam'} \\ \text{CASE} & \text{ERG} \end{bmatrix} \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{`lift } \langle \text{PA}_1, \text{PP}_2 \rangle \text{'} \end{bmatrix}$$

(68) a. Morpholexical feature structure projected from NP_1 ($\lambda(\text{NP}_1)$):

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`Raam'} \\ \text{PA-PROP} & \text{VOL} \\ \text{CASE} & \text{ERG} \end{bmatrix} \\ \text{ASP} & \text{PERF} \end{bmatrix}$$

b. Morpholexical feature structure projected from NP_2 ($\lambda(\text{NP}_2)$):

$$\begin{bmatrix} \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`child'} \\ \text{CASE} & \text{ACC} \end{bmatrix} \end{bmatrix}$$

Taking together the two directions of optimization (59) and (64), we have a match. This means that *Raam-ne bacce-ko uṭ^{h}aayaa* is the optimal way of expressing the underlying content 'lift⟨PA, PP⟩, PA=Ram, PP=child, ASP=PERF', and vice versa 'lift⟨PA, PP⟩, PA=Ram, PP=child, ASP=PERF' is the optimal meaning for the string *Raam-ne bacce-ko uṭ^{h}aayaa*.

Let us now turn to comprehension-based optimization for the string *bacce-ko Raam-ne uṭ^{h}aayaa* 'Ram lifted the/a child', the overt part of the winner in Tableau 2 above. Observe again the key role played by the high-ranked faithfulness constraints

MAX-OO(VOL)$_{perf}$ and MAX-OO(VOL) in selecting candidate (c) (OSV interpretation), which correctly realizes the accusative NP as the object and the ergative NP as the subject. Candidate (c′) loses out to (c) for the same reason that candidate (a′) did so to (a).

(69) Tableau 6. Comprehension-based optimization (perfective)

Input: *bacce-ko Raam-ne uṭ^{h}aayaa*	MAX-OO(VOL)$_{perf}$	*ERG	MAX-OO(VOL)	TOP-L	SUBJ-L	OBJ-L	*ACC	*NOM
a. S/PA$_{erg}$[VOL] O/PP$_{acc}$[ ] V$_{perf}$		*				*	*	
b. S/PA$_{nom}$[ ] O/PP$_{acc}$[ ] V$_{perf}$	*!		*			*	*	*
☞ c. O/PP$_{acc}$[ ] S/PA$_{erg}$[VOL] V$_{perf}$		*			*		*	
d. O/PP$_{acc}$[ ] S/PA$_{nom}$[ ] V$_{perf}$	*!		*		*		*	*
a′. O/PP$_{erg}$[VOL] S/PA$_{acc}$[ ] V$_{perf}$	*!	*	*		*		*	
b′. O/PP$_{nom}$[ ] S/PA$_{acc}$[ ] V$_{perf}$	*!		*		*		*	*
c′. S/PA$_{acc}$[ ] O/PP$_{erg}$[VOL] V$_{perf}$	*!	*	*			*	*	
d′. S/PA$_{acc}$[ ] O/PP$_{nom}$[ ] V$_{perf}$	*!		*			*	*	*

Again the production (60) and comprehension (69) processes yield an identical winner. Therefore, this analysis correctly accounts for the fact that the interpretation of the sentences containing unambiguously case-marked arguments in terms of semantic roles does not rely on word order, but is driven by overt case marking.

The application of comprehension-based optimization illustrated above simply confirms the fact that permuting the ergative nominal and accusative nominal does not change the meaning of the sentence. However, applying optimization in both directions produces rather surprising results for sentences with ambiguously case-marked arguments. Let us look first at comprehension-based optimization for the string *patt^{h}ar ṭ^{h}elaa toḍegaa* 'The/a stone will break the/a cart', the overt part of the winner in the production-based competition shown in Tableau 3 (61) above. The competing candidates are candidates (b) and (b′). As shown in the f-structures in (71) below, candidate (b) has *patt^{h}ar* 'stone' as the subject, whereas in (b′) it is the

object. Here the PA argument is specified as [PA-PROP CAUS] rather than [PA-PROP VOL]. The source of the causation information is an entailment of the verb *toḍ* 'break'. It appears that we have to assume that the inputs are processed in the conceptual cognitive system and this excludes implausible input contents in which an inanimate entity performs an action deliberately and consciously.

(70) Tableau 7. Comprehension-based optimization (future)

	Input: *patt^{h}ar ṭ^{h}elaa toḍegaa*	MAX-OO(VOL)$_{perf}$	*ERG	MAX-OO(VOL)	TOP-L	SUBJ-L	OBJ-L	*ACC	*NOM
	a. S/PA$_{erg}$[VOL] O/PP$_{nom}$[ ] V$_{fut}$		*				*		*
☞	b. S/PA$_{nom}$[ ] O/PP$_{nom}$[ ] V$_{fut}$						*		**
	c. O/PP$_{nom}$[ ] S/PA$_{erg}$[VOL] V$_{fut}$		*			*			*
	d. O/PP$_{nom}$[ ] S/PA$_{nom}$[ ] V$_{fut}$					*			**
	a′. O/PP$_{erg}$[VOL] S/PA$_{nom}$[ ] V$_{fut}$		*			*			*
	b′. O/PP$_{nom}$[ ] S/PA$_{nom}$[ ] V$_{fut}$					*!			**
	c′. S/PA$_{nom}$[ ] O/PP$_{erg}$[VOL] V$_{fut}$		*				*		*
	d′. S/PA$_{nom}$[ ] O/PP$_{nom}$[ ] V$_{fut}$						*		**

Here the faithfulness constraints MAX-OO(VOL)$_{perf}$ and MAX-OO(VOL) have no effect, because in the candidates' f-structures there are no [VOL]. This captures the fact that in this case the grammatical function status of arguments is not determined on the basis of case marking alone, even if it normally provides a direct source of grammatical information in the language. So the decision on the grammatical roles of ambiguously case marked arguments is made entirely by the lower-ranking alignment constraints. As can be read off Tableau 7, candidate (b) is selected as the winner, as it incurs no violation of the higher-ranking alignment constraint SUBJ-L. Hence, we have a match between the two directions of optimization (61) and (70): *patt^{h}ar ṭ^{h}elaa toḍegaa* is predicted to be the optimal expression for 'break⟨PA, PP⟩, PA=stone, PP=cart, ASP=FUT'.

(71) a. F-structure for candidate (b)

$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{`stone'} \\ \text{PA-PROP} & \text{CAUS} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ}_2 & \begin{bmatrix} \text{PRED} & \text{`cart'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{ASP} & \text{FUT} \\ \text{PRED} & \text{`break } \langle \text{PA}_1, \text{PP}_2 \rangle \text{'} \end{bmatrix}$$

b. F-structure for candidate (b′)

$$\begin{bmatrix} \text{OBJ}_2 & \begin{bmatrix} \text{PRED} & \text{`stone'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{`cart'} \\ \text{PA-PROP} & \text{CAUS} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{ASP} & \text{FUT} \\ \text{PRED} & \text{`break } \langle \text{PA}_1, \text{PP}_2 \rangle \text{'} \end{bmatrix}$$

An issue not addressed so far is how TOP-L violations are determined when there is no previous sentence. This question is briefly addressed by Beaver (2000). The idea is that when there is no previous sentence, all of the candidates competing in the comprehension-based evaluation regimen under consideration here incur the same number of violations of higher-ranking discourse constraints governing topic choice, and the determination of a sentence topic is left up to the lower ranking syntactic constraint TOP=SUBJ, which requires the topic to be subject. Therefore, the interpretation where the topic is identified with the referent of the subject NP is the preferred interpretation of a discourse-initial sentence. Hence, the SOV analysis would be preferred to the OSV one as the analysis of such a sentence.[23]

[23]But I chose not to indicate TOP-L violations in tableaux illustrating comprehension-based optimization, because it is also possible that there is no sentence topic, as in the case where the entire sentence is a new information focus.

In the grammars of the languages which I focusses on in this work, there is a strong alignment between the syntactic notion of subject, the semantic notion of agent, and the discoursal notion of topic. However, in languages such as Tagalog and other typologically similar languages with a basic VOS order, these three notions are fully independent, since in basic transitive clauses, the subject is not necessarily either the agent or a topic. For example, in a basic transitive clause in Tagalog, in which the patient bears nominative case, there is a very strong tendency for the agent to precede all other arguments (Kroeger 1993). The relative ranking of TOP-L with respect to grammatical function-based alignment constraints alone does not describe the basic order of languages like Tagalog (i.e., V-OBJ$_{agent}$-SUBJ$_{theme/patient}$) correctly[24] and thematic alignment constraints (see section 2.2) have to be taken into consideration. Moreover, the constraint TOP=SUBJ must be "turned off" in Tagalog, because in basic transitive clauses, the subject is not necessarily a topic (Kroeger 1993). I will not try to determine exactly what constraint does this, as the answer to this question would require a detailed study of this word order pattern in Tagalog.

Finally, let us see what happens if we apply comprehension-based optimization to the string *ʈʰelaa pattʰar toḍegaa*, the overt part of the winner in the production-based optimization in Tableau 4 above. As we saw earlier, the standard unidirectional optimization predicts candidate (d), the OSV interpretation, to be grammatical (for the topical content). But if we assume a bidirectional model, we do not know yet whether it is grammatical. So we have to check whether the production-based winner is optimal also for the input string *ʈʰelaa pattʰar toḍegaa*. This comprehension-based optimization is given in (72).

[24] I am grateful to Ash Asudeh for bringing up this issue.

(72) Tableau 8. Comprehension-based optimization (future)

Input: *ṭʰ elaa pattʰ ar toḍegaa*	MAX-OO(VOL)$_{perf}$	*ERG	MAX-OO(VOL)	TOP-L	SUBJ-L	OBJ-L	*ACC	*NOM
a. S/PA$_{erg}$[VOL] O/PP$_{nom}$[ ] V$_{fut}$		*				*		*
b. S/PA$_{nom}$[ ] O/PP$_{nom}$[ ] V$_{fut}$						*		**
c. O/PP$_{nom}$[ ] S/PA$_{erg}$[VOL] V$_{fut}$		*			*			*
d. O/PP$_{nom}$[ ] S/PA$_{nom}$[ ] V$_{fut}$					*!			**
a′. O/PP$_{erg}$[VOL] S/PA$_{nom}$[ ] V$_{fut}$		*			*			*
b′. O/PP$_{nom}$[ ] S/PA$_{nom}$[ ] V$_{fut}$					*			**
c′. S/PA$_{nom}$[ ] O/PP$_{erg}$[VOL] V$_{fut}$		*				*		*
☞ d′. S/PA$_{nom}$[ ] O/PP$_{nom}$[ ] V$_{fut}$						*		**

This time, the assumption of bidirectional optimization proves essential: by bidirectional optimization we correctly predict that the most harmonic meaning for the string *ṭʰ elaa pattʰ ar toḍegaa* is the SO interpretation. What we have here is the emergence of the unmarked (see McCarthy and Prince (1994)) in comprehension grammar: the alignment constraints favoring canonical word order become decisive when faithfulness is no longer a determining factor. The losing candidate (d), even if optimal in production-based optimization (see Tableau 4 above), is blocked (i.e., made suboptimal and thus ungrammatical) by (d′) on markedness grounds. In this way, dynamic interactions between the two alternative devices for grammatical function specification—case marking and word order—are elegantly captured by candidate competition, the ranking of faithfulness constraints and alignment constraints, and the direction of optimization.

Similar results can be shown for the constructions containing multiple nominals with *-ko* and *-se* in Hindi (see section 3.1.1): in this case, thematic alignment constraints (e.g., PA-L) (see section 2.2), ranked higher than grammatical function-based alignment constraints, emerge as decisive in comprehension-directed optimization, forcing the choice of the canonical order (Agent-Source-Theme-V) determined by the thematic role hierarchy in sentences containing multiple nominals with *-ko* and *-se*. I

will not go through these other results here.

3.3.2 Case, Word Order and Recoverability in Korean

This subsection presents a bidirectional OT account of the word order freezing effect in Korean. In order to see how case marking and word order interact with each other in ensuring recoverability of grammatical relations, we first consider the distribution of case in terms of meanings and grammatical functions. After presenting an account of case patterns in Korean, I then go on to show that if we define grammaticality in terms of bidirectional optimization, we can account for word order freezing, in terms of the same set of constraints that characterize crosslinguistic variation in the expression of grammatical relations.

3.3.2.1 Case Patterns in Korean

In this subsection, I present some basic facts about the distribution of case in Korean in terms of meanings and grammatical functions.

Subjects of all monadic verbs in Korean take nominative case. The grammatical subject of a transitive verb, on the other hand, may be nominative or dative, depending on the degree to which the argument possesses the properties of agent or patient proto-roles. In the transitive sentences in (73) and (74), the subjects are nominative, whereas the objects are accusative.

(73) Minho-ka nonmwun-ul ssu-ss-ta.
Minho-NOM paper-ACC write-PST-DECL
'Minho wrote a paper.'

(74) Yumi-ka pyeng-ul kkay-ss-ta.
Yumi-NOM bottle-ACC break-PST-DECL
'Yumi broke a bottle.'

A class of psych-verbs shows the same case marking pattern as regular transitive verbs:

(75) a. Nay-ka kay-lul mwusep-e-ha-n-ta.
I-NOM dog-ACC be.afraid-do-PRES-DECL
'I am afraid of dogs.'

b. Mary-ka umak-ul coh-a-ha-n-ta.
Mary-NOM music-ACC be.fond-do-PRES-DECL
'Mary likes music'

Korean also has classes of dyadic verbs which take two arguments just like regular transitives, but which manifest a different case pattern than the transitive psych-verbs like those in (75). Consider the examples in (76) and (77), repeated from section 3.1.2, which are to be compared with (75). Recall that the theme of the so-called 'unaccusative' psych verbs and existential-possessive verbs is marked nominative instead of accusative, whereas the experiencer and the possessor are marked either dative or nominative.

(76) Psych predicates

a. John-eykey/i paym-i kacang mwusep-ta.
John-DAT/NOM snake-NOM most be.fearful-DECL
'John is afraid of snakes.'

b. Mary-eykey/ka koyangi-ka coh-ta.
Mary-DAT/NOM cat-NOM like-DECL
'Mary likes cats.'

(77) Existential-possessive predicates

a. Mary-eykey/ka yenge kyosa-ka philyoha-ta.
Mary-DAT/NOM English teacher-NOM need-DECL
'Mary needs an English teacher.'

b. Wuli ay-eykey/ka chinkwu-ka manh-ta.
our kid-DAT/NOM friend-NOM have.many-DECL
'Our kid has many friends.'

One difference between (75) and (76), besides the case marking pattern, is that in (76), the verbs are stative, whereas in (75), the verbs are nonstative. The nonstative verbs in (75) are formed by attaching *-e-ha* to the verbal stems that appear in (76). There are at least two diagnostics by which we can distinguish nonstative predicates from stative predicates in Korean (Kim 1990). First, only nonstative predicates can occur in the progressive form, as illustrated by the acceptability of (78) and (79), in which the predicate is nonstative, and the unacceptability of (80) and (81), in which the predicate is stative:

(78) a. Minho-ka nonmwun-ul ssu-ko iss-ta.
Minho-NOM paper-ACC write-PROG be-DECL
'Minho is writing a paper.'

b. Yumi-ka pyeng-ul kkay-ko iss-ta.
Yumi-NOM bottle-ACC break-PROG be-DECL
'Yumi is breaking a bottle.'

(79) a. Nay-ka kay-lul mwusep-e-ha-ko iss-ta.
I-NOM dog-ACC be.afraid-do-PROG be-DECL
'I am being afraid of dogs.'

b. Mary-ka umak-ul coh-a-ha-ko iss-ta.
Mary-NOM music-ACC be.fond-do-PROG be-DECL
'Mary likes music'

(80) a. *John-eykey/i paym-i kacang mwusep-ko iss-ta.
John-DAT/NOM snake-NOM most be.afraid-PROG be-DECL
'John is being afraid of snakes.'

b. *Mary-eykey/ka koyangi-ka coh-ko iss-ta.
Mary-DAT/NOM cat-NOM be.fond-PROG be-DECL
'Mary is being fond of cats.'

(81) a. *Mary-eykey/ka yenge kyosa-ka philyoha-ko iss-ta.
Mary-DAT/NOM English teacher-NOM need-PROG be-DECL
'Mary needs an English teacher.'

b. *Wuli ay-eykey/ka chinkwu-ka manh-ko iss-ta.
our kid-DAT/NOM friend-NOM have.many-PROG be-DECL
'Our kid has many friends.'

Second, while nonstative predicates are compatible with the present perfect tense, which is formed by combining the verb stem with *-o-ta*, stative predicates are not. This is illustrated by the acceptability of (82) and (83) containing nonstative predicates, and the unacceptability of (84) and (85) containing stative predicates.

(82) a. Minho-ka nonmwun-ul ssu-e o-ass-ta.
Minho-NOM paper-ACC write have-PST-DECL
'Minho has been writing a paper.'

b. Yumi-ka pyeng-ul kkay o-ass-ta.
Yumi-NOM bottle-ACC break have-PST-DECL
'Yumi has been breaking a bottle.'

(83) a. Nay-ka kay-lul mwusew-e-hay o-ass-ta.
I-NOM dog-ACC be.afraid-do have-PST-DECL
'I have been afraid of dogs.'

b. Mary-ka umak-ul coh-a-hay o-ass-ta.
Mary-NOM music-ACC be.fond-do have-PST-DECL
'Mary has liked music.'

(84) a. *John-eykey/i paym-i kacang mwusew-e o-ass-ta.
John-DAT/NOM snake-NOM most be.afraid have-PST-DECL
'John has been afraid of snakes.'

b. *Mary-eykey/ka koyangi-ka coh-a o-ass-ta.
Mary-DAT/NOM cat-NOM be.fond have-PST-DECL
'Mary has been fond cats.'

(85) a. *Mary-eykey/ka yenge kyosa-ka philyohay o-ass-ta.
Mary-DAT/NOM English teacher-NOM need have-PST-DECL
'Mary has needed an English teacher.'

b. *Wuli ay-eykey/ka chinkwu-ka manh-a o-ass-ta.
our kid-DAT/NOM friend-NOM have.many have-PST-DECL
'Our kid has had many friends.'

This difference between the regular transitive verbs and the so-called 'unaccusative' transitives has led many researchers to propose that the stativity of a verb is what determines unaccusativity in Korean. For example, Kang (1986) proposed that nonstative verbs in Korean assign accusative case to their complements, whereas stative verbs do not. Kuno (1973) proposed for Japanese that a nonstative verb marks its object accusative, whereas a stative verb marks its object nominative.

As Kim (1990) rightly points out, however, accusative marking is not governed by the stativity of predicate alone, and the correlation between accusative case on object and the stativity of a predicate is only partial, as illustrated by the existence of nonstative dyadic verbs that do not assign accusative to their arguments:

(86) Locative predicates

a. Yumi-eykey/ka ton-i sayngki-ko iss-ta.
Yumi-DAT/NOM money-NOM come.to.exist-PROG be-DECL
'Yumi is getting money.' (Lit. 'Yumi is coming to have money.')

b. Tomato-eykey/ka pelley-ka manhi kki-ko iss-ta.
tomato-DAT/NOM bug-NOM a lot gather-PROG be-DECL
'Tomatoes are gathering a lot of bugs.'

The dyadic locative verbs exemplified in (86) exhibit exactly the same case-marking pattern as do the base-form psych verbs in (76) and the existential-possessive verbs in (77), though these two classes of verbs differ in stativity. In addition to the case marking pattern, all the dyadic verbs in (76), (77), and (86) above share one significant feature with one another: their subjects are all nonagentive. On the other hand, the *-e-ha* psych verbs exemplified in (75) share the agentivity feature with regular transitive verbs.

The agentivity property of the regular transitive verbs and the *-e-ha* psych verbs compared with the bare-form psych verbs and the locative verbs in (86) is attested by the fact that only the former types pass the agentivity tests that have been established in the Korean literature. As illustrated in (87) and (88), the regular transitive verbs and the *-e-ha* psych verbs can cooccur with the adverbial *uytocekulo* 'deliberately' (87a,b) and occur as complements of agentive control verbs (88a,b), whereas the bare-form psych verbs and the dyadic locative verbs cannot occur in either of these sentence patterns (87c,d) and (88c,d).

(87) Compatibility with *uytocekulo* 'deliberately'

a. Yumi-ka pyeng-ul uytocekulo kkay-ss-ta.
Yumi-NOM bottle-ACC deliberately break-PST-DECL
'Yumi deliberately broke a bottle.'

b. Mary-ka umak-ul uytocekulo coh-a-ha-n-ta.
Mary-NOM music-ACC deliberately be.fond-do-PRES-DECL
'Mary deliberately likes music.'

c. *Mary-eykey/ka koyangi-ka uytocekulo coh-ta.
Mary-DAT/NOM cat-NOM deliberately be.fond-DECL
'Mary deliberately likes cats.'

d. *Yumi-eykey/ka ton-i uytocekulo sayngki-ess-ta.
Yumi-DAT/NOM money-NOM deliberately come.to.exist-PST-DECL
'Yumi deliberately got money.'

(88) Embedding under agentive control verbs

a. Yumi-ka pyeng-ul kkay-lyeko nolyekha-yess-ta.
Yumi-NOM bottle-ACC break-COMP endeavor-PST-DECL
'Yumi tried to break a bottle.'

b. Mary-ka umak-ul coh-a-ha-lyeko nolyekha-yess-ta.
Mary-NOM music-ACC be.fond-do-COMP endeavor-PST-DECL
'Mary tried to like music.'

c. *Mary-eykey/ka koyangi-ka coh-ulyeko nolyekha-yess-ta.
Mary-DAT/NOM cat-NOM be.fond-COMP endeavor-PST-DECL
'Mary tried to like cats.'

d. ??Yumi-eykey/ka ton-i sayngki-lyeko nolekha-yess-ta.
Yumi-DAT/NOM money-NOM come.to.exist-COMP endeavor-PST-DECL
'Yumi tried to get money.'

The semantic characterization that provides the basis for case pattern in Korean should not be understood as a privative contrast between the presence and absence of agentivity. Rather, the property of agentivity here needs to be taken as a notion comprised of more primitive properties, as Dowty (1991) suggests. For our purposes, it is useful to classify the proto-role properties proposed in Dowty (1991) into two groups: those which play a more salient role in determining the Proto-Role classification of an argument and those which are less determining properties.

(89) Table 2. Classification of the semantic entailment of arguments

	P(roto)-A(gent) properties	P(roto)-P(atient) properties
Primary Properties	causer volitional involvement	incremental theme undergoes change of state causally affected
Secondary Property	sentience/perception	
Other Properties	movement independent existence	stationary does not exist independently of the event or not at all.

As has been pointed out by many researchers (e.g., Alsina 1993; Davis 1996), the individual Proto-Role properties are not equal in their relative strength or importance. If an argument is an incremental theme that serves to measure the completion of the event, for example, it is necessarily classified as a PP (Dowty 1991:607). Two other predicate entailments that play a salient role in determining the PP classification of an argument are 'undergoing a change of state' and 'being causally affected by another participant'. As for the PA properties, 'causing an event or change of state in another participant' and 'volitional involvement' seem to be determining properties in the PA classification of an argument. The property of sentience (and/or perception) also seems to be relevant but only if none of the primary PA properties and PP properties apply to the arguments, as Alsina (1993) notes. Hence it is classified as a secondary PA property here. In cases where two arguments of a transitive predicate are not entailed to have primary PA properties or PP properties, languages show greater variation in the way they classify arguments as PA or PP.

The fact that the individual predicate entailments of Dowty's are not equal in strength or importance is also reflected in the Korean case patterns that we saw above. The correlation between the two semantic features of predicates, i.e., stativity and agentivity and their case patterns is summarized in (90), where [+primary PA-properties] indicates that an argument is entailed to have primary PA-properties by the predicate, and [−primary PA-properties] that it is not entailed to.

(90) Table 3. Semantic features of Korean predicates and their case marking pattern

	+ Primary PA-properties	− Primary PA-properties
+ Stative		bare-form psych predicates existential-possessive predicates **dat/nom-nom**
− Stative	regular transive verb *-e-ha* form psych verb **nom-acc**	dyadic locative predicates **dat/nom-nom**

As the above table shows, there is a systematic correlation between case marking and the primary PA properties of arguments in Korean. First, what is important to note is the fact that it is the presence or absence of the primary PA properties rather than stativity that is responsible for the distribution of accusative and nominative case on the object. That is, the theme arguments of a predicate whose subject is entailed to have a primary PA property are accusative.[25] Otherwise, they are nominative. This pattern can be seen as an instance of situations where the case on one argument depends on the property of another, i.e., *dependency effects*. The dative case on the experiencer/goal type argument of a transitive predicate is governed by the same semantic factor: it is restricted to a clause containing arguments that are not entailed to have a primary PA property by the predicate.

The case patterns in Korean discussed so far are summarized as follows:

(91) Case patterns in Korean

a. The case on subjects and objects is determined according to the degree to which the arguments possess the primary PA properties rather than the stativity of the predicate.

b. The case pattern of transitive predicates which entail primary PA properties for their argument is nominative-accusative.

[25] Although they will not be shown here, this claim is confirmed by case patterns in a number of other verb classes describing change of state (e.g., 'come to exist') and differences in case patterns between unaccusative and transitive verbs describing bodily processes (e.g., 'sweat', 'bleed', etc.). See Kim (1990, section 3.2.2) for further details and examples.

c. The case pattern of transitive predicates which do not entail primary PA properties for their highest arguments is nominative-nominative. Of these, those which have an experiencer/goal type of argument allow the dative-nominative pattern.

The next subsection will account for these patterns in terms of a small set of faithfulness and markedness constraints.

3.3.2.2 Conflict of Markedness and Faithfulness in the Korean Case System

In this subsection I will provide an OT analysis for the following features of the Korean case system:

(92) a. The dative-nominative alternation on subject

b. The dependency effect in object marking

These facts will fall out of a small set of markedness and faithfulness constraints that are crosslinguistically plausible.

As before, in the present framework, case morphemes are modeled as pairings of an actual form of case and its semantic and morphosyntactic content. As shown in (93), for example, the dative case marker, as a category of semantic case, is assigned the features [PA-PROP ¬PRIM] and [PA-PROP SENT] (PRIM abbreviates'primary proto-role properties'; ¬PRIM is an abbreviation for ¬CAUS and ¬VOL); the accusative is specified for [PP-PROP], with its value unspecified in the lexicon, and the nominative is left unspecified. This is instrumental in capturing the fact that dative occurs with nonagentive sentient arguments and accusative with themes/patients, whereas nominative occurs with a wider range of semantic roles. Thus, in this analysis, the nominative is the least marked case, being less restricted in its distribution and more general in its featural specification.

(93) a. Dative case marker:
-eykey: $\begin{bmatrix} \text{PA-PROP} & \begin{bmatrix} \neg\text{PRIM} \\ \text{SENT} \end{bmatrix} \end{bmatrix}$

b. Accusative case marker:
-(l)ul: $\begin{bmatrix} \text{PP-PROP} \end{bmatrix}$

c. Nominative case marker:
-i/ka: $\begin{bmatrix} \end{bmatrix}$

Having characterized the content of the lexical entries of the case morphemes, let us now define our constraint set. Based on the above discussion, I propose the following faithfulness constaints, which compare the proto-role features in a candidate's syntactic f-structure and those in the morpholexical structure of a case-marked NP:

(94) FAITHFULNESS constraints

a. IDENT-OO(PA-PROP): If the output syntactic f-structure and morpholexical feature structures both have a PA-PROP(ERTY) feature, the values are identical.

b. MAX-OO(SENT): If the output syntactic f-structure has a SENT value, its corresponding morpholexical feature structure has a SENT value.

These are in conflict with the markedness constraints in (95) (repeated from section 3.2), ranked as shown.

(95) Context-free MARKEDNESS constraints: *DAT $\gg$ *ACC $\gg$ *NOM

In terms of markedness, dative is always worse than nominative and accusative, because it is more marked from the point view of featural complexity. However, in terms of faithfulness (MAX-OO(SENT)), it is better than nominative and accusative as the expression of the SENTIENCE feature (see (93a)); nominative and accusative are not specified for this feature and hence they will be unfaithful to an input (reflected

in the candidate syntactic f-structure) specified for [SENT]. However, for an input specified for primary PA-properties, i.e., causer or volitionality, dative is not allowed for the subject. As we see in the tableaux shortly, this is due to the higher ranking of IDENT-OO(PA-PROP) above MAX-OO(SENT) in Korean: the dative marking of subjects which are a causer or a volitional agent will cause a mismatch between the value for the feature CAUS or VOL in a candidate's syntactic f-structure and that in its morpholexical f-structure, thus leading to a violation of the higher ranking constraint IDENT-OO(PA-PROP).

The markedness constraints in (95) are context-free, since they apply to case-marked nominals of any kind, regardless of their association with particular grammatical functions or their occurrence in particular morphosyntactic contexts. The interaction of these context-free markedness constraints and the faithfulness constraints predicts the distribution of semantic case with respect to meaning. We also need context-sensitive markedness constraints to derive the distribution of case with respect to grammatical function. The following contextual markedness constraints, which hold of arguments of particular grammatical functions, were already introduced in section 2.4.2:

(96) Contextual MARKEDNESS constraints:

a. *SUBJ/ACC, *SUBJ/DAT $\gg$ *SUBJ/NOM

b. *$\sim$SUBJ/NOM $\gg$ *$\sim$SUBJ/ACC, *$\sim$SUBJ/DAT

Interestingly, the contextual and context-free markedness constraints above express conflicting requirements. For example, according to the subhierarchy of the context-free markedness constraints *ACC $\gg$ *NOM, nominative is less marked than accusative. But it is more marked than accusative as the case of a nonsubject, as expressed by the subhierarchy (96b). Korean resolves this conflict in the favor of contextual markedness.[26]

[26]The attentive reader may have noted that the higher ranking of the subhierarchy (96b) above the subhierarchy of the context-free markedness constraints *ACC $\gg$ *NOM does not make a correct prediction about the case of objects of so-called 'unaccusative transitives', which is nominative. As will be shown shortly, the fact that the dative-accusative pattern is never allowed in Korean

In what follows, I will abbreviate markedness constraint types as M (for context-free markedness constraints) and M_C (for context-sensitive markedness constraints). These three types of constraints are ranked in the following way in Korean, instantiating what one may call the alternating dative subject language:

(97) Ranking schema for alternating dative subject language (e.g., Korean):
IDENT-OO $\gg$ {MAX-OO, M_C} $\gg$ M
IDENT-OO(PA-PROP) $\gg$ {MAX-OO(SENT), *SUBJ/DAT} $\gg$ *DAT, *$\sim$SUBJ/NOM $\gg$ *$\sim$SUBJ/ACC $\gg$ *ACC $\gg$ *NOM

This ranking makes a few predictions for situations where more than one case is potentially available to the same argument. First, the distribution of dative in transitive clauses follows from the relative ranking of the faithfulness constraints (favoring semantic case) and markedness constraints (favoring grammatical case). Specifically, the dative-nominative case alternation on subjects can be modeled by treating these two constraints as floating constraints having variable rankings (Boersma 1997; Boersma and Hayes 2001) and allowing them to rerank with respect to each other. As we will see in the tableaux that follow, there will be two evaluations, one in which MAX-OO(SENT) outranks *DAT and the other in which these are ranked in reverse order. Evaluation of the first type will yield a candidate with a dative subject as the winner from an input which is specified as [PA-PROP SENT]; evaluation of the second type will yield a candidate with a nominative subject.[27] As will be formally shown below, what determines the case of objects in situations in which two different grammatical cases are potentially available is the ranking of the IDENT and MAX classes of faithfulness constraints and the markedness constraints.

By ranking MAX-OO(SENT) above *SUBJ/DAT, as in (98), we can derive a type of dative subject language in which the dative is restricted to a sentient argument of

(or in Hindi) is due to the relative ranking of faithfulness and markedness constraints, not just of markedness constraints.

[27]This does not mean that the choice between dative and nominative case is insignificant and absolutely random. Rather what the variable ranking here attempts to capture is that the variation in case on subjects is not determined by the markedness and faithfulness constraints proposed here. As mentioned earlier in section 3.1.2, the nominative case marker in Korean has the function of marking specific topic or exclusive focus. This will be captured by treating the nominative case marker in Korean as the element that parses the 'exclusive focus' information in the input.

a transitive predicate which is not entailed to have primary PA-properties, but does not alternate with nominative. An example of this nonalternating type is Hindi.[28]

(98) Ranking schema for nonalternating dative subject language (e.g., Hindi):
IDENT-OO ≫ MAX-OO ≫ M_C ≫ ...
IDENT-OO(PA-PROP) ≫ MAX-OO(SENT) ≫ *SUBJ/DAT ≫ ...

Korean and Hindi thus differ from each other with respect to whether dative alternates with nominative for the same argument. But both the languages show a valency effect, prohibiting dative subjects in intransitive clauses.

There is another subtype of dative subject language that shows no such restriction on the distribution of the dative, allowing dative subjects in intransitive clauses as well as in transitives. Woolford (2001) classifies Icelandic as an example of this type and proposes to account for the valency effect in the distribution of dative in terms of following rankings:

(99) a. Korean/Hindi type: FAITH-LEX$_{trans}$ ≫ *DAT ≫ FAITH-LEX

b. Icelandic type: FAITH-LEX$_{trans}$ ≫ FAITH-LEX ≫ *DAT

In what follows, I will restrict the discussion of case patterns to transitive clauses and assume that the faithfulness constraints are implicitly restricted to transitive context.

Before we look at a few tableaux illustrating how the above rankings produce the desired results, let us briefly discuss the candidate set to which the constraints in (97) apply.

Here we will consider four possible output candidates: the nominative-accusative candidate (a), the nominative-nominative candidate (b), the dative-nominative candidate (c) and the dative-accusative candidate (d). Among these, the morpholexical

[28] Although I classify Hindi as what one may call the 'nonalternating' dative subject language, the terminology only means that the case of the sentient argument of a transitive predicate which is not entailed to have primary PA-properties is nonalternating, but not that the grammatical function of such an argument must always be the subject. As discussed in section 2.1.1 in detail, nonvolitional transitives in Hindi are subject/object alternating verbs, i.e., either of the two arguments of the verb may be construed as subject, and the other as object.

f-structure (100d) violates the Uniqueness condition since there is one attribute (PA-PROP with two different values (¬PRIM and PRIM). Such ill-formed candidates will not be shown in subsequent tableaux. Again, the candidates are quadruples of (morpholexical and syntactic) feature structures, trees, lexical strings and correspondence functions. The morpholexical feature structures associated with the four candidates under consideration here are shown in (100), where $\lambda(\mathrm{NP}_1)$ and $\lambda(\mathrm{NP}_2)$ are morpholexical f-structures projected from the SUBJ NP and OBJ NP respectively, and $\lambda(\mathrm{NP}_1) + \lambda(\mathrm{NP}_2)$ is a unification of these two structures.

(100) a. Candidate (a) (nom-acc): Morpholexical f-structure projected from NPs

$\lambda(\mathrm{NP}_1)$:
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

$\lambda(\mathrm{NP}_2)$:
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PA-PROP} & \text{PRIM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{CASE} & \text{ACC} \end{bmatrix} \end{bmatrix}$$

$\lambda(\mathrm{NP}_1) + \lambda(\mathrm{NP}_2)$:
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PA-PROP} & \text{PRIM} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{CASE} & \text{ACC} \end{bmatrix} \end{bmatrix}$$

b. Candidate (b) (nom-nom): Morpholexical f-structure projected from NPs

$\lambda(\mathrm{NP}_1)$:
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

$\lambda(\mathrm{NP}_2)$:
$$\begin{bmatrix} \text{OBJ} & \begin{bmatrix} \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

$\lambda(\mathrm{NP}_1) + \lambda(\mathrm{NP}_2)$:
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

c. Candidate (c) (dat-nom): Morpholexical f-structure projected from NPs

$\lambda(\mathrm{NP}_1)$:
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PA-PROP} & \begin{bmatrix} \neg\text{PRIM} \\ \text{SENT} \end{bmatrix} \\ \text{CASE} & \text{DAT} \end{bmatrix} \end{bmatrix}$$

$\lambda(\mathrm{NP}_2)$:
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PA-PROP} & \neg\text{PRIM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

$\lambda(\mathrm{NP}_1) + \lambda(\mathrm{NP}_2)$:
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PA-PROP} & \begin{bmatrix} \neg\text{PRIM} \\ \text{SENT} \end{bmatrix} \\ \text{CASE} & \text{DAT} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

d. Candidate (d) (dat-acc): Morpholexical f-structure projected from NPs

$\lambda(\mathrm{NP}_1)$:
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PA-PROP} & \begin{bmatrix} \neg\text{PRIM} \\ \text{SENT} \end{bmatrix} \\ \text{CASE} & \text{DAT} \end{bmatrix} \end{bmatrix}$$

$\lambda(\mathrm{NP}_2)$:
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PA-PROP} & \neg\text{PRIM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{CASE} & \text{ACC} \end{bmatrix} \end{bmatrix}$$

$\lambda(\mathrm{NP}_1) + \lambda(\mathrm{NP}_2)$:
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PA-PROP} & \begin{bmatrix} \neg\text{PRIM/PRIM} \\ \text{SENT} \end{bmatrix} \\ \text{CASE} & \text{DAT} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{CASE} & \text{ACC} \end{bmatrix} \end{bmatrix}$$

Notice that the candidate morpholexical structures (100c) and (100d) with the dative subject NP carry a negative specification for the primary PA-properties (indicated as ¬PRIM, which abbreviates ¬CAUS and ¬VOL). As discussed above, this information comes from the lexical entry of the dative case marker, repeated below:

(101) Dative case marker:

$$\textit{-eykey}\text{: } \begin{bmatrix} \text{PA-PROP} & \begin{bmatrix} \neg\text{PRIM} \\ \text{SENT} \end{bmatrix} \end{bmatrix}$$

On the other hand, it is assumed here that the accusative is only specified as [PP-PROP], and the nominative is left unspecified and that the proto-role information about the subject of the clause specified in the morpholexical structure for the accusative NP is provided by GEN. Unlike the LFG model of Constructive Case, however, GEN is not deterministic of the morpholexical structures of individual languages. It merely constructs the formal space of candidate morpholexical structures, from which EVAL selects the natural typological space of structures.

Let me illustrate this with an example of accusative case in Hindi and Korean. As I mentioned in section 2.1.1 (see fn. 2 of Chapter 2), Hindi exhibits an accusative split: the (direct) object of transitive verbs is accusative if the referent of the object NP is human, animate-specific, or inanimate-definite (Mohanan 1994a). This variation is not found in nonvolitional transitives, where the theme argument is always nominative, even if human or animate. Based on this pattern, we can postulate the following feature structure constructed by the accusative object NP *Mary-ko* 'Mary-ACC', using Constructive Case:

(102)
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PA-PROP} & \text{PRIM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{'Mary'} \\ \text{CASE} & \text{ACC} \\ \text{ANIM} & \text{HUMAN} \end{bmatrix} \end{bmatrix}$$

Obviously, the semantic content of the accusative object in Korean differs from that in (102): the accusative marker in Korean can mark any kind of theme/patient

argument, regardless of animacy and specificity/definiteness, as long as the subject of the clause is a volitional agent. In other words, it only expresses the content shown in (100a), but does not express the animacy or specificity/definiteness of the nominal to which it is attached. GEN constructs many more types of morpholexical feature structures for the accusative NP other than those given above, and which of these structures is favored in individual grammars is determined by the language-particular rankings of the constraint set.

Suppose now that the context-sensitive markedness constraints (from (96b)) are ranked with respect to the faithfulness constraints on PA-PROP and ANIM(ACY)/DEF (INITENESS) as in (103):

(103) IDENT-OO(PA-PROP) $\gg$ *$\sim$SUBJ/NOM $\gg$ *$\sim$SUBJ/ACC $\gg$ MAX-OO(ANIM), MAX-OO(DEF)

The placement of IDENT-OO(PA-PROP) above the markedness constraints on the case of nonsubjects means that it is worse for an object NP to be unfaithful to the value of the feature PA-PROP in the output syntactic f-structure (reflecting the input) than to be realized as accusative, the unmarked case for an object. Hence, the nominative case, not being specified for any PA-properties and thus incurring no violations of IDENT-OO(PA-PROP), will be preferred over the accusative as the case of the subject specified as [PA-PROP $\neg$PRIM] in the syntactic f-structure; the accusative will be optimal for expressing an object that cooccurs with a subject that has primary PA-properties under the same ranking. But the accusative object in Korean will not be limited to animate or definite nominals. Hence, accusative objects will be unfaithful to an output syntactic f-structure in which the object is specified as human or definite. But this will matter less, given the lower ranking of MAX-OO(ANIM) and MAX-OO(DEF).

Demotion of the markedness constraints below the MAX constraints for animacy and definiteness, illustrated in (104), would yield a language like Hindi, which exhibits an accusative split. The ranking of MAX-OO(ANIM) and MAX-OO(DEF) above the markedness constraints means that violations of the former are worse than violations of the latter. Hence the candidate feature structure (102), specified for animacy, will

be preferred over those in (100a) and (100d) (which is ill-formed) and also over the one in (105), which satisfies MAX-OO(ANIM) but violates *∼SUBJ/NOM.

(104) IDENT-OO(PA-PROP) ≫ MAX-OO(ANIM), MAX-OO(DEF) ≫ *∼SUBJ/NOM ≫ *∼SUBJ/ACC

(105)
$$\begin{bmatrix} \text{SUBJ} & \left[\text{PA-PROP} \quad \text{PRIM}\right] \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`Mary'} \\ \text{CASE} & \text{NOM} \\ \text{ANIM} & \text{HUMAN} \end{bmatrix} \end{bmatrix}$$

In fact, the picture that we have just drawn for the accusative split in Hindi is a simplified version of what actually happens. According to the literature on object case in Hindi, Hindi distinguishes three categories of direct object: (i) those which must be accusative, (ii) those which are either nominative or accusative, and (iii) those which can only be nominative but not accusative. Obligatorily accusative objects are those object NPs referring to humans. The categories of objects that can be either nominative or accusative are human-referring non-specifics and inanimate definites; inanimate-referring non-specifics and specifics can only be nominative. What seems to be needed here is the ranking of a set of locally conjoined constraints that pertain to the dimensions of animacy and definiteness simultaneously (along the lines of Aissen (2000)). Despite the complexity of the phenomena, the main points of the discussion are clear: whether an object is realized by accusative or nominative results from its animacy/definiteness, or the fact of whether it is a participant of a prototypical transitive verb or an unaccusative transitive, or from both. This fact indicates that the lexical entries of the case markers must not stipulate any sortal specification, and strongly argues for an approach that derives the key properties of their distribution through interactions of general constraints.

Let us now look at a few tableaux which illustrate the analysis. The tableaux have been simplified by omitting other morpholexical f-structures for an accusative NP constructed by GEN, considering only the ones in (100a) and (100d), which are unspecified for animacy/definiteness and other semantic properties.

Tableau 9 shows the evaluation of a transitive clause whose input specifies a causer agent (indicated as [PA-PROP CAUS]), and a causally affected patient ([PP-PROP AFFECTED]). This input will have the Korean example (74), repeated below as (106), as its optimal realization.

(106) Yumi-ka pyeng-ul kkay-ss-ta.
Yumi-NOM bottle-ACC break-PST-DECL
'Yumi broke a bottle.'

As before, the candidate f-structures contain the input together with interpretationally irrelevant morphosyntactic case features provided by GEN. So, in the present model the lexical optimizations can be carried out against the candidate f-structures and are constrained by the markedness constraints and faithfulness constraints introduced above. As can be seen by comparing the syntactic f-structures of the candidates and their corresponding morpholexical structures in (100), the dative subject candidates (c) and (d) are eliminated by the high ranking constraint, IDENT-OO(PA-PROP). The remaining candidates, with the nominative subject, incur no violation of the high ranking faithfulness constraints and markedness constraints penalizing the dative, so those constraints have no effect. The decision is made by the next markedness constraint *∼SUBJ/NOM, which eliminates the nominative-nominative pattern, leaving the nominative-accusative candidate (a) as the optimal one.

(107) Tableau 9. Case pattern in Korean transitives I

	Input: [GF$_1$ [PRED 'Yumi'; PA-PROP CAUS]; GF$_2$ [PRED 'bottle'; PP-PROP AFFECTED]; PRED 'break ⟨PA$_1$, PP$_2$⟩']	IDENT-OO(PA-PROP)	{MAX-OO(SENT), *SUBJ/DAT},	*DAT	*∼SUBJ/NOM	*∼SUBJ/ACC	*ACC	*NOM
a. ☞	[SUBJ$_1$ [PRED 'Yumi'; PA-PROP CAUS; CASE NOM]; OBJ$_2$ [PRED 'bottle'; PP-PROP AFFECTED; CASE ACC]; PRED 'break ⟨PA$_1$, PP$_2$⟩']					*	*	*
b.	[SUBJ$_1$ [PRED 'Yumi'; PA-PROP CAUS; CASE NOM]; OBJ$_2$ [PRED 'bottle'; PP-PROP AFFECTED; CASE NOM]; PRED 'break ⟨PA$_1$, PP$_2$⟩']				*!			**
c.	[SUBJ$_1$ [PRED 'Yumi'; PA-PROP CAUS; CASE DAT]; OBJ$_2$ [PRED 'bottle'; PP-PROP AFFECTED; CASE NOM]; PRED 'break ⟨PA$_1$, PP$_2$⟩']	*!		*	*	*			*

Now let us consider Tableau 10, which shows the evaluation of a transitive clause with a volitional and sentient agent and a theme with no primary PP-property. This input will have the Korean example (75a), repeated below as (108), as its optimal

expression.

(108) Nay-ka kay-lul mwusep-e-ha-n-ta.
I-NOM dog-ACC be.afraid-do-PRES-DECL
'I am afraid of dogs.'

(109) Tableau 10. Case pattern in Korean transitives II

	Input: [GF$_1$ [PRED PRO; PA-PROP [VOL; SENT]]; GF$_2$ [PRED 'dog']; PRED 'be afraid of ⟨PA$_1$, PP$_2$⟩']	IDENT-OO(PA-PROP)	{MAX-OO(SENT),	*SUBJ/DAT}	*DAT	*∼SUBJ/NOM	*∼SUBJ/ACC	*ACC	*NOM
a. ☞	[SUBJ$_1$ [PRED PRO; PA-PROP [VOL; SENT]; CASE NOM]; OBJ$_2$ [PRED 'dog'; CASE ACC]; PRED 'be afraid of ⟨PA$_1$, PP$_2$⟩']		*				*	*	*
b.	[SUBJ$_1$ [PRED PRO; PA-PROP [VOL; SENT]; CASE NOM]; OBJ$_2$ [PRED 'dog'; CASE NOM]; PRED 'be afraid of ⟨PA$_1$, PP$_2$⟩']		*			*!			**
c.	[SUBJ$_1$ [PRED PRO; PA-PROP [VOL; SENT]; CASE DAT]; OBJ$_2$ [PRED 'dog'; CASE NOM]; PRED 'be afraid of ⟨PA$_1$, PP$_2$⟩']	*!		*	*	*			*

As we see from the tableau above, the candidates (c) and (d) with a dative subject have a fatal violation of IDENT-OO(PA-PROP), as they contain conflicting values for the feature VOL in their syntactic f-structure and morpholexical f-structure. The candidates (a) and (b), violate MAX-OO(SENT), as the feature SENT in its syntactic f-structure does not correspond to anything in its morpholexical f-structure. But this violation matters less, because Korean has the ranking IDENT-OO(PA-PROP) $\gg$ MAX-OO(SENT), thus favoring deleting the proto-role feature over changing its value. Hence, again, candidate (a) is the winner.

In clauses like (76a), repeated below as (110), where both arguments do not have any of the primary PA properties, the high-ranked constraint IDENT-OO(P-ROLE) is decisive for the outcome here, excluding candidates (a) and (d) with an accusative marked object. The next two constraints, MAX-OO(SENT) and *SUBJ/DAT, are variably ranked in Korean. Hence, candidates (b) and (c) are both optimal, depending on which of the variable constraint rankings of these is realized at evaluation time.

(110) John-eykey/i paym-i kacang mwusep-ta.
John-DAT/NOM snake-NOM most be.fearful-DECL
'John is afraid of snakes.'

(111) Tableau 11. Case pattern in Korean transitives III

	Input: [GF$_1$ [PRED 'John', PA-PROP [¬PRIM, SENT]], GF$_2$ [PRED 'snake'], PRED 'be afraid of ⟨PA$_1$, PP$_2$⟩']	IDENT-OO(PA-PROP)	{MAX-OO(SENT),	*SUBJ/DAT	*DAT	*∼SUBJ/NOM	*∼SUBJ/ACC	*ACC	*NOM
a.	[SUBJ$_1$ [PRED 'John', PA-PROP [¬PRIM, SENT], CASE NOM], OBJ$_2$ [PRED 'snake', CASE ACC], PRED 'be afraid of ⟨PA$_1$, PP$_2$⟩']	*!	*				*	*	*
b. ☞	[SUBJ$_1$ [PRED 'John', PA-PROP [¬PRIM, SENT], CASE NOM], OBJ$_2$ [PRED 'snake', CASE NOM], PRED 'be afraid of ⟨PA$_1$, PP$_2$⟩']		*			*			**
c. ☞	[SUBJ$_1$ [PRED 'John', PA-PROP [¬PRIM, SENT], CASE DAT], OBJ$_2$ [PRED 'snake', CASE NOM], PRED 'be afraid of ⟨PA$_1$, PP$_2$⟩']			*	*	*			*

Thus, the constraint system presented here can account for the key features of the Korean case system summarized in (92) in terms of a single formal mechanism, namely the ranking of simple, violable markedness and faithfulness constraints in parallel structures in a way exactly analogous to the analysis of the honorific agreement (section 2.4.1) and the aspectually-conditioned split ergative case system in Hindi (sections 3.2 and 3.3.1). This demonstrates the generality of the present parallel correspondence-based model of OT-LFG as a more integrated theory of the morphosyntactic expression of grammatical relations.

3.3.2.3 Consequences of Violable Markedness and Faithfulness Constraints for Recoverability

Having identified the constraint set that accounts for the case pattern in Korean, let me now bring the two sets of constraints on case and constituent order together in a single ranking and demonstrate how their interaction explains the observed relation between case marking and word order in the language.

Recall that the case pattern in Koran volitional psych predicates is nominative-accusative, as seen in the example in (108), repeated below.

(112) Nay-ka kay-lul mwusew-e-ha-n-ta.
I-NOM dog-ACC be.afraid-do-PRES-DECL
'I am afraid of dogs.'

The two argument NPs in (112) can appear in either order preceding the verb, and change in their order (as in (113)) does not change the basic meaning of the sentence.

(113) Kay-lul nay-ka mwusew-e-ha-n-ta.
dog-ACC I-NOM be.afraid-do-PRES-DECL
'I am afraid of dogs.'

In other words, different argument functions are identified by the distinct case markings, and hence they don't need to appear in a fixed order. In this subsection I will show that this general character of scrambling languages with rich case marking can be explained as the effect of the faithfulness and markedness constraints (used above) outranking grammatical function-based alignment constraints as in (114).

(114) Ranking for expression of grammatical relations in Korean:
IDENT-OO(PA-PROP) ≫ MAX-OO(PA-PROP) ≫ *∼SUBJ/NOM ≫ TOP-L ≫ SUBJ-L ≫ OBJ-L ≫ *∼SUBJ/ACC ≫ *ACC ≫ *NOM

To put on a more concrete footing the discussion of the effect of markedness and faithfulness constraints on the recoverability of grammatical relations, let us examine the predictions of the above constraint ranking for the contrast between the nominative-accusative clauses in (112) and (113) and the double nominative construction in (115)

(repeated from section 3.1.2). As noted previously, word order is rigid in the Korean double nominative construction. By reversing the order of the two nominative argument NPs, a new SOV sentence is generated. This suggests that, while the language uses case morphology as a primary means of identifying argument functions, under special circumstances of ambiguity, grammatical function identification is made in the phrase structure.

(115) a. John-i paym-i kacang mwusep-ta.
John-NOM snake-NOM most be fearful-sc decl
(i) 'John is afraid of snakes most.' (Lit. 'To John snakes are most fearsome.')
(ii) *'The snake is afraid of John most.' (Lit. 'To the snake John is most fearsome.')

b. Paym-i John-i kacang mwusep-ta.
snake-NOM John-NOM most be fearful-DECL
(i) 'The snake is afraid of John most.' (Lit. 'To the snake John is most fearsome.')
(ii) *'John is afraid of snakes most.' (Lit. 'To John snakes are most fearsome.')

Let us begin with the case of the scrambled version of a clause with unambiguous case marking like the one in (113). We want to derive that the nominative argument is unambiguously interpreted as the (volitional) experiencer and the accusative one with the theme. In a bidirectional system, we have to check whether *kay-lul (O) nay-ka (S) mwusew-e-ha-n-ta* is the optimal way of expressing the content 'be afraid of ⟨PA, PP⟩, PA_{vol}=I, PP=dog' and, vice versa, 'be afraid of ⟨PA, PP⟩, PA_{vol}=I, PP=dog' is the optimal interpretation of the string *kay-lul nay-ka mwusew-e-ha-n-ta*. The production-based optimization is shown in (116) and the parallel syntactic f-structures and morpholexical f-structures projected from the two argument NPs of the candidates are shown in (117) and (118) (NP_1 is the accusative NP and NP_2 the nominative NP). As before, in the tableaux given below, each pairs of candidates labeled the same alphabetically (e.g., (a) and (a′)) share the same string but differ in the semantic role interpretation and grammatical function realization of the two

argument roles. That is, the first four candidates (a)-(d) mean 'I (PA/nom) am afraid of snakes (PP/acc)', whereas the rest of the candidates (a′)-(d′) 'The snake (PA/acc) is afraid of me (PP/nom)'.

(116) Tableau 12. Production-based optimization (nom-acc)

Input: [GF$_1$ [PRED PRO; PA-PROP [VOL; SENT]]; TOP; GF$_2$ [PRED 'dog']; TNS PRES; PRED 'be afraid of ⟨PA$_1$, PP$_2$⟩']	IDENT-OO(PA-PROP)	MAX-OO(PA-PROP)	*∼SUBJ/NOM	TOP-L	SUBJ-L	OBJ-L	*∼SUBJ/ACC	*ACC	*NOM
a. S/PA$_{nom}$ O/PP$_{acc}$ V				*!		*	*	*	*
b. S/PA$_{nom}$ O/PP$_{nom}$ V		*!	*	*		*			**
☞ c. O/PP$_{acc}$ S/PA$_{nom}$ V					*		*	*	*
d. O/PP$_{nom}$ S/PA$_{nom}$ V		*!	*		*				**
a′. O/PP$_{nom}$ S/PA$_{acc}$ V		*	*		*			*	*
b′. O/PP$_{nom}$ S/PA$_{nom}$ V			*		*				**
c′. S/PA$_{acc}$ O/PP$_{nom}$ V		*!	*			*		*	*
d′. S/PA$_{nom}$ O/PP$_{nom}$ V			*!			*			**

(117) a. Syntactic f-structure of (a) and (c):

$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{PRO} \\ \text{PA-PROP} & \begin{bmatrix} \text{VOL} \\ \text{SENT} \end{bmatrix} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ}_2 & \begin{bmatrix} \text{PRED} & \text{`dog'} \\ \text{CASE} & \text{ACC} \end{bmatrix} \\ \text{TNS} & \text{PRES} \\ \text{PRED} & \text{`be afraid of } \langle \text{PA}_1, \text{PP}_2 \rangle \text{'} \end{bmatrix}$$

b. $\lambda(\text{NP}_1) + \lambda(\text{NP}_2)$ of (a) and (c):

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{PRO} \\ \text{PA-PROP} & \text{PRIM} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`dog'} \\ \text{CASE} & \text{ACC} \end{bmatrix} \end{bmatrix}$$

(118) a. Syntactic f-structure of (b) and (d):

$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{PRO} \\ \text{PA-PROP} & \begin{bmatrix} \text{VOL} \\ \text{SENT} \end{bmatrix} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ}_2 & \begin{bmatrix} \text{PRED} & \text{`dog'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{TNS} & \text{PRES} \\ \text{PRED} & \text{`be afraid of } \langle \text{PA}_1, \text{PP}_2 \rangle \text{'} \end{bmatrix}$$

b. $\lambda(\text{NP}_1) + \lambda(\text{NP}_2)$ of (b) and (d):

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{PRO} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`dog'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

As can be seen by comparing the syntactic and morpholexical f-structures of the candidates, the high ranking of MAX-OO(PA-PROP) means that candidates (b) and (d) with a nominative object in the tableau are far from optimal. Of the remaining two candidates, candidate (a) is not topic-initial. In contrast, candidate (c) has a topic, which is identified with the object function, in the left-most position, and is selected.

Let us now turn to comprehension-based optimization for the string *kay-lul nay-ka mwusew-e-ha-n-ta*, the overt part of the winner in Tableau 12 above. As shown

in (119), in comprehension-based optimization different interpretations of the string compete:

(119) Tableau 13. Comprehension-based optimization (nom-acc)

Input: *kay-lul nay-ka mwusep-e-ha-n-ta*	IDENT-OO(PA-PROP)	MAX-OO(PA-PROP)	*∼SUBJ/NOM	TOP-L	SUBJ-L	OBJ-L	*∼SUBJ/ACC	*ACC	*NOM
a. S/PA$_{nom}$ O/PP$_{acc}$ V						*	*	*	*
b. S/PA$_{nom}$ O/PP$_{nom}$ V		*!	*			*			**
☞ c. O/PP$_{acc}$ S/PA$_{nom}$ V					*		*	*	*
d. O/PP$_{nom}$ S/PA$_{nom}$ V		*!	*		*				**
a′. O/PP$_{nom}$ S/PA$_{acc}$ V		*	*		*			*	*
b′. O/PP$_{nom}$ S/PA$_{nom}$ V		*!	*		*				**
c′. S/PA$_{acc}$ O/PP$_{nom}$ V		*!	*			*		*	*
d′. S/PA$_{nom}$ O/PP$_{nom}$ V		*!	*			*			**

Note that the crucial constraint for the outcome here is MAX-OO(PA-PROP): as can be seen by comparing the structures in (120), candidate (c′), the SO interpretation of the accusative-nominative string, which has a fatal MAX-OO(PA-PROP) violation, fails to recover the original input and hence is made ungrammatical under *bidirectional optimization*.

(120)

a. Syntactic f-structure of (c′):

$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{`dog'} \\ \text{PA-PROP} & \begin{bmatrix} \text{VOL} \\ \text{SENT} \end{bmatrix} \\ \text{CASE} & \text{ACC} \end{bmatrix} \\ \text{OBJ}_2 & \begin{bmatrix} \text{PRED} & \text{PRO} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{TNS} & \text{PRES} \\ \text{PRED} & \text{`be afraid of } \langle \text{PA}_1, \text{PP}_2 \rangle \text{'} \end{bmatrix}$$

b. $\lambda(\text{NP}_1) + \lambda(\text{NP}_2)$ of (c′):

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{PRO} \\ \text{PA-PROP} & \text{PRIM} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`dog'} \\ \text{CASE} & \text{ACC} \end{bmatrix} \end{bmatrix}$$

Thus, the analysis developed here accounts for the fact that a change in the order of the nominative nominal and accusative nominal does not change their syntactic function interpretation, since grammatical function identification is made in the case morphology.

However, if we look at examples with ambiguous case marking, the situation changes. Let us first look at the production-based optimization of a clause in which the theme argument of the nonvolitional psych verb is specified as a topic. Here the crucial constraint is IDENT-OO(PA-PROP): the higher ranking of IDENT-OO(PA-PROP) eliminates the nominative-accusative candidates (a) and (c) before the lower-ranked markedness constraints have a chance to apply. As we saw earlier (see Tableau 11 in (111)), the nominative-nominative case pattern is a more harmonic expression for the nonvolitional input on the ground of faithfulness under the ranking for Korean. Of the two double nominative candidates, candidate (d) is the winner as it satisfies the higher-ranked alignment constraint TOP-L, on which it differs from its competitor (b).

(121) Tableau 14. Production-based optimization (nom-nom)

	Input: [GF$_1$ [PRED 'John'; PA-PROP [¬PRIM; SENT]]; TOP → GF$_2$ [PRED 'snake']; TNS PRES; PRED 'be afraid of ⟨PA$_1$, PP$_2$⟩']	IDENT-OO(PA-PROP)	MAX-OO(PA-PROP)	*∼SUBJ/NOM	TOP-L	SUBJ-L	OBJ-L	*∼SUBJ/ACC	*ACC	*NOM
	a. S/PA$_{nom}$ O/PP$_{acc}$ V	*!					*	*	*	*
	b. S/PA$_{nom}$ O/PP$_{nom}$ V		*	*	*!		*			**
	c. O/PP$_{acc}$ S/PA$_{nom}$ V	*!				*		*	*	*
☞	d. O/PP$_{nom}$ S/PA$_{nom}$ V		*	*		*				**
	a′. O/PP$_{nom}$ S/PA$_{acc}$ V		*!	*	*	*			*	*
	b′. O/PP$_{nom}$ S/PA$_{nom}$ V		*!	*	*	*				**
	c′. S/PA$_{acc}$ O/PP$_{nom}$ V		*!				*		*	*
	d′. S/PA$_{nom}$ O/PP$_{nom}$ V		*!	*			*			**

(122)

a. Syntactic f-structure of (a) and (c):

$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{'John'} \\ \text{PA-PROP} & \begin{bmatrix} \neg\text{PRIM} \\ \text{SENT} \end{bmatrix} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ}_2 & \begin{bmatrix} \text{PRED} & \text{'snake'} \\ \text{CASE} & \text{ACC} \end{bmatrix} \\ \text{TNS} & \text{PRES} \\ \text{PRED} & \text{'be afraid of } \langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

b. $\lambda(\text{NP}_1) + \lambda(\text{NP}_2)$ of (a) and (c):

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'John'} \\ \text{PA-PROP} & \text{PRIM} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{'snake'} \\ \text{CASE} & \text{ACC} \end{bmatrix} \end{bmatrix}$$

(123)

a. Syntactic f-structure of (b) and (d):

$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{'John'} \\ \text{PA-PROP} & \begin{bmatrix} \neg\text{PRIM} \\ \text{SENT} \end{bmatrix} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ}_2 & \begin{bmatrix} \text{PRED} & \text{'snake'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{TNS} & \text{PRES} \\ \text{PRED} & \text{'be afraid of } \langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

b. $\lambda(\text{NP}_1) + \lambda(\text{NP}_2)$ of (b) and (d):

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'John'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{'snake'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

Note that the winner does not coincide with the intuitively preferred reading. If we assume the standard (unidirectional) production-based model, this would be a problem: if grammaticality in a particular language is defined only through production-based optimization, we incorrectly predict candidate (d) to be grammatical, because in order to be grammatical, an analysis only needs to be optimal for some underlying input. If we assume a bidirectional model, we do not know yet whether the winners in the production-based competitions, are grammatical. So we have to check whether candidate (d) is optimal also for the input string *paym-i John-i mwusep-ta*. This comprehension-based optimization is checked in (124).

(124) Tableau 15. Comprehension-based optimization (nom-nom)

Input: *paym-i John-i mwusep-ta*	IDENT-OO(PA-PROP)	MAX-OO(PA-PROP)	*∼SUBJ/NOM	TOP-L	SUBJ-L	OBJ-L	*∼SUBJ/ACC	*ACC	*NOM
a. S/PA$_{nom}$ O/PP$_{acc}$ V	*!					*	*	*	*
b. S/PA$_{nom}$ O/PP$_{nom}$ V		*	*			*			**
c. O/PP$_{acc}$ S/PA$_{nom}$ V	*!				*		*	*	*
d. O/PP$_{nom}$ S/PA$_{nom}$ V		*	*		*!				**
a′. O/PP$_{nom}$ S/PA$_{acc}$ V		*	*		*			*	*
b′. O/PP$_{nom}$ S/PA$_{nom}$ V		*	*		*				**
c′. S/PA$_{acc}$ O/PP$_{nom}$ V		*	*			*		*	*
☞ d′. S/PA$_{nom}$ O/PP$_{nom}$ V		*	*			*			**

(125) a. Syntactic f-structure of (d′):

$$\begin{bmatrix} \text{SUBJ}_1 & \begin{bmatrix} \text{PRED} & \text{`snake'} \\ \text{PA-PROP} & \begin{bmatrix} \neg\text{PRIM} \\ \text{SENT} \end{bmatrix} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ}_2 & \begin{bmatrix} \text{PRED} & \text{`John'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{TNS} & \text{PRES} \\ \text{PRED} & \text{`be afraid of } \langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

b. $\lambda(\text{NP}_1) + \lambda(\text{NP}_2)$ of (d′):

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`snake'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`John'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

As can be read off Tableau 15, what emerges as the most harmonic meaning for the string *paym-i John-i mwusep-ta* is the SO interpretation. This means that the input f-structure we started from is not the most harmonic meaning for the string corresponding to the winning candidate (d) in the production direction, and hence we can consider that candidate ungrammatical under *bidirectional optimization* as it does not provide recoverability for the original input.

3.3.2.4 Other Cases of Word Order Freezing in Korean

Similar results can be shown for sentences like (126) (repeated from section 3.1.2) where the discourse markings on both the subject and object NPs are identical. In this case, reversing the order of subject and object changes not only their grammatical function but also topic/focus assignment. Although I will not show the bidirectional analysis for this here, it should be clear that this turns out to be straightforward.

(126) a. Yenge kyosa-nun Mary-nun philyoha-ta.
English teacher-TOP Mary-TOP need-DECL
(i) 'As for the/an English teacher, he/she needs Mary (but not others).'
(ii) *'As for Mary, she needs the/an English teacher (but not other teachers).'

b. Mary-nun Yenge kyosa-nun philyoha-ta.
Mary-TOP English teacher-TOP need-DECL
(i) 'As for Mary, she needs the/an English teacher (but not other teachers).'
(ii) *'As for the/an English teacher, he/she needs Mary (but not others).'

Let us augment our constraint set with a discourse-based alignment constraint C(ONTRASTIVE)FOC(US)-L, and rank it below SUBJ-L, as in (127).

(127) TOP-L ≫ SUBJ-L ≫ CFOC-L, OBJ-L

If we apply comprehension-based optimization to the strings like those in (126), the constraint ranking in (127) will predict exactly the preferred readings. Since in this direction of optimization, the string is fixed for all competing candidates, the most harmonic analysis will be the one which interprets the initial *-nun*-marked NP as the topical subject and the second NP as the contrastive focus object.

The other situation where word order freezing occurs in Korean, is when the grammatical function of argument roles of a single predicate cannot be distinguished by morphological means due to case marker drop (section 3.2.1), as illustrated in (128).

(128) a. Mary Jane manna-ss-e.
Mary Jane meet-PST-DECL
(i) 'Mary met Jane.'
(ii) *'Jane met Mary.'

b. Jane Mary manna-ss-e.

Jane Mary meet-PST-DECL
(i) 'Jane met Mary.'
(ii) *'Mary met Jane.'

Because the case markers tying nominal arguments to their grammatical functions are not present in these sentences, the nouns must receive their grammatical functions through other means. One source for inferences about the grammatical function status of argument NPs is knowledge about the canonical word order of the language. Even if in languages having a high degree of word order flexibility, like Korean, word order does not usually permit hard inferences, it may have considerable effects on disambiguation. Moreover, further grammatical information about argument NPs may be derivable from the grammatical function status of argument NPs inferred from knowledge about the canonical word order of the language.

Examples of grammatical information derivable, based on linguistic knowledge, are given below. The inferences, based on grammatical constraints on word order, GF/case mappings and GF/proto-role mappings, are indicated by arrows.

(129) Table 4. Case marker drop and grammatical function disambiguation

String:	*Mary*	*Jane*	*manna-ss-e*	
	⇓	⇓		
GF:	SUBJ	OBJ		SUBJ-L ≫ OBJ-L
	⇓	⇓		
CASE:	NOM	ACC		*SUBJ/ACC ≫ *SUBJ/NOM
				*∼SUBJ/NOM ≫ *∼SUBJ/ACC
String:	*Mary*	*Jane*	*manna-ss-e*	
	⇓	⇓		
GF:	SUBJ	OBJ		SUBJ-L ≫ OBJ-L
	⇓	⇓		
PROTO-ROLE:	PA	PP		*SUBJ/PP ≫ *SUBJ/PA
				*∼SUBJ/PA ≫ *∼SUBJ/PP

The competing GF interpretation, i.e., the OS interpretation, would involve the mappings between GF and other dimensions, illustrated in (130). Given the higher ranking of the constraints that bar marked GF/case mappings and GF/proto-role mappings above the GF-based alignment constraints, the analysis like the one given in (130), which respects unmarked GF/case mappings and GF/proto-role mappings, is preferred over the analyses involving marked associations of these dimensions.

(130) Table 5. Competing GF analysis

String:	*Mary*	*Jane*	*manna-ss-e*
	⇓	⇓	
GF:	OBJ	SUBJ	
	⇓	⇓	
CASE:	ACC	NOM	
String:	*Mary*	*Jane*	*manna-ss-e*
	⇓	⇓	
GF:	OBJ	SUBJ	
	⇓	⇓	
PROTO-ROLE:	PP	PA	

In order to see how the constraint system developed so far can capture the disambiguation preferences for null case-marked argument NPs, compare the two GF analyses in the tables in (129) and (130), which correspond to the SO and OS interpretation respectively. Suppose we apply comprehension-based optimization. For the high-ranking markedness constraints that bar marked GF/case mappings and GF/proto-role mappings, the two analyses have the same constraint profile, since they both respect unmarked GF/case mappings and GF/proto-role mappings. As in the case of double nominative constructions discussed above, what breaks the tie and favors the SO interpretation is the lower-ranking GF-based alignment constraints. Again we see an emergence of the unmarked subject/object ordering, but only in the case where other constraints are unable to distinguish the competing analyses.

The prediction that unmarked word order may have considerable parsing effects can be made by a grammar model where grammars are conceived of as hierarchies of ranked violable constraints, but not by a model with only inviolable principles.

3.3.3 Summary

In this section, I have presented an OT approach to the expression of grammatical relations in Hindi and Korean, one that succeeds in capturing the relation between

alternative devices for encoding grammatical relations, e.g., case and word order, in a principled way. Specifically, inspired by a lexicalized theory of faithfulness (Bresnan 2000c; Kuhn 2001a), I have developed a new approach to case. We have seen that the ideas of imperfect correspondence and violable constraints can be naturally extended to other empirical domains, e.g., to aspectually-based split ergativity, dependency effects on object case, and other case alternation phenomena (e.g., dative-nominative alternation on subjects in Korean and nominative-accusative alternation on objects in Hindi) that depend on different semantic conditions.

A general practice in case theory has been to treat non-nominative case on subjects (in nominative-accusative languages) as lexically stipulated (e.g., Zaenen, Maling and Thráinson 1985; Lee 1993; Woolford 2001, among others) and nominative case on objects as stipulated default case, assigned unless accusative case is required by other specific case assignment rules (e.g., Kang 1986; Kim 1990; Hong 1991). Under the approach to case that I developed here, such stipulations and 'unless' clauses in the formulation of case assignment rules are unnecessary, and the distribution of abstract case, both semantic and grammatical, results from a small number of ranking schemata: interactions of OO-faithfulness and markedness constraints.

The present approach to case contrasts with that of Woolford (2001), which is developed under the MP assumption that licensing inherent Cases (e.g., ergative and dative) involves faithfulness to the lexical requirements of licensing heads. In my approach, licensing abstract case, both semantic and grammatical, involves correspondence between parallel, co-present output structures: syntactic and morpholexical structures. This approach not only offers a more uniform view of case but also permits a straightforward extension of the interaction of markedness and faithfulness constraints to a class of cases that are sensitive to semantic properties other than the thematic relations that a case-marked nominal bears to the verbal predicate (e.g., nominative-accusative alternation on object case in Hindi).

An interesting consequence of this approach, incorporating LFG's feature logic-based model of GEN for morphosyntax, is that systematic lexical properties (e.g., which grammatical function case-marked nominals canonically appear with and which morphosyntactic context they appear in, etc.) need no longer be stipulated at the

level of lexical entries, as in the LFG model of Constructive Case. Instead, they are derived by the ranking of faithfulness constraints amongst markedness constraints.

In addition to providing a less stipulative theory of case than pre-OT lexicalist theories of case, the present approach to the expression of grammatical relations derives word order freezing effects in scrambling languages as the emergence of the unmarked in comprehension grammar. By defining grammaticality in terms of bidirectional optimization (i.e., requiring recoverability of the input from the output), we were able to account for the word order freezing effect in terms of the same set of constraints that are independently motivated for a production-based optimization account of the expression of grammatical relations. It is a result that can be derived within the assumptions of OT, but not in theories with only inviolable principles.

3.4 Recovery of Marked Interpretation

We have seen that in Hindi and Korean the order of two arguments bearing identical case markings is fixed in SOV order in a null or neutral context. In this case, word order can be said to have a disambiguating function: it is the fixed word order that determines which phrase is the subject and which is the object.

This freezing effect operative in sentences with ambiguous case marking, unlike the 'worst of the worst' type examined in Chapter 2, is in fact overriden by contextualization. For example, take the example of the Korean double nominative construction, illustrated in (131).

(131) a. Koyangi et-ess-e? Kay et-ess-e? [Korean]
cat-(ACC) get-PST-END dog-(ACC) get-PST-END
'Did you get a cat or a dog?

b. Kay-ka na-nun coh-untey, [**koyangi-ka**$_O$ **ay-tul-i**$_S$ **philyohay-se**],
dog-NOM I-TOP like-but cat-NOM kid-PL-NOM need-because
koyangi-lul et-ess-e.
cat-ACC get-PST-END
'I like a dog, but since my kids need a cat, (I) got a cat.'

Here, it is the previous discourse context which allows clear inferences about the semantic role interpretation of the argument phrases, narrowing down the choice of readings: drawing on clues provided by the context (and also by intonational marking in spoken language),[29] *koyangi* 'cat' is inferred as the theme argument of *philyoha* 'need' and *ay-tul* 'kids' as the experiencer argument.

For such effects of context-based inferences on disambiguation to be integrated in comprehension-based optimization, however, one modification of the bidirectional model assumed so far is needed, because the current form of bidirectional optimization gives only the unmarked order for any string involving ambiguous case marking under the ranking for Hindi and Korean. The source of this limitation of the model is the impoverishment of the input. So far the input to comprehension has been taken to consist of bare strings, lacking all information (other than strings of words) available to language users that activates the constraints on the realization of information structure and the proto-role properties of arguments. As a result, these constraints can never be active in comprehension, if the input consists solely of bare strings. To solve this problem, we need to assume that the input can no longer be regarded as consisting solely of the bare string. A representation of the contextual and proto-role information for previous sentences is now also part of this input, and it can be formally modeled as a set of underspecified feature structures indicating the information status of the string referents. In other words, when context is supplied to comprehension-directed optimization, the string input to comprehension is enriched with interpretational features, just as the f-structure input to the production direction contains information about each element's discourse status and proto-role information. This additional information plays a role in selecting the optimal analysis of the string, by activating discourse-based alignment constraints and interpretation constraints.

Another way of treating context-defeating word order freezing would be to say that the restriction on nominal arguments bearing identical case marking that they occur in SOV ordering may not be syntactic at all.[30] However, I believe that there are

[29]In fact, the OS interpretation for (131b) is only natural with an implicit stress on the two preposed NPs that are being contrasted.

[30]An argument against the view that freezing effects lie outside the realm of syntax and are merely

deep theoretical and empirical motivations for why a theory of linguistic competence needs to model the integration of information that have been traditionally regarded as "nonlinguistic" in nature. Here, I will mention three interrelated but distinct reasons that one might give for the value of modeling this integration.

First, our refined model of bidirectional optimization provides a highly flexible framework for having syntactic and other extra-syntactic factors interact in constructing grammatical analyses. Research on language processing and learning has suggested that language users and learners are extremely sensitive to information from discourse context, frequency biases and plausibility information and that knowledge of discourse context and the statistical properties of input (e.g., lexical frequencies) is part of linguistic knowledge (e.g., see Gibson and Pearlmutter (1998), Jurafsky (1996), MacDonald (1994), MacDonald et al. (1994), among others). So, if a grammar is to be compatible with models of sentence processing and learning, then it needs to formally model linguistic knowledge in a way that allows for the dynamic interaction between syntactic and extra-syntactic factors in the construction of grammatical analyses.

The tighter coupling of competence and performance has already been argued for in the performance model of constituent ordering (Hawkins 1994), as well as in lexicalist theories of grammar (Bresnan 1978; Bresnan and Kaplan 1982; Pollard and Sag 1994), which have developed models of linguistic competence that are embeddable in models of language processing. Under such research programs, the kind of representations used to characterize speakers' knowledge of language should also be justifiable by processing considerations, as Bresnan (1978) puts it succintly:

> ... First, I assume that the syntactic and semantic components of the grammar should correspond psychologically to an active, automatic processing system that makes use of a very limited short-term memory. ... Second, I assume that the pragmatic procedures for producing and understanding language in context belong to an inferential system that makes

the result of performance was detailed in Bloom (1999). He demonstrated that, in Russian, clauses with two syncretized nominal arguments are still frozen into SVO (in non-emotive speech), even when we have enough information from context or verbal morphology to resolve the grammatical roles of the syncretized arguments.

> use of long-term memory and general knowledge. The extreme rapidity of language comprehension then suggests that we should minimize the information that requires grammatical processing and maximize the information that permits inferential interpretation ... (1978: 14).

In brief, enrichment of the input in comprehension with information that allows inferential interpretation is motivated for processing considerations.

Second, another advantage of including a context representation as part of the input is that it allows us to capture the symmetry between the production grammar and comprehension grammar. Research on language processing has shown us that much linguistic knowledge is process-independent[31] and that the kind of linguistic description that linguistic theory provides should therefore be a process-neutral grammar.[32] Note that in our model of bidirectional optimization the representation of contextual and proto-role information is part of the input both in production-directed and in comprehension-directed optimization. This refinement of the model has the effect of allowing constraints sensitive to contextual and semantic information as well as markedness constraints to apply simultaneously to representations of linguistic structures in both production and comprehension. Thus, in our model of grammar, both production and comprehension can be viewed in terms of a process of satisfaction of the same set of competing constraints. The process-neutrality of our linguistic description seems very suggestive, given that linguistic knowledge is process-independent.

Third, in addition to modeling the symmetry between production and comprehension-based optimization grammar, the present model of extended optimization offers the formal integration of syntax and phonology. As Boersma (1999) independently

[31] In phonology, a common assumption in structural and generative models is that the phonological part of the grammar should be used for production as well as comprehension. The recent literature on phonological acquisition is also justified in using the same grammar for describing the processes of human speech production and comprehension, because the performance system of the learner shows systematic behavior, as if it belonged to the grammar. However, it may be an oversimplification to claim that the production and comprehension modules of the grammar share all constraints.

[32] For further discussion of how a declarative system of constraints can best ensure process-neutrality, see Bresnan and Kaplan (1982b), Halvorsen (1983), Pollard and Sag (1994), Smolensky (1996b) and Sag and Wasow (1999).

observes, contextual/semantic information is also needed to account for phonological acquisition and the interaction between phonology and semantics.[33] As an example from phonology parallel to the case discussed above, consider the case of final devoicing in Dutch, which causes the two words *rad* 'wheel' and *rat* 'rat' to merge on the surface. Smolensky's comprehension model cannot account for the fact that if the semantic context is 'turn', the recognition of 'wheel' is favored over that of 'rat', as far as the lexicon is concerned—i.e., the fact that infrequent and contextually disfavored items are hard to access. Boersma (1999a) therefore proposes to include the semantic context as part of the input to the recognition grammar (e.g., input: [rat], context = 'turn') and to include in the recognition grammar lexical-access constraints whose rankings depend on the semantic context and on frequency of occurrence. So, by including a formal representation of the extra-sentential context as part of the input both in comprehension-directed and production-directed optimization, the present model of bidirectional optimization can capture the symmetry between phonology-semantics interactions and syntax-semantics interactions.[34]

In order to capture effects of discourse-based inferences on disambiguation relevant to examples like (131b), here I assume the PAR(ALLEL)FOC(US) constraints in (132).[35]

[33]In a series of publications, Boersma argues for the need to make a finer-grained distinction between the processes of production and comprehension, and develops a model that distinguishes four processing systems: articulation and perception (production), and recognition and perception (comprehension). In this view, the four processing systems may not share all sets of constraints, and hence are not strictly symmetrical. See also Zeevat (2000) for discussion of some conceptual differences between production- and comprehension-based optimization.

[34]Enrichment of the input in comprehension is also justified by computational considerations. For parsing/comprehension tasks, a given string is parsed to arrive at possible structures (to which production-directed optimization can apply). To ensure decidability of the parsing/comprehension task and to make constraint violations more detectable, the bidirectional model needs to be further constrained, and one way to do this is to take a context representation into account (Jonas Kuhn, p.c., March 2000).

[35]A similar effect of parallelism on disambiguation in word order in Russian is observed by Bloom (1999).

(132) ParFoc:

a. ParFoc(p-role): The current and previous clauses have a thematically parallel focus.

b. ParFoc(str): The current and previous clauses have a focus parallel in linear order.

ParFoc is one instance of the Parallelism family, which has been motivated extensively in the literature on anaphora and ellipsis (see Hendriks and de Hoop (1999) for an overview). Specifically, ParFoc(p-role) can be understood as an instantiation of a basic psycho-communicative principle that interpretations should not conflict with the context. It can be violated, since it is certainly possible to contradict the given context, using corrections or other means.

Let us now augment our constraint set with the ParFoc constraints in (132). With ParFoc(P-role) and ParFoc(str) ranked above alignment constraints, tableaux 16 and 17 are obtained. Here I assume a simple context representation indicating the semantic and discoursal information of antecedent structures. This can be modeled as a set of underspecified f-structures.[36] The examples in (131) are interesting since they illustrate the need for the surface form of earlier sentences to be included as part of a context representation, in order for the ParFoc(str) constraint to be able to see it. Thus, the context representation I assume here is more accurately thought of as pairs of a set of underspecified f-structures for previous context and the surface string of previous sentences.

[36]Ultimately, a broader concept of context which includes knowledge of social and situational context as well as speakers' intention and the common ground has to be considered if we want to capture effects of such knowledge sources on the construction of grammatical analyses in a competence theory of grammar.

(133) Tableau 16. Production-based optimiation

String:

Kay-ka na-nun coh-untey

Context:

$$\begin{bmatrix} \text{C.FOC} & \\ \text{GF}_1 & \begin{bmatrix} \text{PRED} & \text{PRO} \\ \text{PERS} & 1 \\ \text{PA-PROP} & \text{SENT} \end{bmatrix} \\ \text{C.FOC} & \\ \text{GF}_2 & \begin{bmatrix} \text{PRED} & \text{'dog'} \end{bmatrix} \\ \text{PRED} & \text{'like } \langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

Semantic form:

$$\begin{bmatrix} \text{C.FOC} & \\ \text{GF}_1 & \begin{bmatrix} \text{PRED} & \text{'kids'} \\ \text{PA-PROP} & \text{SENT} \end{bmatrix} \\ \text{C.FOC} & \\ \text{GF}_2 & \begin{bmatrix} \text{PRED} & \text{'cat'} \end{bmatrix} \\ \text{PRED} & \text{'need } \langle \text{PA}_1, \text{PP}_2 \rangle\text{'} \end{bmatrix}$$

		ParFoc(p-role)	ParFoc(str)	Top-L	Subj-L	Obj-L
	a. $\text{kid}_{S/PA}$ $\text{cat}_{O/PP}$ needs		*!			*
☞	b. $\text{cat}_{O/PP}$ $\text{kid}_{S/PA}$ needs				*	
	c. $\text{kid}_{O/PP}$ $\text{cat}_{S/PA}$ needs	*!	*		*	
	d. $\text{cat}_{S/PA}$ $\text{kid}_{O/PP}$ needs	*!				*

For the production-based optimization (133), ParFoc(p-role) has no effect, since the argument structure semantics is fixed. Here, what is crucial for the outcome is ParFoc(str). We get candidate (b) as a clear winner: it realizes elements that are in contrast in the antecedent clause and the current clause in a structurally parallel way.

The context representation also constitutes part of the representation of input to the comprehension-based evaluation regimen, with the string of words, as shown in (134). The string input, then, will be optimized with respect to the prior context.

(134) Tableau 17. Comprehension-based optimiation: Recovery of marked interpretation

String: *Kay-ka na-nun coh-untey* Context: [C.FOC — GF$_1$ [PRED PRO; PERS 1; PA-PROP SENT] — C.FOC — GF$_2$ [PRED 'dog'] — PRED 'like ⟨PA$_1$, PP$_2$⟩'] String: *koyangi-ka aytul-i philyoha-ta*	ParFoc(p-role)	ParFoc(str)	Top-L	Subj-L	Obj-L
a. kid$_{S/PA}$ cat$_{O/PP}$ needs		*			*
☞ b. cat$_{O/PP}$ kid$_{S/PA}$ needs				*	
c. kid$_{O/PP}$ cat$_{S/PA}$ needs	*!	*		*	
d. cat$_{S/PA}$ kid$_{O/PP}$ needs	*!				*

As can be seen, the comprehension-based optimization confirms the object-subject reading (b) as optimal. It is the most consistent continuation of the discourse, in which the elements that are in contrast in the current and previous clauses are structurally and thematically parallel.

To summarize, I have shown that by enriching the string input to comprehension with semantic and contextual information, the bidirectional approach, based on the same set of constraints, predicts that preferences for canonical ordering are overriden by constraints on discourse consistency, which outrank markedness constraints against noncanonical GF order in both the production and comprehension grammars.

3.5 Conclusion

In this chapter, I presented an OT account of word order freezing in Hindi and Korean under morphological ambiguity. The original motivation for developing a syntactic account of this phenomenon was the observation that the coexistence of the flexibility

and invariance of word order within languages with extensive case marking mirrors a widely observed crosslinguistic generalization about the 'inverse' relation between the amount of information about grammatical function expressed by case marking and the amount expressed by phrase structures.

As noted, the key to a successful account of word order freezing effects resides in the very fact that case marking and word order are formally different but functionally equivalent means of expressing the same grammatical relations. Languages like Hindi and Korean make use of case marking as the primary means of specifying the grammatical function of argument roles. However, it is not uncommon to find examples where case morphology cannot clearly indicate the grammatical function of argument phrases in these languages. In such instances, it is the fixed word order that takes the role normally played by case morphology and determines which phrase is the subject and which is the object.

This correlation between case marking and word order seems intuitive. However, to date, previous attempts to explain it within pre-OT generative syntax have not yet been successful. This is due to the basic architecture of derivational models of syntax, as pointed out in section 3.1. In GB theories of syntax, which view order as an abstract underlying property of sentences, the problem of accounting for surface orderings is handled together with other aspects of structure such as Case and Agreement. Such theories can easily account for word order variation within a particular language in terms of various movement processes, but lack any principled explanation of the coexistence of the flexibility and invariance of word order within languages. The word order freezing effect widely observed in scrambling languages does not follow naturally from frameworks like LFG which do not employ explicit transformational movement, either. In order to capture the generalization that 'Morphology competes with syntax' both within and across languages formally, a mechanism EVAL is required (section 3.1.3).

Optimality Theory suggests a more general theory of the relation between alternative formal means of expressing the same grammatical relations. The basic architecture of OT, in which well-formedness is defined in terms of the outcome of competition among all universally possible candidates rather than in terms of the

serial application of rules subject to filtering constraints, provides a natural way to explicate the relation between formally different but functionally equivalent devices. However, word order freezing effects do not follow from the standard design of OT *per se*. The standard production-based OT model generates all possible orderings of argument phrases, both unambiguously case-marked and ambiguously case-marked, and hence does not predict any difference in word order flexibility between the two cases (section 3.2).

In section 3.3, I proposed to account for word order freezing effects by extending optimization in OT to comprehension as well as production (Smolensky 1996b, 1998; Wilson 2001) and showed that a small set of faithfulness and markedness constraints, motivated independently for a production-based optimization account, can be applied to accounting for the disambiguation preferences. For cases where arguments bear distinct case markings, the effects of the syntactic alignment constraints favoring the unmarked order remain hidden behind other factors, in particular the preservation of semantic contrast between argument roles and case features (faithfulness). However, in contexts where the influence of faithfulness is absent, the alignment constraints operate decisively in comprehension. Since in comprehension-based optimization the string is fixed for all competing candidates, the analysis which interprets ambiguously case-marked arguments in accordance with the grammatical function hierarchy would be the most harmonic one under the ranking proposed for Hindi and Korean (FAITHFULNESS $\gg$ discourse-based alignment constraints $\gg$ GF-based alignment constraints). In section 3.4, I have also shown that by enriching the string input to comprehension with contextual information, the bidirectional approach, based on the same set of constraints, captures recovery of marked interpretation of an ambiguous string.

It goes without saying that this approach to structure and interpretation, based on bidirectional optimality, raises many new research questions. Further issues that need to be addressed for a more adequate account of disambiguation preferences will be discussed in Chapter 4.

Chapter 4

Conclusion

The original impetus for this work was the observation that the kinds of markedness asymmetries one finds within a language bear striking relations to typological asymmetries across languages. This study has sought to add to our understanding of the relation between language-internal and typological markedness asymmetries by closely examining word order freezing in Hindi and Korean, a phenomenon which poses serious challenges for the classic conception of language structure within generative grammar.

In the preceding chapters, I have proposed an account within OT which explains why in certain circumstances certain word orders are not possible even in languages with flexible word order, and suggested that the word order freezing effects found in particular languages are a case of the more general phenomena: markedness reduction in marked grammatical contexts and emergence of the unmarked.

In the process of developing the specific analysis of the word order facts in Hindi and Korean, I have also proposed a novel approach to the expression of grammatical relations in which surface word order, case morphology and head-marking agreement all interact with each other in a single constraint hierarchy. The systematicity and variability in these central morphosyntactic devices for argument expression, illustrated through analyses of the freezing effects in Hindi and Korean, turned out to be captured by a small set of general markedness and faithfulness constraints in OT. These are the results that can be derived within the assumptions of OT, but not in

theories which do not allow the resolution of conflicts among violable constraints.

In this chapter, I first present a brief summary of the conclusions reached and discuss implications that this study has for linguistic theory. This is followed by a discussion of several areas for future research.

4.1 Summary and Implications

This dissertation investigated fixed word order phenomena in "free" word order languages and their consequences for linguistic theory. As has long been observed, languages with flexible word order, in certain circumstances, show "freezing" effects, where only a canonical word order is possible. The present study took a detailed look at two types of freezing effects in Hindi and Korean from a variety of points of view, from the perspective of markedness, from the perspective of formal syntactic theory and from the perspective of parsing.

From the perspective of markedness, I proposed new generalizations about the two types of freezing effects, namely markedness reduction in marked grammatical contexts and the emergence of the unmarked, and showed that these pervasive patterns of markedness are incompatible with the classical conception of grammar within generative linguistics that principles of universal grammar (UG) are both universal (by definition of UG) and inviolable (sections 1.3, 2.1, and 3.2).

An alternative assumption about grammar is that principles or constraints are universal but violated under compulsion from some higher-ranked constraint(s). This is the position taken in Optimality Theory (OT: Prince and Smolensky 1993; Grimshaw 1997). In OT, a grammar is conceived of as a system of conflicting universal constraints which are violable and ranked in a dominance hierarchy. The concepts of violability and constraint interaction are formalized in such a way that variation across languages derives from alternative rankings of the same violable universal constraints. In this work, I have presented a development of an OT approach to the expression and interpretation of grammatical relations, concentrating on the phenomenon of word order freezing. Specifically, I have assumed the formal framework of Lexical-Functional Grammar recast within the OT style of constraint interaction

(OT-LFG), pioneered by Bresnan (1996, 2000c).

Chapter 2 of this dissertation presented an OT account of markedness reduction in word order. Why are certain types of argument (e.g., theme subjects and oblique subjects) restricted to unmarked word order position even in languages having a high degree of word order flexibility? I argued that freezing effects occur when more than one of the marked associations of elements in different dimensions of linguistic substance (e.g., grammatical function, semantic role, case, positions in phrase structure, etc.) cooccurs with another marked one in a single clause.

The proposed explanation of this 'worst of the worst' situation involves local constraint conjunction of markedness constraints that ban marked combinations of grammatical function and other dimensions with alignment constraints. A candidate that has a theme subject in noninitial position in Hindi, for example, violates the conjoined markedness constraint *SUBJ/Proto-Patient & SUBJ-L, while the constraint is satisfied by a candidate that has a theme subject in initial position.

I have further developed the view that the pattern of markedness reduction (or avoidance of the worst of the worst) in word order is a case of the more general phenomenon contextual neutralization. In languages with fairly free word order, noncanonical orderings are preferred options to mark a special information structure. However, as we have seen in the previous sections, under the special circumstances of markedness, they are replaced by the less marked, canonical order. This has been shown to be due to the ranking of the markedness constraints banning marked argument types in the marked positions and the information structuring constraints, which favor realization of contrasting prominence of arguments. The overriding of the information structuring constraints such as TOP-L gives rise to contextual neutralization in word order: realization of contrasts in discourse prominence, even if otherwise preferred in the language, is avoided in the most marked argument types. Beyond providing a specific analysis for the freezing effects in Hindi and Korean, I have shown how the constraint system I developed can be employed to explain markedness reduction in the systems of contrast in other domains of morphosyntax (section 2.5).

Chapter 3 examined a fundamental and pervasive pattern of interaction between

morphology and syntactic structure, focusing on another type of word order freezing found in Hindi and Korean. As has long been observed, languages with rich morphological resources for function specification (case marking in dependent-marking languages and pronominal incorporation in head-marking languages) tend to make less use of purely structural resources, whereas languages poor in morphology overwhelmingly tend to have rigid phrase structures. The existence of the inverse relation between the amount of information about grammatical function expressed by morphology and the amount expressed by phrase structures is also attested within particular languages. For instance, the flexible word order allowed by nominative and accusative case on nominal arguments in Korean becomes rigid when case morphology fails to distinguish grammatical roles of arguments. The key to a successful account of word order freezing effects resides in the very fact that case marking and word order are formally different but functionally equivalent means of expressing the same grammatical relations.

As the first step to account for this relation between case and word order, I developed an OT account of case patterns in Hindi and Korean, based on the idea of 'output-to-output correspondence' in OT phonology, specifically correspondence between output syntactic structures and morpholexical structures. We have seen that the inventory of abstract cases is not lexically stipulated but is an epiphenomenon of ranked markedness and faithfulness constraints (sections 3.2 and 3.3). A further result of treating case patterns as the result of constraint interaction is that the lexical representations of case markers in particular languages as well as the language-internal distributonal facts are derivable from the same constraint interactions that determine the crosslinguistic inventories of cases. This demonstrates that constraint violability and constraint ranking allow greatly increased generality not only for constraints but also for the entire system, thus helping us create a more economical theory of morphosyntax.

In section 3.2, we have seen what account of interaction of case and word order in scrambling languages emerges within the standard design of OT. Under the standard generation-based form of OT, in which syntactic structures are optimized with respect to a semantic input, all possible orderings of argument phrases, both unambiguously

case-marked and ambiguously case-marked are generated, and hence no difference in word order flexibility between the two cases is predicted.

I proposed a solution that remedies this problem of the generation-based OT approach to interaction of case and word order, based on bidirectional optimization (Smolensky 1996a,1998; Wilson 2001). The essential idea of bidirectional optimization is *recoverability* of the inputs from the outputs: grammatical outputs must have recoverable meanings. That is, if f_{prod} (production-based function) applied to a given input gives an optimal form-meaning pair $\langle f,\ m\rangle$, then f_{comp} (comprehension-based function) applied to the overt part of the optimal form, should return the same input. If a different input results from f_{comp} then the original input is unrecoverable, and we can consider the candidate ungrammatical under *bidirectional* optimization.

In section 3.3, the constraint systems developed to account for word order patterns and case patterns in Hindi and Korean were brought together into a single constraint hierarchy in the *bidirectional* competition model and extended to shed new light on expression of grammatical relations in scrambling languages. Specifically, by defining grammaticality in terms of bidirectional optimization (that is requiring recoverability of the input from the output), we were able to account for the word order freezing effects, in terms of the same set of constraints that are independently motivated for a production-based optimization account of the expression of grammatical relations. For sentences containing unambiguously case-marked arguments, change in the order of these NPs does not change their syntactic function interpretation. This is because a candidate that does not interpret the grammatical function of argument NPs in line with the unmarked grammatical function/case association (e.g., SUBJ/nominative and OBJ/accusative) violates high-ranked OO-faithfulness constraints and this violation leads to unrecoverability of the original input. For cases of ambiguously case-marked arguments, high-ranking OO-faithfulness constraints are inapplicable (hence inactive) and low-ranking alignment constraints like SUBJ-L and OBJ-L become decisive. The result is the SO interpretation of potentially ambiguous strings. The marked OS interpretation is eliminated not because it violates high-ranking OO-faithfulness constraints but because it violates low-ranking alignment constraints.

From the perspective of parsing, the prediction that constraints too low-ranked

to be decisive in production may have considerable effects on disambiguation in comprehension grammar appears to be made by an OT approach only, so that the phenomenon of word order freezing discussed here constitutes solid evidence in favor of the present optimization-based approach to disambiguation preferences.

The present study is only a first step in the development of a fully articulated nonderivational, optimization-based theory of argument expression and interpretation, but the initial integrative effects resulting from the approach are encouraging indeed.

It is striking that most of the seemingly unrelated complex morphosyntactic phenomena dealt with in this work can be accounted for in terms of interactions of the same formal and markedness principles that have been shown to pervade in phonology. Among constraints, the interplay between markedness and faithfulness constraints played a prominent role in many of the specific anlayses of word order patterns and case and agreement patterns in Hindi and Korean. As in phonology, the interaction of these constraint types can derive lexical inventories (sections 2.4.1, 3.2 and 3.3); they display emergence of the unmarked effects (resulting from satisfaction of lower-ranking constraints when higher-ranking constraints are inapplicable) (section 3.3); they are organized into subhierarchies, which make clear predictions about implicational universals. In addition, the possibility of constraint conjunction is central to an account of particularly marked configurations (sections 2.3 and 2.4). Along with other optimization-based approaches to morphosyntax,[1] the present study contributes solid evidence for fundamental structural parallels between phonology and syntax.

Moreover, the bidirectional view of syntax advocated here serves to highlight the closeness that exists in OT work in language structure, sentence processing and learning. As mentioned in section 3.3, in bidirectional OT models, both grammaticality (for phonology, syntax and semantics) and learning are characterized by the feature of recoverability or bidirectional optimality. Departing from the fixed conception of linguistic competence held by many generative linguists, exitsting work in bidirectional

[1]See, e.g., contributions in Archangeli and Langendoen (eds.) (1997), Barbosa et al. (eds.) (1998), Dekkers et al. (eds.) (2000), Legendre, Grimshaw and Vikner (eds.) (2001), and Sells (ed.) (2001).

OT has made the strong claim about linguistic integration with nonlinguistic cognitive systems. It is to be hoped that further research on the precise formal character of the kinds of optimization involved and substantive content of constraints shared by the modules of optimization will continue to have an integrative effect on theoretical linguistics and other research fields of human language.

4.2 Areas for Future Research

In this section, I discuss two areas for future research based on issues raised here. First I address an issue that has not been discussed here: the problem of ambiguity in syntactic interpretation. Second I turn to a brief discussion of possible extensions of the constraint system developed here.

4.2.1 Ambiguity in Syntactic Interpretation and Stochastic OT

The focus of this work has been word order freezing, a longstanding problem of syntactic theory. Although it is an extremely common phenomenon found in various languages typologically remote from Hindi and Korean, it is not the case both within and across languages that morphological ambiguity always leads to the word order freezing effect. Given that the constraint ranking proposed here predicts that there is only one preferred reading for a morphologically ambiguous string, the problem of ambiguity becomes of interest. Here I will exemplify some of the cases where ambiguity occurs with particular types of arguments and constructions and give hint at a possible extension of the bidirectional OT model to this problem, without aiming at presenting a detailed analysis.

The discussion of linguistic factors leading to disambiguation has up until now focused on grammatical function and semantic role. But an examination of a variety of languages typologically remote from Hindi and Korean reveals that the situation is far richer and sensitive to factors other than grammatical function and semantic role.

Donno Sɔ, a Dogon language studied by Culy (1995) is an interesting example of a language that shows an intriguing interaction of word order, semantic properties of nominal arguments and ambiguity. In Donno Sɔ, which is both head- and dependent-marking, ambiguity arises in ditransitives under special circumstances. In this language only objects are case-marked. Finite verbs in matrix clauses agree in person and number. Culy (1995) discovered that object case marking in Donno Sɔ is sensitive to various ordered conditions such as animacy, semantic role, pronominality, definiteness and ambiguity. The strongest condition among these is the animacy restriction: if the goal/recipient and theme objects of a ditransitive verb are both human, it is the goal/recipient that must occur with case marking. Thus, there is potentially some ambiguity if the subject and the theme object of a ditransitive are equal in animacy and both refer to arguments of the same number. In these instances, the clause will be ambiguous as to which arguments are subject and object, as seen in (1) (I am glossing the case OM ('object marker'), following Culy (1995)). In each case, either the first or second NP can be interpreted as the subject. What is somewhat unusual is that such sentences are ambiguous only when the subject and theme object are not separated by the goal/recipient.

(1) Ambiguity in ditransitives in Donno Sɔ (Culy 1995:57)

a. Yaana I wojinɛ anna pay-ñ tagaa be.
female child stranger male old-OM showed AUX
'A girl showed a stranger to an old man.' or
'A stranger showed a girl to an old man.'

b. Wojinɛ yaana I anna pay-ñ tagaa be.
stranger female child male old-OM showed AUX
'A stranger showed a girl to an old man.' or
'A girl showed a stranger to an old man.'

The Donno Sɔ facts show that the patterns of ambiguity are more sensitive to linguistic detail than an explanation of extralinguistic 'anti-ambiguity' devices would have us believe, leading us to wonder where an account of such patterns might lie, if

not in the realm of linguistic competence.[2]

How could we reconcile ambiguity (of this kind) with an OT model which assumes a strict dominance hierarchy of constraints? Does it really capture preferences among multiply available analyses for a potentially ambiguous string? In this respect, the rat/rad problem (Boersma 1998, 1999) discussed in section 3.4 is highly suggestive. As discussed briefly in section 3.4, the Dutch word *rat* (meaning rat) is homophonous with the Dutch word *rad* (meaning wheel) in its singular form. The pronunciation of *rad* (but not *rat*) is derived by the IDENT-IO(VOICE) violation. Without making the constraint system sensitive to context as discussed in section 3.4, the application of a bidirectional OT systems (both strong and weak versions) does not make the correct prediction about the interpretation of the sound [rat]: according to the concept of superoptimality (both strong and weak notions) (Blutner 2000), the form-meaning pair ⟨[rat], /rat/⟩ is more harmonic on the ground of faithfulness and hence grammatical, and the pair ⟨[rat], /wheel/⟩ is thrown out of the competition, both in production and comprehension.

The rat/rad problem is a simple phonological problem. But many examples of this kind can be found in syntax as well, for any cases where in one of pairs ⟨*form, meaning*$_1$⟩, ⟨*form, meaning*$_2$⟩, 'form' is in one of the pairs derived by more serious syntactic constraint violations than the other. Let me illustrate with an example from Korean, discussed in section 3.1.2.

As I noted, the basic meaning 'Mary needs an/the English teacher' can be expressed by any of the following four sentence patterns in Korean; the discourse marker -*nun* can mark either topic or contrastive focus, and the case marker -*ka* can mark both the subject and object of so-called unaccusative transitives.

[2]Broadwell (2000) notes that in Kaqchikel, a Mayan language spoken in Guatemala, definiteness of nominal arguments interacts with ambiguity in an interesting way. In this language, if a transitive verb is followed by two NPs with equal degrees of definiteness, then either order of the NPs is grammatical and the sentence is ambiguous. If, on the other hand, one of the NPs is definite and the other is indefinite, then the definite NP must follow the indefinite and the definite is interpreted as the subject. The manner in which degrees of definiteness interact with grammatical function interpretation remains to be worked out, but as a grammatical factor affecting subject selection in Kaqchikel and other Mayan languages, they are a matter of grammar. The Kaqchikel facts thus give us even stronger evidence that disambiguation preferences of this kind must lie within the domain of linguistic competence, and are not simply attributable to performance effects.

(2) a. Mary-nun yenge kyosa-ka philyoha-ta.
Mary-TOP English teacher-NOM need-DECL
'As for Mary, she needs an English teacher'.

b. Mary-nun yenge kyosa-nun philyoha-ta.
Mary-TOP English teacher-TOP need-DECL
'As for Mary, she needs an English teacher (but not other teachers).'

c. Mary-ka yenge kyosa-ka philyoha-ta.
Mary-NOM English teacher-NOM need-DECL
'It is Mary who needs an English teacher'.

d. Mary-ka yenge kyosa-nun philyoha-ta.
Mary-NOM English teacher-TOP need-DECL
'It is Mary who needs an English teacher (but not other teachers)'.

Recall from section 3.1.2 that in sentences like (2b,c), where the case markings or discourse markings on both the subject and object NPs are identical, their order is fixed as SO (though it is possible to get other orderings under a marked stress pattern or in an appropriate context): the examples (2b,c) are only grammatical when interpreted as an SO order. If, on the other hand, two arguments of the verb bear distinct markings as in (2a,d), either order of subject and object is available, with different meanings.

However, if we apply comprehension-based optimization, our constraints will predict not just that the subject-object reading is preferred (due to SUBJ-L $\gg$ OBJ-L) but that it is the only reading, of course under the assumption of superoptimality.

As this brief discussion of ambiguity in grammatical function interpretation already suggests, the direction of optimization alone cannot be the only way to capture disambiguation preferences. What is required is a system that not only predicts one preferred analysis of a given string but preferences among multiply available analyses relative to context. The stochastic OT model developed by Boersma (1997, 1998) and Boersma and Hayes (2001) along with a learning algorithm, the Gradual Learning

Algorithm (GLA), seems exactly what is needed for a more satisfactory account of disambiguation preferences.

The basic idea of the GLA is that constraints are ranked on a continuous scale. In the GLA every time a candidate set is evaluated, the position of each constraint is perturbed by a random variable (either in a positive or negative direction). Boersma and Hayes (2001:48) refer to the permanent value of a constraint as the ranking value, while a constraint's value on any given evaluation is called the selection point. Thus, each candidate has a range of selection points associated with its ranking value, which is the mean of its affiliated normal distribution.

Under this view, categorical constraint ranking arises as a special case when two constraints have ranking values relatively far away from one another, i.e., when two constraints are strictly ranked. When two constraints have relatively close ranking values and hence their relative ranking is less fixed, however, their ranges may overlap, allowing for selection points where on some evaluations $Constraint_1$ dominates $Constraint_2$, while on others $Constraint_2$ is ranked higher than $Constraint_1$.

Boersma and Hayes (2001) exemplify stochastic OT with various empirical test-cases of phonological variation, and recently it has been increasingly applied in syntactic variation as well (Asudeh 2001; Bresnan and Deo 2001; Bresnan *et al.* 2001). In what follows, I will briefly illustrate how the stochastic OT model could be generalized to ambiguity in syntactic interpretation through the Korean example in (2d) above.

Let us first augment our original constraint set with TOP=SUBJ ("topic is subject"), a constraint that has been extensively motivated in the literature on the syntax-discourse interface (e.g., Birner 1994; Lambrecht and Polinsky 1997; Polinsky 1998) and also in some recent work on anaphora in OT (e.g., Beaver 2000; Lee 2001a): I assume that TOP=SUBJ and SUBJ-L are floating constraints having variable ranking values in Korean.

(3) {TOP=SUBJ, SUBJ-L} $\gg$ OBJ-L

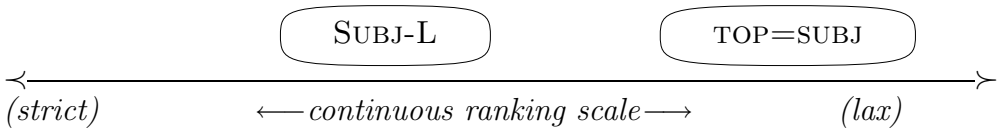
The two possible analyses for the string in (2d) are evaluated by these three constraints as in (4). Recall that arguments with the nominative case marker *-i/ka*

allow two readings in Korean: a neutral reading and an exclusive or exhaustive focus reading. For simplicity and ease of illustration, here I assume that the *-ka* marked NP (*Mary-ka*) in (2d) has the neutral reading, not the exhaustive focus reading.

		TOP=SUBJ	SUBJ-L	OBJ-L
(4)	a. $SO_{c.foc}$	*	√	*
	b. OS_{top}	√	*	√

Using Boersma and Hayes's system in comprehension-directed optimization, it would be possible to capture the observed pattern of ambiguity. As explained by Boersma and Hayes (2001), a stochastic OT grammar can generate both categorical and variable outputs. In Figure 4.1, for example, SUBJ-L is ranked higher on the scale than the other constraints in (3), and the distribution for SUBJ-L (which is illustrated here by ovals) does not overlap with TOP=SUBJ.[3] In such instances, despite the stochastic architecture, categorical behavior arises for these two constraints: when applied in comprehension direction, the ranking of SUBJ-L and TOP=SUBJ shown in Figure 4.1 will yield the categorical $SO_{c.foc}$ output (e.g., the reading 'Mary needs an English teacher (but not other teachers)').

Figure 4.1: Categorical constraint ranking with ranges of variation:



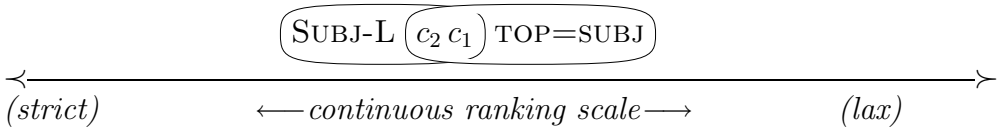
When these two constraints have relatively close ranking value, however, their ranges may overlap, as in Figure 4.2, allowing for selection points where on some evaluations, SUBJ-L is ranked higher than TOP=SUBJ, procuding the $SO_{c.foc}$ output, while on others their ranking is reversed as in Figure 4.3, yielding the syntactically marked, OS_{top} output (e.g., the reading 'As for the English teacher, he/she needs

[3]The diagrams in Figure 4.1–4.3 are adapted from Bresnan and Deo (2001).

Mary'). The frequency of this reversal in constraint dominance depends on the ranking distance between constraints and the amount of evaluation noise (the standard deviation of the distribution).

Figure 4.2: Free constraint ranking with ranges of variation:

Figure 4.3: Reversal of constraint dominance:



With the stochastic constraint ranking like the one illustrated above, the OT learning model can take into account the probability distribution of outputs with respect to input contexts, which shows us which interpretation of a sentence occurs with a sufficient frequency in which contexts.

4.2.2 Testing the Reality of the OT Constraint System

The stochastic OT approach relates to the final issue addressed here: testing the reality of the constraint system developed in this work. Two important areas which predictions of the current OT constraint system can be tested empirically against are discussed here. The first is the application of the constraint system to corpora and a learning algorithm. The second is the application of the proposed bidirectional OT analysis to crosslinguistic variation in syntactic function interpretation.

4.2.2.1 Testing Predictions of the Constraint System Against Corpora and a Learning Algorithm

Most of the data discussed here were judged in relative isolation. The validation of the proposed constraint system would require testing against naturally occurring discourse and ultimately also a larger-scale computer simulation of learning based on empirical data. As mentioned in the preceding section, the stochastic OT learning model predicts the probability distribution of outputs with respect to inputs. Especially for variable phenomena such as syntactic function interpretation which are highly sensitive to multiple conditioning factors and utterance context, a probability distribution is empirically more adequate than a single preferred interpretation for a given string.

By examining the probability distribution of outputs with respect to input contexts, it should be possible to determine what grammatical factors (or combinations of factors) practically lead to (non)ambiguity in which contexts and also to further refine the proposed constraint system. The bidirectional OT approach, coupled with the stochastic constraint ranking, could also be used to investigate whether the probability distribution of the output learned by the OT learning algorithm matches the actual frequencies observed in real corpus data. This empirical orientation in syntactic research would increase the usefulness of theoretical linguistics to other research fields of human language.

4.2.2.2 Crosslinguistic Variation in Disambiguation Preferences

One of the prominent claims made here is that disambiguation preferences in syntactic function interpretation can be derived from the application of the principles of grammar, if the proper grammatical theory is selected, viz. OT. That principles of grammar shape disambiguation preferences was demonstrated in Chapter 3, by the bidirectional OT analysis of freezing effects in Hindi and Korean. Specifically, the OT constraint system proposed here makes two particular predictions. First, the higher-ranking constraints should have more influence on disambiguation than the lower-ranking ones. I have shown this aspect of the prediction made by the OT approach

to disambiguation through the account of absence of freezing effects in clauses containing unambiguously case-marked arguments: a candidate that does not interpret the grammatical function of argument NPs in line with the unmarked grammatical function/case association violates the high-ranking OO-faithfulness constraints and this violation leads to unrecoverability of the original input.

A second prediction is that constraints ranked too low to be decisive in production grammar may have considerable effects on disambiguation. The derivation of the emergence of the unmarked appears to be possible in an optimization-based approach to disambiguation only, and thus supports the proposal here in a particularly strong way.[4]

If the claim that variation in disambiguation preferences and in grammar goes hand in hand is indeed correct, we should also be able to account for differences in disambiguation preferences across languages in terms of variations on relevant grammatical constraints. Although not explored here, in Lee (2000) I have proposed an extension of the bidirectional approach to differences in disambiguation patterns in double object constructions in two Bantu languages, Kikuyu and Sesotho. Although the grammars of the two languages are closely related, they differ systematically in terms of the identification of grammatical functions of arguments of potentially ambiguous passive clauses and ambiguous incorporated pronouns, which implies a certain number of subtle syntactic differences. The main claim of that paper is that parsing differences in Kikuyu and Sesotho follow from different rankings of word order constraints and markedness constraints on pronominal form/semantic role mappings. More comprehensive research into disambiguation patterns in different construction types in different languages will hopefully be a topic for further research.

[4]Compare Fanselow *et al.* (1999) for a similar result with respect to case agreement effects in German.

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