

Case realization and identity[☆]

Stephen Wechsler^{a,*}, Larisa Zlatic^b

^a *University of Texas at Austin, Linguistics Department, University of Texas,
Austin, Texas 78712-1196, USA*

^b *Synthesys Technologies, Inc., 4030 W. Braker Lane, Austin, Texas 78759, USA*

Abstract

Languages with case concord sometimes require that at least one case-concord element in the NP be inflected for case, while others may be uninflected. Focusing primarily on Serbo-Croatian, we review some variants of this case realization requirement in different languages and propose a unified account. This analysis makes crucial use of reentrancy (cp. structure-sharing) in attribute-value matrices, a key explanatory tool of Head-Driven Phrase Structure Grammar. © 2001 Elsevier Science B.V. All rights reserved.

Keywords: Case; Concord; Serbo-Croatian; Slavic; Reentrancy; HPSG; Head-Driven Phrase Structure Grammar; Morphosyntax

1. Introduction: Obligatory but variable case expression

Case concord within the noun phrase is optional in some languages. Or, to put it differently, some languages allow for variation as to which element of the NP inflectionally realizes the case feature. For example, in the Australian language Gooniyandi, the case ending can appear on virtually any element within the NP, the only requirement being that it must appear on at least one (and usually exactly one) of them (McGregor, 1990: 277):¹

[☆] Many thanks to Frank Richter and Adam Przepiórkowski for valuable discussion of the HPSG formalism; to Josef Bayer, Hans Uszkoreit, and Stefan Mueller for discussion of German; to Bill Davies for information on Choctaw; and to Avery Andrews, Annabel Cormack, and Anna Feldman for answering our queries with leads on various languages.

* Phone: +1 512 471 1701; Fax: +1 512 471 4340; E-mail: wechsler@mail.utexas.edu; E-mail second author: lzlatic@alum1.utexas.net

¹ Morpheme glosses:

NOM	nominative	F	feminine
A(CC)	accusative	M	masculine

- (1) a. ngooddoo-ngga garndiwiddi yoowooloo
 that-ERG two man
 ‘by those two men’
 b. marla doomoo-ngga
 hand clenched-ERG
 ‘by a fist’
 c. mayaroo yoowarni-ya
 house one-LOC
 ‘in one house’

According to McGregor (1990: 277), the case ending may attach to any of the following nominal elements, listed in decreasing order of preference: deictic (as in (1a)), quantifier (as in (1c)), qualifier (as in (1b)), head noun, classifier. Normally the case ending appears only once in the nominal, but in various special circumstances it can be doubled, such as when the NP is discontinuous or to give equal salience to two members of a coordinate phrase (McGregor, 1990: 281–282).

Choctaw provides another interesting example where case must obligatorily be expressed, but can appear on a variety of NP-internal elements. In coordinate NP's, for example, the case suffix can appear on any combination of the conjuncts as long as it marks at least one of them (Davies, 1981: 457):

- (2) a. Ofi, katos, micha alla-t washoha-tok.
 dog cat and child-NOM play-PAST
 ‘The dog, the cat, and the child played.’
 b. Ofi, katos-a-t, micha alla-t washoha-tok.
 c. Ofi-a-t, katos-a-t, micha alla-t washoha-tok.
 d. Ofi, katos-a-t, micha alla washoha-tok.
 e. Ofi-a-t, katos-a-t, micha alla washoha-tok.
 f. Ofi-a-t, katos, micha alla washoha-tok.
 g. Ofi-a-t, katos, micha alla-t washoha-tok.
 h. *Ofi, katos, micha alla washoha-tok.

The operative condition on case realization is an ‘existential’ one: case morphology must appear on *some* case-bearing element(s), but the grammar does not dictate which one(s). Apart from that requirement, case morphology is optional.

There are various ways of capturing such a condition in a formal grammar. In a derivational syntactic framework allowing deletion operations, case endings could be generated on all potentially case-bearing words, then freely deleted on all but one. On the other hand the deletion approach is not available within a non-derivational

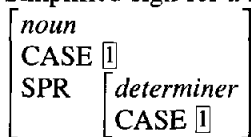
DAT	dative	N(T)	neuter
GEN	genitive	SG	singular
INST	instrumental	PL	plural
LOC	locative	AUX	auxiliary
ERG	ergative		

framework such as Head-Driven Phrase Structure Grammar (Pollard and Sag, 1994; Sag and Wasow, 1999). In this paper we propose a simple and general approach within the HPSG framework to the problem of obligatory but variable expression of morphosyntactic features. Then we apply the same formal analysis in more detail to a slightly different phenomenon from Serbo-Croatian case (described in Wechsler and Zlatić, 1999), where case is obligatory and so the deletion approach is no longer an option. In section 6 we briefly compare our analysis to feature percolation approaches such as Wechsler and Zlatić (1999) and Bayer et al. (this issue).

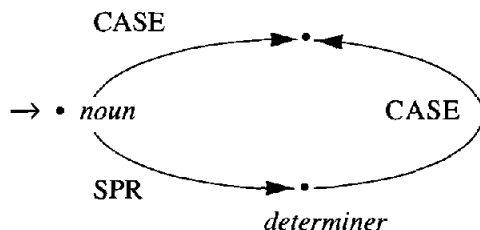
2. Reentrancy and concord

Frameworks such as HPSG and Lexical-Functional Grammar are particularly well-suited to solving the problem of variable location of the case inflection. To see why, we need to understand how syntactic dependencies are captured in such frameworks. Almost all syntactic dependencies, including agreement, concord, and ‘wh-movement’, are captured with the simple formal device of *reentrancy* (also called *structure-sharing* or *token-identity*) (for an introduction see Shieber, 1986). Information is represented in the form of a recursive Attribute-Value Matrix (AVM). The value of each feature can be an atomic symbol, or an embedded AVM (other values such as lists and sets are also allowed). To take a simple example, consider case concord between a noun and its determiner. Assuming for the sake of illustration that the noun is the head subcategorizing for its determiner, we capture case concord by specifying within the noun’s lexical entry that its value for CASE is token-identical to the CASE value of its determiner, as shown in (3a). The boxed numeral $\boxed{1}$ indicates token-identity; that is, the two places in this AVM where the numeral $\boxed{1}$ appears are to be interpreted as a single node in a directed graph, as shown in (3b).

- (3) a. Simplified sign for a noun showing case concord with its determiner



- b. Notational variant of (3a).



To make this point clearer, we can restate (3a) in the alternative graph notation in (3b). Each set of AVM brackets in (3a) translates to a node, with the outermost

brackets corresponding to the root node, identified by the small arrow at the left. The type (=sort) names appearing in italics at the top left of the bracketed feature structures in the AVM become node labels. Features are represented as arcs, with the attribute name (CASE, SPR, etc.) labeling the arc itself and the value represented as the node toward which the arc points. Case concord follows because the noun's and the determiner's CASE features have a single node as their value, namely the node at the top of diagram (3b). Hence whatever type name (*nominative*, *dative*, etc.) labels that node must serve as the value for both the noun's and the determiner's CASE features.

When the hypothetical noun represented in (3) syntactically combines with its specifier, the AVM representing the specifier unifies with the structure

$\left[\begin{array}{l} \textit{determiner} \\ \text{CASE } \boxed{\text{I}} \end{array} \right]$, in accordance with the Valence Principle, the basic mechanism for

syntactic combination of heads with their subcategorized dependents. If the CASE value of the determiner does not match that of the head noun then unification fails, predicting unacceptability. Hence agreement (concord) is a by-product of basic syntactic composition. Crucially, syntactic combination does not merely lead to checking that the CASE values are equal, but of unifying those values. In fact, under standard (though not universal) assumptions of monotonicity, merely checking case is impossible. The only way to check the identity of two values is to unify them, and there is no way to undo unification once it is done.

As a consequence, in the formal representation for an NP showing concord the case value appears only once. For example in the hypothetical NP [these-dative dogs-dative], where both the determiner and the noun are inflected for dative case, the abstract dative case feature appears once, not twice. This fact, an automatic consequence of the formalism, leads us to a solution to the problem of variable but obligatory expression of case. Since all case-concord items must share a single CASE value (i.e. a single token) within the AVM representing the NP, the condition that at least one of those elements must in fact be inflected for case, reduces to a simple condition on the single node housing that shared CASE value.

How can we state this very reasonable and functionally plausible condition that certain abstract grammatical features must have morphological exponents? Here we will explore the view that this condition follows automatically from the way phonological form is connected with grammatical features. This requires a minor adjustment to the theory, to be explained next.

In a semiotic theory like HPSG, the lexicon connects phonological form to grammatical features through the theory of *types*. By way of illustration, Choctaw nouns bearing the nominative case inflection /-t/, illustrated in (2) above, could be analyzed as belonging to the type *nom-noun*, subject to the constraint in (4):

$$(4) \quad \text{nom-noun} \Rightarrow \left[\begin{array}{l} \text{PHON } \Phi + t \\ \text{SYNSEM|LOC|CAT|HEAD|CASE } \textit{nom} \\ \text{STEM } \left[\begin{array}{l} \textit{noun-stem} \\ \text{PHON } \Phi \end{array} \right] \end{array} \right]$$

$$(5) \quad \text{inflected-word} \Rightarrow \left[\begin{array}{l} \text{SYNSEM } [\text{I}] \\ \text{STEM } \left[\begin{array}{l} \textit{word-stem} \\ \text{SYNSEM } [\text{I}] \end{array} \right] \end{array} \right]$$

Constraint (4) specifies the following facts about a word of type *nom-noun*: it has a stem of type *noun-stem*; its phonological form consists of the phonology of the stem (represented with the variable Φ) plus the suffix *-t*; and its CASE value is *nom(inative)*. Constraint (5) specifies that for any word of type *inflected-word*, the SYNSEM (SYNTAX/SEMANTICS) field of the word is identical to that of its stem. The type *nom-noun* is a subtype of *inflected-word*, so any nominative noun will also inherit the properties common to inflected words.

For the present discussion we focus on the connection between phonological form and the case feature it expresses. For reasons that will become clear, we replace (4) with the three simpler constraints in (6):

(6) a. Phonological spell-out of the type *nom-noun*:

$$\text{nom-noun} \Rightarrow \left[\begin{array}{l} \text{PHON } \Phi + t \\ \text{STEM } \left[\begin{array}{l} \textit{noun-stem} \\ \text{PHON } F \end{array} \right] \end{array} \right]$$

b. Implication from morphological form (*nom-noun*) to CASE feature (*nom*):

$$\text{nom-noun} \Rightarrow [\text{SYNSEM|...|CASE } \textit{nom}]$$

c. Implication from CASE feature (*nom*) to morphological form (*nom-noun*):

A node labelled *nom* must be the terminus of some path satisfying the following description: $\left[\begin{array}{l} \textit{nom-noun} \\ \text{SYNSEM|...|CASE } \textit{nom} \end{array} \right]$

Constraint (6a) defines *nom-noun* as a morphological (formal) type, namely that of nouns with the *-t* suffix. Constraint (6b) states that if a given noun belongs to that morphological type, then that noun encodes the abstract grammatical feature [CASE *nom*]. Constraint (6c) takes the implication in the other direction. It states that for every [CASE *nom*] feature there must be a word of the morphological type *nom-noun* encoding a path whose terminus is that *nom* value.² Assuming a standard HPSG feature architecture, the specific feature path abbreviated in (6b) and (6c) would be the following: [SYNSEM| LOC| CAT| HEAD| CASE *nom*]. Below we will continue to abbreviate this path description as [SYNSEM|...|CASE *nom*].

² Note that this constraint involves an implicit existential quantifier. On the use of existential quantifiers in AVM constraints as in (6c), see Richter et al. (1999) and Richter (2000).

There is an important conceptual difference between the status of form-to-content implications like (6b) and content-to-form implications like (6c). Form-to-content implications naturally belong in the lexicon: (6b) effectively interprets the /-t/ morpheme as expressing the grammatical feature of nominative case. But (6c) is a condition on a grammatical feature. Since a single feature can often be expressed by more than one word (recall (3) above), (6c) properly belongs to the syntax, not the lexicon. To put it differently, (6b) is concerned with the interpretation, while (6c) is concerned with generation, i.e., how to express an abstract grammatical feature. What we propose here is to leave within the lexicon the constraints interpreting morphemes in terms of the grammatical features they express, but move into the syntax the constraints dictating how abstract features are to be expressed morphologically. So the constraint in (6c) must be understood as applying to whole sentences.³ Hereafter, form-to-content case constraints like (6c) will be called Case Realization Constraints.

This modified approach correctly predicts the Choctaw facts in (2). We may assume that the CASE values of the NP conjuncts in (2) are token-identical. As explained above, this is needed to explain the case ‘concord’ across conjuncts illustrated in (2c), for example. According to (6c) the single *nom* value for CASE in the AVM representing the coordinate NP must be the terminus of at least one path starting from a node labeled *nom-noun*. Hence at least one noun must have nominative inflection. More generally, where a Case Realization Constraint applies it predicts the Gooniyandi/Choctaw type of pattern, as long as case endings are otherwise optional in the language in question (e.g. if case inflection is not required by the morphology).

In languages where case morphemes are not optional, the effects of a Case Realization Constraint differ accordingly. In the remainder of this paper we analyze an extended example of this kind from Serbo-Croatian. In that language case morphology is obligatory on declinable words, but certain special words such as some loans and quantifiers cannot be declined. As we will see, the same kind of Case Realization Constraint interacts with language-particular aspects of the grammar to explain a complex array of facts.

3. Undeclared nominals in Serbo-Croatian

In Serbo-Croatian, common nouns generally inflect for case and number features. Within the noun phrase, all of the noun’s dependents (determiners, possessives, adjectives) must morphologically realize the features of case, number, and gender in

³ HPSG-savvy readers may notice a technical complication with formalizing (6c) precisely. This constraint must be formulated to apply only to paths sharing their case values due to the effects of the grammar (subcategorization, principles, etc.). We must ignore ‘spurious reentrancy’ with other type-identical case values that happen to appear in the same sentence. Normally spurious reentrancy is harmless (except for leading to spurious structural ambiguity), but in this case it matters. The solution to this formal problem, which may be tricky within a monotonic framework, will be left for future work.

agreement with the features of the head noun. An example of agreement with the feminine noun *knjiga* ‘book’ is given below.

- (7) [moja stara knjiga]_{NP}
 my.F.SG.NOM old.F.SG.NOM book.SG.NOM
 ‘my old book’

Just like common nouns, proper names in Serbo-Croatian also inflect for case (and number) as shown by the paradigm in Table 1:

Table 1
 Serbo-Croatian 2nd declension singular case paradigm of common and proper nouns

Singular	‘woman’ (f)	‘Marija’ (f)
Nominative	žen-a	Marij-a
Accusative	žen-u	Marij-u
Genitive	žen-e	Marij-e
Dative/Locative	žen-i	Marij-i
Instrumental	žen-om	Marij-om
Vocative	žen-o	Marij-a

However, certain female names with endings other than /-a/ (generally loan words) are normally undeclined. Some examples are given in (8):

- (8) Some undeclined female names:
Miki, Ketī, Meri, Džejn, Džin, Ines, Nives, ...
 Also the borrowed common noun *lejdi* ‘lady’.

Feminine nouns normally end in /-a/ in the citation form, which places them in the traditional 2nd declension class shown in Table 1. Because of their exceptional phonological shape, female names lacking the final /-a/ are generally not declined.

Regardless of whether they are inflected or not, female names act like other nouns in that they transmit their case to their modifiers, as shown in (9). We interpret this to mean that while these names are lexically underspecified for the CASE feature, they still receive a case value and transmit it to their modifiers.

- (9) a. (Ova) Miki je došla iz Amerike.
 this-NOM.F.SG Miki AUX came-F.SG from Amerika.
 (This) Miki came from America.’
 b. Poznajem (jednu) Miki.
 Know-1SG one-ACC.SG Miki
 ‘I know (a person named) Miki’.
 c. *sećati se* ‘remember’ assigns genitive:
 Sećam se (jedne) stare Miki.
 remember REFL one-GEN.SG old-GEN.SG Miki
 ‘I remember old Miki.’

- d. The preposition *prema* ‘toward’ assigns dative:
 On je trčao prema (lepoj) Miki.
 He AUX ran towards beautiful-DAT.SG Miki
 ‘He ran towards (beautiful) Miki.’
- e. The preposition *sa* ‘with’ assigns instrumental:
 Dolazim sa (mojom) Miki.
 come-1SG with my-INST.SG Miki
 ‘I am coming with Miki.’
- f. The preposition *o* ‘about’ assigns locative case:
 Razgovarali smo o (mojoj) Miki.
 talked-1PL AUX about my-LOC.SG Miki
 ‘We talked about (my) Miki.’

A name like *Miki* has a case feature, but the value is underspecified in the lexical sign. The value is transmitted to the specifier, as shown in (10):

- (10) Partial lexical sign for undeclined female name like *Miki*:

word HEAD	[noun	[CASE case	NUMBER sg	GENDER fem]]]						
			CONCORD 1														
VALENCE		[SPR		<[AP[CONCORD 1]]									

(Specifiers and pronominal modifiers in Serbo-Croatian are categorially adjectives; see Zlatić, 1997.) The noun is lexically unspecified for case, but whatever case value is assigned to the NP is transmitted to the specifier via structure-sharing (indicated by the tag [1]).

The distribution of undeclined female names is rather unusual: they appear as objects of any preposition, and in all verb- or noun-governed positions – *except where dative or instrumental case is assigned*.

- (11) a. *diviti se* ‘admire’ assigns dative:
 Divim se Larisi / *Miki.
 admire-1SG REFL Larisa-DAT / Miki
 ‘I admire Larisa / Miki.’
- b. *ponositi se* ‘be proud of’ assigns instrumental:
 Ponosim se Larisom / *Miki.
 proud-1sg REFL Larisa-INST / Miki
 ‘I am proud of Larisa / Miki.’
- c. passive agent-phrase appears in instrumental:
 Oduševljena sam Larisom / *Miki.
 impressed-1SG AUX Larisa-INST / Miki
 ‘I am impressed by Larisa / Miki.’

In contrast, these names can appear where a preposition would assign dative or instrumental case, as illustrated in (9d,e), above. How are we to explain the restriction against appearing in noun- and verb-governed dative/instrumental case positions?

Actually the restriction is subtler. An NP headed by an uninflected female name can appear in a dative/instrumental case position, *as long as some element in the NP morphologically realizes the case feature*. The dative and instrumental examples in (12a,b) are unacceptable unless the possessive adjective *mojoj/mojom* ‘my’ appears. When the possessive adjective realizes the case feature, it is acceptable. In (12c) we contrast the adjective *braon* ‘brown’ – a loan word which is undeclined – with the inflected form *lepoj* ‘beautiful’. The example is acceptable only with the inflected adjective.

- (12) a. Divim se *(mojoj) Miki.
 admire-1SG REFL my-DAT.SG Miki
 ‘I admire (my) Miki.’
 b. Oduševljena sam *(mojom) Miki.
 impressed-1SG AUX my-INST.SG Miki
 ‘I am impressed by (my) Miki.’
 c. Divim se {*braon / lepoj} Miki.
 admire-1SG REFL brown / beautiful-DAT.SG Miki
 ‘I admire {brunette/ beautiful} Miki’

We can formulate the descriptive summary in (13):

(13) *Serbo-Croatian Dative/Instrumental Case Realization Condition*

If a verb or noun assigns dative or instrumental case to an NP, then that case must be morphologically realized by some element within the NP.

Next we turn to quantified NPs or ‘QNP’s in Serbo-Croatian, which have a similar distribution to uninflected proper names. These are phrases introduced by undeclined quantifiers such as *mnogo* ‘many/much’, *malo* ‘few/little’, and the numerals *pet* ‘five’ and higher. An example is the bracketed phrase in (14):

- (14) [Mnogo srpskih pisaca] je otišlo.
 many Serbian-GEN.PL writer-GEN.PL AUX.SG left-3.NT.SG
 ‘Many Serbian writers have left.’

The quantifier itself does not inflect for case or person, number and gender (PNG) features. In that respect quantifiers resemble the uninflected female names discussed in the preceding section.

Following earlier work (Wechsler and Zlatić, 1997), we analyze the quantifier as the head of the QNP. We assume that the quantifier is of category N, hence the entire QNP it heads is categorially an NP. These assumptions explain two facts: First, like other nouns in Serbo-Croatian, the quantifier governs genitive case on its direct NP

complement (e.g. *srpskih pisaca* ‘Serbian-GEN.PL writer-GEN.PL’ in (14) appears in genitive). Second, QNPs have the same distribution as ordinary nominals (modulo considerations of case-marking, which we discuss below).

Quantifiers differ from both ordinary nouns and uninflected female names in that determiners and other modifiers preceding the quantifier do not show the case assigned to the QNP as a whole, but instead appear invariably in genitive plural. Ordinary nouns transmit their case value to any case-marked determiners or other modifiers. For example, in (15) the bracketed ordinary NP is in a nominative position, so the determiner, adjective, and head noun all appear in nominative case. But quantifiers take modifiers in genitive plural form, irrespective of where the QNP appears. The QNP in (16) is invariant in form and could appear in any of the case-marked positions where QNPs appear (see just below for distribution of QNPs).

- (15) [Moja stara knjiga] stalno pada.
 my.F.SG.NOM old.F.SG.NOM book.NOM always falls.3SG
 ‘My old book keeps falling.’
- (16) mojih / zadnjih pet godina
 my.GEN.PL /last.GEN.PL five year-GEN.PL
 ‘my five years / the last five years’

The distribution of these uninflected QNPs closely resembles that of the uninflected female names. QNPs can appear as arguments of verbs, in nominative, accusative or genitive positions, but not in positions receiving dative or instrumental case. Example (14) above shows a QNP in a nominative position; (17) and (18) illustrate accusative and genitive positions, respectively.

- (17) a. Poznajem ove studente
 know-1SG this-ACC.PL student-ACC.PL
 ‘I know these students.’
 b. Poznajem [ovih pet studenata].
 know-1SG this-GEN.PL five student-GEN.PL
 ‘I know these five students.’
- (18) a. Sećam se ovih studenata.
 remember-1SG REFL this-GEN.PL student-GEN.PL
 ‘I remember these students.’
 b. Sećam se [ovih pet studenata].
 remember-1SG REFL this-GEN.PL five student-GEN.PL
 ‘I remember these five students.’

QNPs can also appear in noun complement positions where genitive would normally appear, as in (19).

- (19) a. knjiga [ovih studenata]
 book this-GEN.PL student-GEN.PL
 ‘a book of these students’

- b. knjiga [ovih pet studenata]
 book this-GEN.PL five student-GEN.PL
 ‘a book of these five students’

However, QNPs cannot appear in positions where the verb or noun governs dative (20b) or instrumental (21b).

- (20) a. pokloniti knjige [ovim studentima]
 give-INF books-ACC this-DAT.PL student-M.PL
 ‘to give books to these students’
 b. *pokloniti knjige [ovih pet studenata]
 give-INF books-ACC this-GEN.PL five student-GEN.PL
 (‘to give books to these five students’)
- (21) a. upravljanje [ovim preduzećima]
 management this-INST.PL company-INST.PL
 ‘management of these companies’
 b. *upravljanje [ovih pet preduzeća]
 management this-GEN.PL five company-GEN.PL
 (‘management of these five companies’)

However, these quantifiers can occur as complements of any preposition, irrespective of which case the preposition calls for: instrumental or genitive, as in (22c), locative (23b), or dative (24b):

- (22) a. sa srpskim piscima
 with Serbian-INST.PL writers-INST.PL
 b. od srpskih pisaca
 from Serbian-GEN.PL writers-GEN.PL
 c. sa/od mnogo/pet [srpskih pisaca]
 with/from many/five Serbian-GEN.PL writers-GEN.PL
- (23) a. u/na kući
 in/on house-LOC
 b. u/na pet/nekoliko kuća
 in/on five/several houses-GEN.PL
- (24) a. prema demonstratima
 towards demonstrators-DAT.PL
 b. prema nekoliko/puno demonstranata
 towards several /a lot demonstrators-GEN.PL

Note that Locative case is assigned only by prepositions.

Summarizing the distribution, QNPs appear in nominative, accusative, and genitive (but not instrumental or dative) positions governed by verbs, genitive positions governed by nouns, and any position governed by a preposition, including dative and instrumental. This is essentially the same distribution as uninflected female names, with one difference. Recall that uninflected female names

in verb- or noun-governed dative/instrumental positions can be rescued from ungrammaticality by including some element in the NP to express the dative/instrumental case. Specifically, pre-head modifiers like demonstratives and adjectives agree in case with the head, so these can be used to save such a dative/instrumental NP (see (12)). However, as noted above, uninflected quantifiers, unlike female names and other nouns, fail to transmit case to the pre-head modifiers such as demonstratives and adjectives. Thus there is no element of a QNP that can morphologically express the case assigned to it from outside. As a consequence of (13), QNPs can never appear in verb- or noun-governed dative/instrumental positions.

4. Analysis

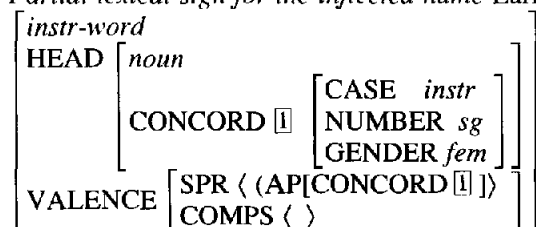
The Serbo-Croatian facts can be explained by positing a Case Realization Constraint like the one posited in (6c) above for Choctaw. As shown above, this condition applies only to Dative and Instrumental cases in Serbo-Croatian:

(25) *Serbo-Croatian Case Realization Constraints*

- a. A node labelled *dative* must be the terminus of some path satisfying the following description: $\left[\begin{array}{l} \text{dative-word} \\ \text{SYNSEM|...|CASE } dative \end{array} \right]$
- b. A node labelled *instr* must be the terminus of some path satisfying the following description: $\left[\begin{array}{l} \text{instr-word} \\ \text{SYNSEM|...|CASE } instr \end{array} \right]$

Like the type *nom-noun* in (6) above, the types *dative-word* and *instr-word* characterize words (nouns, adjectives, determiners, etc.) bearing actual dative and instrumental case morphology, respectively. The sorts *dative* and *instr* represent case values assigned to the nominal by the governing verb, noun, or preposition. (We return to the problem of preposition-assigned case below.) Since CASE is a HEAD feature, the Head Feature Principle ensures that this feature (including both attribute and value) is structure-shared between the NP as a whole and its head noun. Normal processes of syntactic composition further ensure that the CASE feature will be shared with all concord elements. Relevant sample lexical signs, somewhat simplified for expository purposes, follow:

(26) *Partial lexical sign for the inflected name Laris-om 'Larisa-INSTR'*



- (27)
- Partial lexical sign for undeclined female name like Miki*

[<i>root-word</i>		
HEAD	[<i>noun</i>	
	CONCORD [1]	[CASE <i>case</i>
		NUMBER <i>sg</i>
VALENCE	[SPR < (AP[CONCORD [1]])	GENDER <i>fem</i>
		COMPS < >

- (28)
- Partial lexical sign for undeclined quantifiers such as mnogo 'many'*

[<i>root-word</i>		
HEAD	[<i>noun</i>	
	CONCORD [CASE <i>case</i>]	
VALENCE	[SPR < (AP[<i>gen</i>])	
	COMPS < (NP[<i>gen</i>])	

Most of the information in these lexical representations is predictable, hence is not stipulated for individual words but rather captured by using a hierarchical inheritance lexicon (Flickinger, 1987). For simplicity we present the resulting AVMs and omit the theory responsible for 'generating' them, i.e. for capturing lexical generalizations (Davis, 1996; Flickinger, 1987; Koenig, 1999, *inter alia*). Nor will we describe the morphological theory responsible for building up forms like *Laris-om* 'Larisa-INSTR' in (27) from the noun stem and inflectional paradigm (see (4) and (6a) above for a rough idea; see Sag and Wasow (1999) for one approach to HPSG morphology; see Wechsler and Zlatić (2000) on Serbo-Croatian nominal inflection). Note that the sign for *Larisom* 'Larisa.INSTR' in (27) is of type *instr-word*, while the undeclined *Miki* and *mnogo* 'many' are of type *root-word*. Hence *Larisom* suffices to satisfy the Case Realization Constraint (25b), while *Miki* and *mnogo* do not, as desired.

We showed above that the case realization condition does not apply to objects of prepositions, which can therefore be undeclined (cp. undeclined names in (9d,e); QNP's in (22)–(24)). How are we to explain the special behavior of prepositions? According to one proposal, the preposition is itself a case-marker; e.g. the preposition *sa* 'with' is an instrumental case marker (Franks, 1995; Leko, 1987). Since many verbs and nouns alternate between taking an instrumental NP and a *sa*-PP, contrasts like the following can be constructed (from Franks, 1995: 98):

- (29) a. Predsjednik vlada zemljom.
 president rules country-INST
 'The president rules the country.'
 b. Predsjednik vlada sa nekoliko zemalja.
 president rules with several countries-GEN
 'The president rules several countries.'

In our view *vlada* 'rules' assigns instrumental case to its NP object in (29a), while *sa* 'with' assigns instrumental case to its NP object in (29b). But on the alternative

Franks (1995) view, *sa* in (29b) is itself an instrumental case marker, inserted before a QNP in a special strategy invoked to realize the instrumental case assigned by the verb, since the quantifier is undeclined. In Wechsler and Zlatić (1999), which took a feature percolation approach to the case issue (see Section 6 below for comparison with the present approach), we rejected the *sa*-as-instrumental-marker approach, noting some empirical problems with it. But under the present analysis those problems vanish, and so we will reconsider a version of this approach here.

Wechsler and Zlatić (1999) gave two reasons for rejecting the preposition-as-case-marker proposal. First, not all instrumental-assigning verbs permit the alternative *sa*-PP complement. For example, *lutati* ‘wander’ takes an instrumental NP:

- (30) a. On je lutao morima.
 he AUX wandered seas-INST
 ‘He wandered the seas.’
 b. *On je lutao sa morima.
 he AUX wandered with seas-INST
 (‘He wandered the seas.’)
 c. *On je lutao pet mora.
 he AUX wandered five seas
 (‘He wandered five seas.’)
 d. *On je lutao sa pet mora.
 he AUX wandered with five seas
 (‘He wandered five seas.’)

As shown in (30a,b), *lutati* ‘wander’ takes an instrumental NP but not a *sa*-PP. It follows that this verb’s complement cannot be a QNP, since this violates either the Serbo-Croatian Dative/Instrumental Case Realization Condition (13) (as in (30c)) or the subcategorization frame of the verb (as in (30d)). On the *sa*-insertion view, there is no explanation for why *sa* cannot be inserted to ‘save’ (30c), yielding (30d). On the present account, the alternation between instrumental NPs and *sa*-PPs is a matter of subcategorization, so we expect variation across verbs.

Secondly, notwithstanding a prescriptive rule to the contrary, *sa* often introduces ordinary (non-QNP) instrumental NPs in Serbo-Croatian speech, even for complements of verbs, as in these examples:

- (31) a. Oni upravljaju (sa) ovim preduzećem.
 they manage with this-INST company-INST
 b. Oni rukovode (sa) državom.
 they rule with country-INST

On the *sa*-as-case-marker view, the variants of (31a–b) with *sa* are inexplicable since they would involve double case marking.

The functional intuition behind this proposal is that the preposition serves a similar function to a case marker, namely to identify a thematic role type (see Bayer et al. (this issue) for related discussion). Under the present assumptions, we can capture

the intuition that prepositions and case markers are *functionally* similar, without thereby assimilating the two in categorial or *structural* terms. To do this, we maintain the traditional view that the item in question (*sa* ‘with’, for example) is of category preposition and that it subcategorizes and assigns instrumental case to an NP object. But we further posit that it is of sort *instr-word*, and that it has a CASE feature whose value is shared with its object NP’s CASE value:

(32) *Partial lexical sign for the preposition sa ‘with’*

<i>instr-word</i>	
HEAD	$\left[\begin{array}{l} \textit{preposition} \\ \text{CASE } \underline{1} \end{array} \right]$
VALENCE COMPS	$\langle \text{NP}[\text{CASE } \underline{1} \textit{instr}] \rangle$

Given these assumptions, the preposition will allow even an uninflected NP object to satisfy the Case Realization Constraint, as desired. This analysis directly expresses the intuition that the preposition itself satisfies the requirement that some element must identify the theta-role normally marked by instrumental case. But the traditional PP structure is preserved under this analysis, so the facts in (30) are unproblematical, and nothing prevents the ‘double case-marking’ illustrated in (31).

Still, it is somewhat ad hoc to assign case features to prepositions, which are indeclinable, so it is worth considering alternatives. Under the present assumptions, the alternative to the preposition-as-case-marker view is rather inelegant. It requires distinguishing two different subtypes of the *dative* case value, say [CASE *real-dative*] and [CASE *unreal-dative*], and two types of instrumental, *real-instr* and *unreal-instr* (*real* for ‘morphologically realized’; *unreal* for ‘morphologically unrealized’). A dative-taking verb or noun specifies [CASE *real-dative*] for its complement NP, while a dative-taking preposition specifies [CASE *dative*] for its complement NP. The dative Case Realization Constraint would then be modified to apply only to *real-dative*, not *unreal-dative*.

Why is case realization obligatory for dative and instrumental case, but not nominative, accusative, or genitive? Two related explanations present themselves. First, as noted already in Wechsler and Zlatić (1999), dative and instrumental are the most thematically marked (semantically restricted) of the cases: nominative and accusative are the direct (unrestricted) cases in the verbal domain, and genitive is the corresponding direct case in the nominal domain (see Zlatić (1997) for evidence that genitive assigned by nouns is direct or ‘structural’ rather than oblique or ‘inherent’ case). Generally forms which are structurally marked (*markiert*, to use the structuralist term) tend to be phonologically marked (*merkmalhaft*) as well, so that if case realization is to be required for any of the cases, we would expect it on the most structurally marked ones: dative and instrumental. Second, it has long been noted that forms expressing semantically relevant information tend to be retained in surface structure (Kiparsky, 1972, *inter alia*). Instrumental and Dative cases have more semantic content than do the other cases, so if a case realization condition is to apply anywhere, we expect it to apply there. See also Bayer et al. (this issue) for further discussion.

5. Agreement

In contrast with ordinary NPs (35) and uninflected names (36), a QNP does not trigger subject-verb agreement ((14), repeated here).

- (35) Srpski pisari su otišli.
 Serbian-NOM.M.PL writer-NOM.M.PL AUX.3PL left-M.PL
 'The Serbian writers have left.'
- (36) (Ova) Džejn je došla iz Amerike.
 this-NOM.F.SG Jane AUX.3SG came-F.SG from America.
 (This) Jane came from America.'
- (14) [Mnogo srpskih pisaca] je otišlo.
 [many Serbian-GEN.PL writer-GEN.PL] AUX.3SG left-NT.SG
 'Many Serbian writers have left.'

With normal (non-QNP) subjects as in (35) and (36), auxiliaries agree in person and number (e.g. the plural auxiliary *su*) and non-finite predicates agree in number and gender (e.g. the third person plural masculine form *otišli*). In contrast, these elements appear in neuter singular form when the subject is a QNP.

As in many case languages, verbs agree only with nominative NP arguments. When no nominative argument is present, the verb must appear in its default form, which is homophonous with the neuter third person singular form. For example, clausal subjects as in (37b) fail to trigger agreement on the verb, just like QNP subjects as in (37c). In contrast an ordinary NP subject triggers normal agreement as shown in (37a).

- (37) a. Ova povišica je iznenadila Jovana
 this raise-F.NOM AUX.SG surprised-F.SG John-ACC
 'This (pay) raise surprised John.'
- b. Jovana je iznenadilo [što su se cene povećale].
 John-ACC AUX.SG surprised-N.SG [that prices were raised]
 'That prices have been raised surprised John.'
- c. Mnogo/nekoliko povišica je iznenadilo Jovana
 many/several raises AUX.SG surprised-N.SG John-ACC
 'Many/several (pay) raises surprised John.'

These facts are immediately explained if we assume that an argument must satisfy two requirements in order to trigger agreement: first, as mentioned already, it must be in nominative case; second, its referential index must contain person, number, and gender (PNG) features. Ordinary nouns and uninflected names satisfy both requirements, so they trigger agreement. Quantifiers satisfy the first condition when the QNP appears in a nominative position, but they lack PNG features so they fail the second condition. Non-nominative NPs like the accusative NP *Jovana* in (37a,b,c) satisfy the second condition but not the first; clausal arguments as in (37b) satisfy neither condition. See Wechsler and Zlatić (1999) for a more detailed presentation and defense of this analysis.

It is tempting to try to explain the failure of agreement by positing that the QNP is inherently non-nominative, since it lacks case inflection and only nominatives trigger agreement. But this analysis runs into problems. First, it is suspicious since uninflected female names have the same case distribution as QNP's but, unlike QNP's, the names do trigger agreement when in nominative positions. Also, agreement on bound anaphors provides evidence that the QNP subject in a sentence like (14) receives nominative case, despite the lack of agreement or case inflection. The antecedent of a reflexive pronoun in Serbo-Croatian must be either a nominative subject or a non-nominative 'logical subject' such as a dative, genitive or accusative experiencer role. Reflexive intensifiers take the default neuter singular form when the reflexive pronoun is bound by a nominative QNP, as in (38a) (cp. *samo* 'own-NT.SG'). Masculine plural 'semantic agreement' with 'five boys' is not possible. However, with verbs taking non-nominative logical subjects, the situation is reversed: the reflexive modifier shows semantic agreement, and the neuter singular form is impossible, as shown in (38b).

- (38) a. [Pet dečaka]_{NOM} je volelo {samo / *sami} sebe.
 five boys AUX.SG liked-N.SG own-N.SG / -M.PL self-A
 'Five boys liked themselves.'
- b. [Pet dečaka]_{ACC} je bilo stid od
 five boys AUX.SG was-N.SG shame from
 {samih / *samog} sebe.
 own-GEN.PL / *own-GEN.N.SG self-GEN
 'Five boys were shy about themselves.'

The construction in (38b) takes an accusative experiencer, i.e., an ordinary NP substituted for *pet dečaka* would appear in accusative case. As shown in (38b), when the antecedent QNP is non-nominative then the reflexive modifier must appear in plural form, and not the neuter singular (although the auxiliary and verb take the neuter singular). While the analysis of this interesting fact is a matter for future research (on Serbo-Croatian binding see Zlatić, 1997), it is clear that any analysis of the contrast between (38a) and (38b) must minimally involve the differential case-marking on the two QNP subjects. This is problematical for the view that QNPs are inherently non-nominative.

6. Comparison with feature percolation accounts

In earlier work (Wechsler and Zlatić, 1999) we proposed a rather different account of the Serbo-Croatian case facts. That earlier account relies on the percolation through the NP of a Boolean feature REAL to encode whether the NP contains a case-inflected item or not. Any item bearing overt case morphology such as a noun, determiner, or adjective, will be specified for [REAL +], while undeclined items are specified for [REAL -]. As we have seen, dative or instrumental case assigned to an NP by a verb or noun must be expressed by a [REAL +] noun or

concord target somewhere within the NP. We formalized this with a mechanism for inheritance of the REAL value up to the NP node, such that the value on a mother is *plus* if any of its relevant (namely, CASE-agreeing) daughters is *plus*, and *minus* if all relevant daughters are *minus*. The biconditional constraint in (39) has that effect. (40) is a prose statement of that same constraint.

(39) *REAL Inheritance Principle*

$$\left[\begin{array}{l} \text{phrase} \\ \text{SYNSEMI} \parallel \text{CASE } \boxed{1} \\ \text{F-DTR(S)} \left\langle \dots \left[\begin{array}{l} \text{CASE } \boxed{1} \\ \text{REAL } + \end{array} \right] \dots \right\rangle \end{array} \right] \Leftrightarrow \left[\begin{array}{l} \text{phrase} \\ \text{SYNSEMI} \parallel \text{REAL } + \end{array} \right]$$

where $F \in \{\text{HEAD, SPR, ADJUNCT, etc.}\}$

(40) *REAL Inheritance Principle (in prose)*

A phrase is specified [REAL +] if and only if some daughter of that phrase which shares its case value with the phrase is also specified [REAL +].

The REAL Inheritance Principle applies recursively to assign a positive REAL value to the NP node if any case-agreeing item dominated by that NP has a positive value.

The REAL feature is arguably ad hoc (for discussion see Wechsler and Zlatić 1999: 308–309). The present paper takes a different tack that gains, we hope, in the intuitive plausibility of the account. Another advantage of the present account over the feature percolation account is that it can be applied to related phenomena that stem from the same sort of functional forces responsible for the case facts, but where feature percolation is more problematic. Poplack's (1980) study of Puerto Rican Spanish spoken corpora investigates the optional deletion of plural /-s/ from nouns and NP-internal concord elements (determiners, adjectives, etc.) and of the third person plural subject agreement marker /-n/ from verbs. Both nominal /-s/ and verbal /-n/ are omissible under the right conditions:

- (41) Bailaba(-n) una(-s) nena(-s) bien bonita(-s).
 danced-3PL indef-PL girl-PL well pretty-PL
 'Some pretty girls were dancing.'

In some NPs within the corpus, every plural /-s/ marker in the NP was omitted, notional plurality being clear from context (e.g. the /-s/ was missing from *un par de mata[s]* 'a couple of plants'). Another context licensing omission of plural /-s/ was when the NP served as subject of a verb inflected with the plural /-n/ agreement marker. Turning to omission of the verbal agreement, Poplack showed that the conditions on its appearance had been grammaticized: the agreement marker always appears on the verb unless there is at least one plural /-s/ marker in the subject. In other words, when subject-internal concord items and the agreeing verb are taken together, the condition is similar to what we found above for case: plural morphology must appear somewhere, whether on the verb or on the noun or a concord element within the subject NP. For example, in (41) at least one of the parenthesized suffixes must appear, if the sentence is to be interpreted with plural semantics.

Subject-verb agreement, like NP-internal concord, is modeled in terms of structure-sharing of the agreement features. The verb form *bailaban* ‘danced-3PL’ in (41) subcategorizes for a subject with 3PL agreement features. The valence specification on the verb unifies with the features of the NP, guaranteeing agreement. As with the above analysis of CASE concord, there is only a single [NUMBER *plural*] feature in the AVM representing the sentence (41), although this feature may be accessed via several different paths. As a consequence the same sort of analysis is possible: a simple condition on the plural value to the effect that at least one path to that value must be from a word inflected for plural number.

The feature percolation account does not extend so easily to Puerto Rican Spanish. Where exactly would the feature percolate to? In order to take in both subject and verb, it would presumably need to reach the clausal node. Clauses with plural subjects would be constrained to bear the feature [REAL +]. But this is even more suspicious than the percolation account of case, because it endows categories such as the clause with number features that are otherwise ignored by the grammar (the putative number feature on subordinate clauses is not selected for by complementizers or clause-taking verbs, for example). Intuitively, it is looking in the tree geometry to solve an information-theoretic problem that is indifferent to constituent structure.

Bayer et al. (this issue) propose a related feature percolation account of case facts in German that roughly parallel those of Serbo-Croatian. Their analysis is carried out in the feature movement variant of MP proposed in Chomsky (1995). In the feature movement framework, fully inflected words are merged; what move are features rather than words or morphemes. (At a general level the Chomsky (1995) framework resembles lexicalist theories like HPSG and LFG, except that reentrancy is replaced with feature chains that have poorly understood formal properties.) Bayer et al. show that German genitives and datives have properties similar to what we observe for Serbo-Croatian dative and instrumental (but with some interesting wrinkles). For example, they show that the uninflected QNP *viel Unsinn* ‘much nonsense’ can appear in nominative or accusative but not dative positions. Bayer et al. propose that the crucial difference between datives and direct cases is that dative nominals have an extra KP (Kase Phrase) shell, while direct case nominals (nominative and accusative) project only to DP.

While a full discussion of Bayer et al. is beyond the scope of this paper, we will make a few relevant comments here. We have already seen that feature percolation accounts fail to generalize to the Puerto Rican Spanish agreement facts, a potential problem if one believes that the case realization and agreement realization facts should receive a similar treatment (of course, we have not yet established that this is the case). We note a further problem with extending the Bayer et al. account to Serbo-Croatian. Bayer et al. cite interesting independent evidence for their KP analysis from the fact that German datives cannot bind anaphors. This would follow from the proposed KP structure since the DP under KP would no longer c-command the anaphor. Turning to Serbo-Croatian, anaphors are subject-oriented but dative ‘logical subjects’ are also potential binders (Zlatić, 1997: 241):

- (42) Mariji, je bilo žao sebe.
 Mary.DAT AUX was.NT.SG sorry self
 'Mary felt sorry for herself.'

This seems to suggest that the inability to bind anaphors is independent of the case-realization requirement, although more research is needed to settle this issue.

Another interesting difference between Serbo-Croatian and German concerns the contrast between genitive and dative case. Citing Schachtel (1989), Bayer et al. note that uninflected nominals such as bare plurals cannot appear in genitive positions (these are 'uninflected' in the sense that nominative, accusative, genitive, and dative forms are non-distinct in the plural). However, they can appear in dative positions (example from Bayer et al., this issue, ex. (29)):

- (43) a. {Dirigenten/ Professoren/ Bauern} soll man nicht
 conductors/ professors/ farmers should one not
 {widersprechen/ schaden}.
 object/ harm
 'One should not {object to/ harm} {conductors/ professors/ farmers}.
 b. *{Dirigenten/ Professoren/ Bauern} kan ich mich leider nicht
 conductors/ professors/ farmers can I REFL unfortunately not
 erinnern.
 remember
 'Unfortunately I cannot remember {conductors/ professors/ farmers}.'

(The verbs *widersprechen* and *schaden* assign dative case, while *sich erinnern* assigns genitive.) This actually reverses the pattern found in Serbo-Croatian, where uninflected nominals appear in genitive but not dative positions (cp. (9c), (11), (19), (20) above). Clearly more research is needed to understand this cross-linguistic contrast.

7. Conclusion

It has long been noted, both in structuralist and generative studies, that important grammatical and semantic features tend to resist neutralization or deletion. There is an obvious functional motivation for such a tendency, as it aids communication and helps avoid ambiguity. An interesting question is how this tendency is grammaticalized in particular grammatical contexts. As Plank (1980: 295) puts it, one way a grammar can avoid ambiguity is "not to accept any of the potential readings of an ambiguously coded construction, i.e. to stigmatize potentially ambiguous constructions as ungrammatical, irrespective of any potentially disambiguating context of use". In this paper we have looked at examples of such grammaticalization in which a case feature need not be expressed at any particular one of its potential syntactic addresses – as long as it appears in at least one of them. Such generalizations devolve upon informational units such as case features, and not representations of

linguistic form such as tree diagrams. For that reason this phenomenon is suitably treated in frameworks where a unit of information such as the case value of an NP, though potentially expressed in diverse positions across the constituent structure of that NP, must receive a unitary representation within the AVM. The relation between information structure (in this broad sense; cp. ‘grammatical structure’, ‘functional structure’, etc.) and constituent structure is derived by basic principles of syntactic composition (Valence Principle, Semantics Principle, etc.; see Pollard and Sag, 1994, *inter alia*). While some principles apply to constituent structure, principles such as the ones investigated here apply to information structure.

The use of reentrancy resembles the indexing conventions that capture dependencies within Government and Binding/ Minimalist Program (GB/MP), but with a crucial difference. The agreeing elements are connected via token-identity in HPSG, but only type-identity is usually assumed in GB/MP (apart from occasional proposals to incorporate unification into GB/MP; see e.g. Johannessen, 1996). If the agreeing elements are connected only via type-identity, notated perhaps with coindexation, then we must replace our condition on the CASE feature (Case Realization Constraint) with a condition on the entire set of coindexed words. Roughly, this would state that at least one of those coindexed elements must be inflected for case. But this merely restates the empirical observation from which we started. In contrast, the assumption of token-identity allows us to capture the rather obvious, functionally-based intuition that it is the case feature itself – one linguistic entity, not many – that must be morphologically expressed. Hence we have progressed from mere description towards explanation.

Another theoretical implication of the present proposal is that it suggests that some form-content pairing takes place in the syntax rather than the lexicon. This move is in line with the recent trend towards ‘construction grammar’. It also bears a faint similarity to Distributed Morphology (Halle and Marantz, 1993), although we still maintain the syntax/ lexicon divide, while it is dissolved entirely in DM.

Interestingly, essentially the same analysis can be applied to Serbo-Croatian and Choctaw, with rather different consequences depending on parochial facts of the languages. Specifically, the languages differ in that the case suffixes are optional in Choctaw but obligatory in Serbo-Croatian. But both languages are governed by the requirement that case be expressed somewhere, as shown in Serbo-Croatian by the behavior of indeclinable elements. We consider it to be a sign of this approach’s promise that it allows one to factor out universal, functionally motivated principles from diverse grammars.

References

- Bayer, Josef, Markus Bader and Michael Meng, this issue. Morphological underspecification meets oblique case: Syntactic and processing effects in German. *Lingua*.
- Chomsky, Noam, 1995. The minimalist program. Cambridge, Mass.: MIT Press.
- Davies, William, 1981. Choctaw clause structure. Ph.D. dissertation, University of California, San Diego.
- Davis, Tony, 1996. Linking and the hierarchical lexicon. Ph.D. dissertation, Stanford University, Stanford, CA.

- Flickinger, Daniel, 1987. *Lexical rules in the hierarchical lexicon*. Ph.D. Stanford University, Stanford, CA.
- Franks, Steven, 1995. *Parameters of Slavic morphosyntax*. New York: Oxford University Press.
- Halle, Morris and Alec Marantz, 1993. Distributed morphology and the pieces of inflection. In: K. Hale and S.J. Keyser (eds.), *The view from Building 20 – Essays in linguistics in honor of Sylvain Bromberger*, 111–176. Cambridge, MA: MIT Press.
- Johannessen, Janne Bondi. 1996. Partial agreement and coordination. *Linguistic Inquiry* 27(4): 661–676.
- Kiparsky, Paul, 1972. Explanation in phonology. In: S. Peters (ed.), *Goals of linguistic theory*, 189–227. Englewood Cliffs, NJ: Prentice-Hall.
- Koenig, Jean-Pierre, 1999. *Lexical relations*. Stanford, California: CSLI Publications.
- Leko, Nedžad, 1987. *Syntax of noun headed structures in Serbo-Croatian and corresponding phrasal structures in English*. Ph.D. Dissertation, Indiana University.
- McGregor, William, 1990. *A functional grammar of Gooniyandi*. Amsterdam: John Benjamins.
- Plank, F., 1980. Encoding grammatical relations: Acceptable and unacceptable non-distinctness. In: J. Fisiak, (ed.), *Historical morphology*, 289–325. The Hague: Mouton.
- Pollard, Carl and Ivan Sag, 1994. *Head Driven Phrase Structure Grammar*. Stanford, CA and Chicago, IL: CSLI Publications and University of Chicago Press.
- Poplack, Shana, 1980. Deletion and disambiguation in Puerto Rican Spanish. *Language* 56(2), 371–385.
- Richter, Frank, 2000. *A mathematical formalism for linguistic theories with an application in HPSG*. Ph.D. dissertation, Universität Tübingen, Tübingen.
- Richter, Frank, Manfred Sailer and Gerald Penn, 1999. A formal interpretation of relations and quantification in HPSG. In: G. Bouma, E. Hinrichs, G.-J. Kruijf and R. Oehrle (eds.), *Constraints and resources in natural language syntax and semantics*, 281–298. Stanford, CA: CSLI Publications.
- Sag, Ivan and Thomas Wasow, 1999. *Syntactic theory: A formal introduction*. Stanford, CA: CSLI Publications.
- Schachtel, Stefanie, 1989. Morphological case and abstract case: Evidence from the German genitive construction. In: C. Bhatt, E. Löbel and C. Schmidt (eds.), *Syntactic phrase structure phenomena in noun phrases and sentences*, 99–112. Amsterdam: Benjamins.
- Shieber, Stuart, 1986. *An introduction to unification-based approaches to grammar (CSLI Lecture Notes 4)*. Stanford, CA: CSLI Publications.
- Wechsler, Stephen and Larisa Zlatić, 1997. The morphosyntax of Serbian quantified NP's. Paper read at the Fourth International Conference on Head-Driven Phrase Structure Grammar, July 18, 1997, at Cornell University, Ithaca N.Y.
- Wechsler, Stephen and Larisa Zlatić, 1999. Syntax and morphological realization in Serbo-Croatian. In: R. Borsley and A. Przepiorkowski (eds.), *Slavic in HPSG*, 283–309. Stanford: CSLI Publications.
- Wechsler, Stephen and Larisa Zlatić, 2000. A theory of agreement and its application to Serbo-Croatian. *Language* 76(4), 799–832.
- Zlatić, Larisa, 1997. *The structure of the Serbian noun phrase*. Ph.D. dissertation, University of Texas, Austin.