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Syntagmatic constraints on insertion

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Abstract This paper argues that the availability of exponents for insertion is restricted not only by their morpho-syntactic feature specification but, in addition, by an accessibility relation holding within a marker inventory: The exponent inserted at step n constrains the set of exponents competing for insertion at step $n + 1$. The proposal is applied to a number of phenomena that have previously been dealt with by stipulating designated post-syntactic operations that modify the syntactically determined feature sets before morphological exponence is determined. Apparent mismatches between syntactically motivated feature specifications and morphological exponence are treated as the result of the accessibility relation. The paper contains analyses of multiple exponence in Archi and Dumi, apparent feature insertion in Nimboran, and obligatory co-occurrence of exponents in Spanish clitics.

Keywords Distributed morphology · Multiple exponence · Feature insertion · Post-syntactic operations

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1 Introduction

Much work within the framework of Distributed Morphology implicitly or explicitly assumes some version of the claim in (1).[1]

(1) For any given input, knowing the morpho-syntactic specification of each exponent is sufficient to deduce the exponence produced for this input by vocabulary insertion.

What (1) states is that, given a set of vocabulary items each bearing some morpho-synactic feature specification, the morpho-syntactic features of the syntactic structure that forms the input to vocabulary insertion are all one needs to know to determine the exponence produced for this input. Under this view, vocabulary insertion is quite simple: It faithfully maps syntactic feature specifications onto phonological exponence.

While (1) is appealing due to its simplicity, it stands in an apparent contrast with phenomena in which the morphological exponence does not go hand in hand with the syntactically and semantically motivated feature specification. A well-known example, discussed at length by Noyer (1998), is Nimboran verb inflection. Here a syntactically and semantically dual configuration receives plural exponence in certain environments. All else being equal, this is at odds with (1). If there is a dual feature present in the input structure, we expect to see dual morphology rather than plural, precisely because of the principle in (1).

There are two ways of approaching the problem. The first is to assume that (1) holds nevertheless but that the syntactically and semantically motivated feature specification is not the one that forms the input to vocabulary insertion. The second option is to dispense with (1) and view vocabulary insertion as a more complex process. Virtually all work in Distributed Morphology has adhered to the former option; this paper explores some consequences of the latter.

Previous analyses in Distributed Morphology commonly treat situations involving a disparity between the syntactically motivated feature specification and the exponence it is mapped onto as syntax-morphology mismatches. According to this general line of analysis, the syntactic representation is modified by post-syntactic operations prior to vocabulary insertion. It is this altered structure that forms the input to subsequent vocabulary insertion. Going back to the Nimboran facts mentioned above (and discussed in more detail in Sect. 5), Noyer (1998) proposes that a syntactic dual feature is morphologically transformed into a plural feature in certain configurations. This plural feature then conditions plural exponence, in line with (1). A similar argument is put forth by Harbour (2003).

As it turns out, this line of approach requires a multitude of non-related post-syntactic operations that tweak a feature representation in one way or the other, all to the effect that vocabulary insertion yields the desired output in conformity with (1). To name just a few examples, Halle and Marantz (1994) suggest that vocabulary insertion itself may modify feature sets, thus affecting its next application; Noyer,

[1] I will tacitly assume here that inflection class features are morpho-syntactic and hence of the same nature as other features.

Noyer (1992, 1997) proposes that vocabulary insertion introduces diacritics into the feature set; Müller (2007) employs enrichment rules that double features, etc.

The aim of this paper is to approach this tension from a different angle. Rather than devising new operations on morpho-syntactic feature sets that allow (1) to produce the desired exponence, I propose that (1) is best dispensed with altogether. Specifically, I claim that morpho-syntactic features are only one of two constraints on the availability of exponents. A second restriction on insertion is imposed by an ACCESSIBILITY RELATION holding within morphological inventories. More concretely, this paper develops the claim in (2).

(2) The exponent chosen at step n affects the set of exponents competing for insertion at step $n + 1$.

The intuition is the following: By assumption, there exists an accessibility relation between pairs of vocabulary items such that if at some point an exponent A is inserted, only exponents that stand in an accessibility relation with A are considered for insertion. Within this (smaller) set of exponents selection proceeds based on morpho-syntactic features. There are, therefore, two constraints on the insertion of vocabulary items: one imposed by feature specifications, the other by the accessibility relation. Thus, in addition to knowing the morpho-syntactic input, one has to keep track of the last exponent inserted in the derivation. This is obviously incompatible with (1), which maintains that morpho-syntactic features are all that has to be considered.

Under the view advanced here, apparent mismatches between syntax and morphology are not the result of designated post-syntactic operations. Rather, they illustrate the impact of the accessibility relation on morphological exponence. In this sense, the proposal follows the lead of Trommer (1999, 2001) in aiming to recast the apparent effects of post-syntactic operations as direct consequences of the insertion algorithm itself.

The paper is structured as follows: Sect. 2 lays out the proposal in more precise terms and develops its formal underpinnings. The system is then applied to multiple exponence in Archi nominal declension in Sect. 3 and apparent multiple exponence between non-adjacent positions in Dumi in Sect. 4. Section 5 applies the framework to apparent cases of morphology overwriting syntactic feature specifications in Nimboran. Finally, Sect. 6 shows how the system accounts for obligatory co-occurrence of exponents, based on the Spanish clitic system. Section 7 concludes.

2 Axiomatization

This section lays out a formalization of the idea of accessibility relations as formulated in (2). My proposal is built around the claim that morphological systems do not only comprise sets of exponents, but, in addition, accessibility relations between these exponents. This view is formulated in (3).

(3) MORPHOLOGICAL INVENTORY
Morphological inventories are ordered pairs $\langle \Gamma, \Delta \rangle$ with Γ a set of exponents and Δ an accessibility relation defined over Γ.

a. *Exponent*
An exponent $\mathcal{A}$ is an ordered pair $\langle \sigma, \pi \rangle$, where σ is a set of morpho-syntactic features and π is a phonological string.[2]

b. *Accessibility relation*
The accessibility relation is a set of ordered pairs of exponents. If $\langle \mathcal{A}, \mathcal{B} \rangle \in \Delta$, then $\mathcal{A}, \mathcal{B} \in \Gamma$. $\langle \mathcal{A}, \mathcal{B} \rangle \in \Delta$ will be notated as '$\mathcal{A} \rightarrow \mathcal{B}$' for convenience.

I will tentatively assume here that the accessibility relation does not allow cycles. More formally, if $\mathcal{A} \rightarrow \cdots \rightarrow \mathcal{B}$, then $\mathcal{B} \nrightarrow \mathcal{A}$ for all $\mathcal{A}, \mathcal{B} \in \Gamma$.[3]

To implement the main claim that the set of exponents available at some step of the derivation is contingent on the exponents inserted in the previous step we first define the notion of a STATE (4). A state comprises (i) information about the marker lastly inserted, (ii) the morpho-syntactic features that exponents can refer to, and (iii) the phonological string accumulated so far.

(4) STATE
A state is an ordered triple $\langle \mathcal{A}, \Sigma, \Pi \rangle$ such that $\mathcal{A}$ is an exponent, Σ is a set of morpho-syntactic features, and Π is a phonological string.

The insertion algorithm is defined in (5). The initial state of each derivation comprises an exponent $\aleph$ as an entry point into the system. For concreteness, I will take $\aleph$ to designate insertion of the morphological root.[4] Root insertion does not discharge morpho-syntactic features and provides a phonological string around which subsequent exponents accumulate. Upon transition, the morpho-syntactic features associated with an exponent are substracted from the state, while its phonological features are added, and the information concerning the exponent inserted in the last step is updated. In (5), '$\backslash$' designates set reduction; '$\oplus$' refers to phonological concatenation.

(5) INSERTION
Given a morphological inventory $\langle \Gamma, \Delta \rangle$,

a. *initial state:*
$\langle \aleph, \Sigma, \Pi \rangle$, with Σ being some syntactically well-formed set of morpho-syntactic features and Π being some lexically determined phonological string;

b. *transition* '$\rhd$':
given some state $\langle \mathcal{A}, \Sigma, \Pi \rangle$ and an exponent $\mathcal{B} = \langle \sigma, \pi \rangle$, a well-formed transition into $\mathcal{B}$ subtracts σ from Σ and adds π to Π:
$\langle \mathcal{A}, \Sigma, \Pi \rangle \rhd \mathcal{B} \equiv \langle \mathcal{B}, \Sigma \backslash \sigma, \Pi \oplus \pi \rangle$.

[2] As an anonymous reviewer points out, it may be desirable to define exponents as ordered pairs of feature sets and *functions from strings to strings* in order to extend the system to non-concatenative morphology. Since all the data discussed here are instances of affixation, I will stick to the simpler definition, noting that the system may be straightforwardly extended.

[3] To emphasize, this restriction does not follow from any definition in the paper. Whether anything is gained by allowing cycles in the accessibility relation is ultimately an empirical question.

[4] It is a common assumption that realization of the root (i.e. *l-morphemes*) subject to different principles than realization of functional morphemes (*f-morphemes*), see Marantz (1996, 1997).

A note of clarification: Whereas *transition* (5b), designated as '$\rhd$', is an operation applied to a state, whose output is another state, *accessibility* (3b), symbolized as '$\rightarrow$', is a static relation between exponents.

The definition of insertion in (5) requires transitions to be well-formed. A transition is well-formed if it adheres to (6):

(6) WELLFORMEDNESS RESTRICTION ON TRANSITIONS
Given a state $\Omega = \langle \mathcal{B}, \Sigma, \Pi \rangle$, transition into an exponent $\mathcal{A} = \langle \sigma, \pi \rangle$ is well-formed if

a. $\mathcal{A}$ is accessible from $\mathcal{B}$:
$\mathcal{B} \rightarrow \mathcal{A}$,
b. the morpho-syntactic features of $\mathcal{A}$ are a subset of the morpho-syntactic features of Σ:
$\sigma \subseteq \Sigma$,
c. for all exponents $\mathcal{C} = \langle \sigma', \pi' \rangle$, such that $\mathcal{B} \rightarrow \mathcal{C}$ and $\sigma' \subseteq \Sigma$, $\mathcal{A}$ is more specific than $\mathcal{C}$.

(6a) requires that an accessibility relation holds between the most recently inserted exponent $\mathcal{B}$ and the subsequently inserted $\mathcal{A}$. Clause (6b) is the familiar subset requirement in standard Distributed Morphology. Finally, (6c) determines the competition between exponents if more than one fulfills (a) and (b). This competition makes reference to the notion of SPECIFICITY, defined in (7).[5]

(7) SPECIFICITY (Müller 2004a, 2004b)
An exponent $\mathcal{A}$ is more specific than an exponent $\mathcal{B}$ iff there is a class of features $\mathbb{F}$ such that

a. $\mathcal{A}$ bears more features belonging to $\mathbb{F}$ than $\mathcal{B}$ does,
b. there is no higher-ranked class of features $\mathbb{G}$ such that $\mathcal{A}$ and $\mathcal{B}$ have a different number of features in $\mathbb{G}$.

Specificity entails that there exists a strict hierarchical ranking among features (see Lumsden 1992; Noyer 1992; Wiese 1999; Müller 2004a, 2004b). $\mathbb{G}$ being ranked higher than $\mathbb{F}$ will be notated as '$\mathbb{G} > \mathbb{F}$.' The required hierarchy will be given for each example.

A derivation ends if no further transition is possible, as stated more precisely in (8) and (9). Intuitively, the derivation terminates as soon as there is no more exponent fulfilling the Subset Principle (6). There are no designated endpoints. Instead, the derivation can stop at any time as long as (9) is fulfilled.

(8) Insertion terminates if and only if a FINAL STATE is reached.

[5] In fact, various principles have been proposed to choose among several competing exponents, including definitions based on an extrinsic ordering (e.g., Bierwisch 1967; Anderson 1992; Halle and Marantz 1993), set cardinality (Halle 1997), a Pāṇinian subset relation (Kiparsky 1973; Stump 2001), and feature hierarchies. The definition in (7) embodies the last alternative. The choice between these alternative is orthogonal to the issue of accessibility relations *per se*.

(9) FINAL STATE
Given a morphological inventory $\langle \Gamma, \Delta \rangle$, a state $\langle \mathcal{A}, \Sigma, \Pi \rangle$ is final if for all exponents $\mathcal{B} \in \Gamma$ with $\mathcal{B} = \langle \sigma, \pi \rangle$, either $\mathcal{A} \not\rightarrow \mathcal{B}$ or $\sigma \nsubseteq \Sigma$ or both.

According to (9), a final state is reached either if there is no more accessible exponent (given that insertion of an exponent is licit only if this exponent is accessible from the previous one) or if among all the accessible exponents there is none whose feature specification is a subset of the input specification (for example, if the input is a singular configuration but only a plural marker is accessible).

With these definitions in place, we can formally define the notion of a DERIVATION:

(10) DERIVATION
A derivation is sequence of well-formed transition steps from an initial state Γ_1 to some final state Γ_n:
$\Gamma_1 \rhd \Gamma_i \rhd \cdots \rhd \Gamma_j \rhd \Gamma_n$

It is worth pointing out that the system is deterministic. In particular, the definition of a well-formed transition step in (6) requires the target of transition to be the single most specific accessible exponent. There can be no optionality. Consider some stage Γ and two exponents $\mathcal{A}$ and $\mathcal{B}$, both of which are accessible from Γ. Both $\mathcal{A}$ and $\mathcal{B}$ satisfy clauses (a) and (b) of (6) but transition into neither would conform to clause (c). Consequently, there is no well-formed transition step from Γ. Since Γ is furthermore not a final state (because there are exponents that are accessible and fulfill the subset requirement), the derivation never terminates. Although this configuration will not play a role in what is to come, we might conceive of it as the source of paradigmatic gaps (see Kratzer 2009).

The system just defined does not allow for *contextual features*, i.e. features in the input that an exponent is sensitive to but which are not affected by its insertion. If transition to an exponent $\mathcal{E}$ applies, the morpho-syntactic features of $\mathcal{E}$ are deleted from the state. As there is no derivational backtracking, it follows that these features are not retrievable and may thus not have an effect on any subsequent step in the derivation. The set of definitions above hence gives rise to the STRICT FEATURE DISCHARGE THEOREM (11).

(11) STRICT FEATURE DISCHARGE THEOREM
Every morpho-syntactic feature can be active only once. All features are discharged if an exponent refers to them, being then irretrievably deleted for the rest of the derivation.

Apart from the operations and notions just explicated, the system does not make use of post-syntactic operations familiar from work in Distributed Morphology, such as *fusion*, *fission*, *merger* or *local dislocation* (see, e.g., Halle and Marantz 1993, 1994; Embick and Noyer 2001, 2007). It also does not employ *rules of referral* (Zwicky 1985; Stump 1993). The underlying idea is that the concept of accessibility relations introduced here provides a unified account for the phenomena that have so far been captured by these operations.

Notice furthermore that only the information concerning the exponent inserted in the immediately preceding step of the derivation is represented in a state (it is thus

overwritten once another transition step takes place; see the definition in (5b)). The influence between individual markers by means of the accessibility relations is thus minimal and strictly local. Long-distance interactions between markers is thus ruled out, a point to be taken up in Sect. 4.

The notion of the accessibility relation is clearly related to the concept of morphological SCHEMAS (Anderson 1992) or RULE BLOCKS (Stump 2001). According to the former two views, exponents are organized into sets, with accessibility relations being formulated over such sets. Relatedly, Hankamer, Hankamer (1986, 1989) suggests that exponents require stems of certain types, which are produced by other exponents. In all of these approaches exponents are available only at specific points in the derivation and selection of one exponent may presuppose prior selection of a member of another class of exponents. While the analysis developed here shares with these accounts the view that exponents may require insertion of other exponents, they differ in the fact that rule blocks define an order over sets of exponents (i.e., all the exponents belonging to one block), while the accessibility relation as suggested here holds between individual exponents. One consequence of this view is that the syntagmatic position of a marker is not fixed. It may occur as the first exponent in one form and as the second or third in others. The concept of rigid position classes, rule blocks or stem types, by contrast, does not easily lend itself to such flexibility.[6]

In the remainder of the paper, I will apply the system to a number of case studies that have been previously analyzed by invoking various operations modifying the input to vocabulary insertion. The overarching goal of these applications is to demonstrate that the notion of an accessibility relation provides a unified way of analyzing these phenomena.

3 Multiple exponence in Archi

MULTIPLE or EXTENDED EXPONENCE (Matthews 1972) poses a problem for feature discharge based theories as a single morpho-syntactic feature apparently triggers insertion more than once, a situation canonically ruled out by either some notion of feature discharge (Noyer 1997) or by the assumption that there is only one insertion step into each morpheme (Halle and Marantz 1993). Intuitively, extended exponence instantiates a syntax-morphology mismatch because there is 'too much' exponence. Several accounts implement the phenomenon by enabling in one way or another a given morpho-syntactic feature to be relevant more than once in a derivation. By (11), this is not possible in the present framework. This section demonstrates that the concept of an accessibility relation provides the means of reconciling a strictly discharge-based framework with the descriptive phenomenon of extended exponence. Based on nominal inflection in Archi, I will develop an analysis of extended exponence that relies on accessibility relations and compare it to standard, feature-based accounts.

[6]This resemblance between the two concepts raises the question whether the two concepts can be combined, allowing for the accessibility relation to hold over individual exponents as well as sets of them. An exploration of this possibility lies beyond the scope of this paper.

3.1 Data

Archi nominal inflection is highly complex (see, for example, Kibrik 1991, 1998, 2003; Mel'čuk 1999, Corbett 2007), but the present argument is only based on the behavior of two exponents: *-li* and *-čaj*. Both exponents are used to mark all cases except the nominative in at least some inflection class. In all of these cases except for the ergative, *-li* or *-čaj* is followed by some other exponent further specifying the case of a nominal. Generally, *-li* appears in the singular, while *-čaj* occurs in plural forms. Following the previous literature on Archi, I will assume here that all cases except for the nominative form a natural class, designated as [+OBLIQUE]. The table in (12) gives partial declension paradigms for three nouns belonging to different classes (Kibrik 1998:471, 1991:256). The number of noun classes is considerably higher, a complication orthogonal to the issue at hand.[7]

(12) Partial paradigms of *aInš* 'apple', *dab* 'awl', and *qIin* 'bridge'

	aInš		dab		qIin	
	SG	PL	SG	PL	SG	PL
NOM	*aInš*	*aInš-um*	*dab*	*dab-mul*	*qIin*	*qionn-or*
ERG	*aInš-li*	*aInš-um-čaj*	*dab-li*	*dab-mul-čaj*	*qIinn-i*	*qIonn-or-čaj*
GEN	*aInš-li-n*	*aInš-um-če-n*	*dab-li-n*	*dab-mul-če-n*	*qIinn-i-n*	*qIonn-or-če-n*
DAT	*aInš-li-s*	*aInš-um-če-s*	*dab-li-s*	*dab-mul-če-s*	*qIinn-i-s*	*qIonn-or-če-s*
⋮	⋮	⋮	⋮	⋮	⋮	⋮

The paradigm in (12) instantiates multiple exponence because a plural feature is reflected in two positions: First, it is marked by an inflection class dependent plural marker (*-um*, *-mul* and *-or* in (12)). Second, the oblique marker occurs in a specific form in plural forms, viz., *-čaj* (or *-če*)[8] instead of *-li*.

Upon closer scrutiny, the distribution of the [+OBLIQUE] markers *-čaj* and *-li* turns out to be more complex than that. As pointed out by Corbett (2007:39–41), certain lexemes, such as *haˤtəra* 'river' and *c'aj* 'female goat', allow *-čaj* to occur in both singular and plural forms.[9] Conversely, at least the lexeme *χˤon* 'cow' allows *-li* to occur in its plural form:

(13) Partial paradigms for *haˤtəra* 'river', *c'aj* 'female goat', and *χˤon* 'cow'

	haˤtəra		c'aj		χˤon	
	SG	PL	SG	PL	SG	PL
NOM	*haˤtəra*	*haˤtər-mul*	*c'aj*	*c'ohor*	*χˤon*	*būc'i*
ERG	*haˤtər-čaj*	*haˤtər-mul-čaj*	*c'ej-āj*	*c'ohor-čaj*	*χˤini*	*būc'i-li*

[7] I have left Kibrik's notation unchanged. The sequence *aI* corresponds to a pharyngealized vowel [a̟]; an *I* following a consonant indicates pharyngealization of the consonant (e.g., *tI* [tˤ]).

[8] The allomorphy of *-čaj*/*-če* is morphological and depends on whether the exponent is word-final or not.

[9] The marker *-čaj* shows the same alternation with *-če* as in (12). Thus, the locative singular of *haˤtəra* is *haˤtər-če-qˤ*. The locative of *c'aj* is *c'ej-ēe-t* (source: *Archi Dictionary*, Surrey Morphology Group, University of Surrey, available at: http://www.smg.surrey.ac.uk/archi/linguists/). This provides support for viewing the two markers as in fact identical.

The tables in (12) and (13) lead to apparently contradictory conclusions: In (12) the distribution of *-li* consistently correlates with singular number, while *-čaj* appears only in plural forms. This suggests that they are exponents of singular and plural, respectively. In (13), on the other hand, both *-čaj* and *-li* occur in singular as well as plural cells, implying that they are not specified for either number.[10] It seems, then, that either the two exponents are properly specified for number and (13) involves morphological exponence conditioned by features other than the syntactically/semantically present ones (giving rise to DEPONENCY); or both exponents are not specified for number, thus requiring a second constraint on their distribution in addition to their morpho-syntactic feature specification. As I will show below, feature-based approaches to multiple exponence do not cover the entire paradigm in (12) *and* (13) without further assumptions. An accessibility-based approach, by contrast, provides a uniform account of the data set.

3.2 Accessibility-based implementation

An analysis of the Archi data within the accessibility-based approach advocated here is given in Fig. 1. To increase readability, I will write exponents in the format (14) instead of the more cumbersome bracketed notation.

(14) *Notational convention for exponents*
$\pi_\sigma \equiv \langle \sigma, \pi \rangle$

I will assume here that inflection classes are the result of morpho-syntactic features (Müller 2004a, 2004b, 2005), which are simply called α and β. Furthermore, I assume that *χˤon* as well as *haˤtəra* and *c'aj* are members of specific inflection classes. For ease of exposition, I will designate these classes as [haˤtəra] and [χˤon], respectively. These features are to be read as abbreviations for inflection class features just like α and β. A last thing to note about Fig. 1 is the role of the hierarchy 'NUMBER

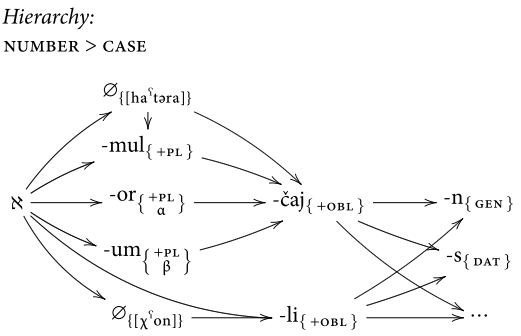

Fig. 1 Analysis of Archi (12) and (13)

[10] I treat [χˤini] as underlyingly /χˤon-li/ 'cow-OBL'. Locative: /χˤini-t/ (source: *Archi Dictionary*, Surrey Morphology Group, University of Surrey, available at: http://www.smg.surrey.ac.uk/archi/linguists/). This assumption is, however, not mandatory. For the argument to go through, it is sufficient to note that *-li* may in principle occur in plural forms. That it is also compatible with singular forms is amply demonstrated by the forms in (12).

> CASE'. It is relevant for the concept of Specificity: Specificity for number outranks specificity for case.

I will illustrate the workings of the system devised in Sect. 2 by demonstrating how the Archi system in Fig. 1 produces some output forms. The first example to be discussed is the nominative plural form *qionn-or*. The initial state of the derivation is given in (15a).[11] In line with (5a), the state (15a) consists of the exponent ℵ, the syntactically determined feature set {−oblique, +pl, α} and the root string [qionn] that forms the base around which affixation will take place. Given the system in Fig. 1, the following markers are accessible from ℵ: $\emptyset_{\{[\text{ha}^{\text{ʕ}}\text{tara}]\}}$, *-mul*, *-or*, *-um*, *-li*, and $\emptyset_{\{[\chi^{\text{ʕ}}\text{on}]\}}$. Thus, all of these markers fulfill the requirement (6a). Among these markers, only the specification of *-mul* and *-or* forms a subset of the input feature set {−oblique, +pl, α}. Hence, only these two vocabulary items fulfill requirement (6b). Since the specification of *-mul* forms a subset of the specification of *-or*, the latter will always be more specific, regardless of whether number or class features are higher on the feature hierarchy. Consequently, *-or* is the only marker fulfilling all three requirements of the Subset Principle given in (6). It is thus inserted according to the definition in (5). As a result, (i) the exponent *-or* is substituted for ℵ, (ii) the feature specification of *-or* is subtracted from the morpho-syntactic feature set, and (iii) the string [or] is suffixed to the base [qionn]. See (15b).

(15) *Derivation of* qionn-or

a. Initial state:
$\langle \aleph, \{-\text{oblique}, +\text{pl}, \alpha\}, [\text{qionn}] \rangle$

b. Derivation:

$$\langle \aleph, \{-\text{oblique}, +\text{pl}, \alpha\}, [\text{qionn}] \rangle \rhd -\text{or}_{\left\{ {}^{+\text{pl}}_{\alpha} \right\}}$$

$$= \langle -\text{or}_{\left\{ {}^{+\text{pl}}_{\alpha} \right\}}, \{-\text{oblique}, +\text{pl}, \alpha\} \backslash \{+\text{pl}, \alpha\}, [\text{qionn}] \oplus [\text{or}] \rangle$$

$$= \langle -\text{or}_{\left\{ {}^{+\text{pl}}_{\alpha} \right\}}, \{-\text{oblique}\}, [\text{qionnor}] \rangle$$

Insertion of *-or* produces the state in the last line of (15b). As the exponent inserted in the last step of the derivation has been *-or*, competition is now limited to the set of exponents that are accessible from *-or*. According to Fig. 1, only *-čaj* fulfills this criterion. However, since [+oblique] is not part of the input specification, *-čaj* does not fulfill (6b). At this point, there is no exponent that fulfills the requirements of the Subset Principle (6). A final state is reached (see (9)) and the derivation terminates.

As a second example, consider the ergative plural form *qIonn-or-čaj*. The initial state of the derivation for this input is basically identical to the previous one, with the exception that the set of morpho-syntactic features contains [+oblique] rather than

[11] One might wonder what syntactic structure this input state corresponds to. For the notion of accessibility among markers to have a substantial effect, it must be the case that vocabulary insertion for any given input may apply iteratively (as suggested by Noyer 1997) and that the number of features in the relevant input set is sufficiently large to allow this. This may be ensured by assuming that several distinct functional heads are fused into one that forms the input for the insertion algorithm. Another option is to invoke head movement producing complex heads in familiar ways and vocabulary insertion targeting the *M-word* (Marantz 1997; Embick and Noyer 2007), i.e. the highest X° category.

[–oblique] (see (16a)). The derivation for this input is provided in (16b). The first step of vocabulary insertion proceeds similarly to the one in the previous example. A notable difference is that in (16) *-li* now fulfills both (6a) and (6b) as [+obl] forms a subset of the feature set in (16a). Thus, both *-li* and *-or* are accessible from ℵ (fulfilling (6a)) and their feature specification forms a subset of the input feature set (complying with (6b)). Specificity as defined in (7) determines which of the two is inserted based on the feature hierarchy 'NUMBER > CASE'. As number is ranked higher than case, realization of the former takes priority over realization of the latter. Because *-li* is specified for case but not for number and *-or* bears number but not case features, the feature hierarchy determines *-or* to be the more specific marker. Thus, only *-or* fulfills (6c) and is hence inserted.

After insertion of *-or* only *-čaj* is accessible. In contrast to (15), *-čaj* fulfills (6b) for the input (16a) and is hence inserted, discharging the [+obl] feature and suffixing the string [čaj]. Note here that *-li* would also have fulfilled (6b) as it realizes the same feature that *-čaj* does. In contrast to *-čaj*, however, *-li* is not accessible from *-or* (*-or* → *-čaj*; *-or* ↛ *-li*). Its distribution is thus constrained by the accessibility relation holding within the marker inventory. After insertion of *-čaj*, the only vocabulary items accessible are *-n* and *-s*. As neither of them fulfills (6b), they are not available for insertion. The derivation reaches a final state and terminates.

(16) *Derivation of* qionn-or-čaj

a. Initial state:
$\langle \aleph, \{+\text{obl}, +\text{pl}, \alpha\}, [\text{qionn}] \rangle$

b. Derivation:

$$\left(\langle \aleph, \{+\text{obl}, +\text{pl}, \alpha\}, [\text{qionn}] \rangle \rhd -\text{or}_{\left\{ {}^{+\text{pl}}_{\alpha} \right\}}\right) \rhd -\text{čaj}_{\{+\text{obl}\}}$$

$$= \langle -\text{or}_{\left\{ {}^{+\text{pl}}_{\alpha} \right\}}, \{+\text{obl}\}, [\text{qionnor}] \rangle \rhd -\text{čaj}_{\{+\text{obl}\}}$$

$$= \langle -\text{čaj}_{\{+\text{obl}\}}, \{+\text{obl}\} \backslash \{+\text{obl}\}, [\text{qionnor}] \oplus [\text{čaj}] \rangle$$

$$= \langle -\text{čaj}_{\{+\text{obl}\}}, \emptyset, [\text{qionnorčaj}] \rangle$$

In the accessibility-based analysis in Fig. 1, there is, theoretically speaking, no multiple exponence. Every feature is active only once and irretrievably lost after being realized. The descriptive notion of multiple exponence observed in (12) is conceived of as the effect of restrictions imposed by the accessibility relation. We have seen in (12) that a plural feature is apparently realized by both a plural exponent as well as a plural oblique exponent. Figure 1 models this co-dependency by specifying *-mul, -or*, and *-um* for a plural feature and stipulating that *-čaj* is accessible from these markers. This restriction has the effect of making *-čaj* dependent on a prior plural marker despite its not being specific for a plural feature itself. Put differently, *-čaj* and *-li* are not *internally* restricted to a certain number (i.e., as a result of their feature specification) but *externally* (viz., as a result of their relation to other exponents).

This analysis straightforwardly accommodates the observation that both *-čaj* and *-li* are in principle compatible with both singular and plural number (as demonstrated by (13)). If for a certain lexeme there is a way of reaching *-čaj* without having to traverse through plural markers beforehand, *-čaj* may appear in singular contexts as well, precisely because the distributional restriction witnessed in (12) is a result of the

accessibility relation rather than feature specification. This is the case for *ha*ʕ*təra* and *c'aj*. Conversely, if a lexeme does not allow transition into the plural markers *-mul, -or,* and *-um* (with the consequence that *-čaj* is never accessible for these lexemes), *-li* may realize both singular and plural cells, again because *-li* itself is not restricted to either number. This is the case for *χ*ʕ*on*.[12]

The accessibility approach proposed here thus captures the observation that *-čaj* and *-li* seem to be subject to a number restriction in some cases (i.e., (12)) and be exempt from it in others (viz., (13)). Modelling apparent multiple exponence as a result of an accessibility relation thus provides a unified account of both (12) and (13). As I will show in the next section, such a unification is out of reach for feature-based analyses of multiple exponence. Under such approaches, one has to assume either accidental homophony of at least some markers or invoke at least two distinct post-syntactic operations. Parsimony thus favors the accessibility account.

3.3 Comparison with feature-based accounts

Approaches to morphology that subscribe to (1) and thus view the set of morpho-syntactic input features to be the only factor that conditions selection of exponents within a given inventory generally assume a condition to the effect that each feature can be active only once. Multiple exponence is at odds with these general restrictions and accordingly handled by invoking special operations that, in one or the other, render features relevant for more than one insertion step. In this section, I will briefly outline some of these operations and compare them to the accessibility analysis developed in the preceding section.

Noyer's (1997) classical treatment of extended exponence centers around the idea that discharged features are not deleted but furnished with a diacritic and still accessible for exponents specified for the discharged version of this feature. Applied to the data in (12), the exponents can be specified as in (17), where *-or*, *-um*, and *-mul* are primary exponents of a plural feature. The exponent *-čaj* is inserted in the context of a discharged plural feature. In Noyer's terminology, *-čaj* is a SECONDARY EXPONENT of plural.

(17) *Secondary exponence approach*

/-or/	↔	[+pl], [−α]	
/-um/	↔	[+pl], [+α]	
/-mul/	↔	[+pl]	
/-čaj/	↔	[+obl]	([+pl])

In a more recent approach to multiple exponence, Müller (2007) proposes ENRICHMENT operations, which duplicate feature tokens. Each token may then trigger insertion of one exponent. For the paradigm in (12), Müller (2007) suggests the system in (18). The feature [+plural] is duplicated, and each token realized by the number and the oblique marker.

[12] As noted above, Corbett (2007) considers the distribution of *-čaj* and *-li* in (13) to be an instance of deponency as they appear in the 'wrong' number cells. Under the analysis in Fig. 1 neither of the two exponents bears a number feature so there is nothing wrong with their occurrence in both singular and plural cells. Consequently, under this analysis there is no deponency in (13).

(18) *Enrichment analysis* (Müller 2007)

a. $\emptyset \rightarrow$ [+pl] / [+pl], [+obl] ___

b.

/-or/	↔	[+pl], [−α]
/-um/	↔	[+pl], [+α]
/-mul/	↔	[+pl]
/-čaj/	↔	[+pl], [+obl]

A third type of analysis that has been proposed to deal with extended exponence is a syntactic AGREE operation that copies a certain feature (in this case a plural feature) onto another head (Halle and Marantz 1993). As a consequence, this feature is present on two syntactic heads and may thus affect two applications of vocabulary insertion.

Despite their differences, all of these approaches have in common that they adhere to the view in (1). Multiple exponence is modelled by an operation that affects the set of morpho-syntactic features in a way that lets vocabulary insertion produce the desired output, either by inserting a diacritic into the feature set or by duplicating feature tokens. Moreover, in contrast to the accessibility-based account proposed here the oblique markers *-li* and *-čaj* are *inherently* specified for number. While this derives their distribution in (12), it does not extend to (13). In (13) both exponents occur in cells from which they should be categorically barred given this number specification. There is thus the following contradiction: If *-li* and *-čaj* are specified for number, their distribution in (12) follows but (13) does not. On the other hand, not specifying the two markers for number at all is compatible with their number insensitivity in (13) but leaves their correlation with number in (12) unaccounted for. We have seen above that this problem does not arise if the distribution of *-li* and *-čaj* is taken to be externally constrained, i.e. by the accessibility relation. Hence, the problem is specific to the view in (1): If only morpho-syntactic features are a constraining factor on the distribution of vocabulary items, there is no coherent way of specifying the two markers to cover their entire distribution.

There are, of course, ways for the analyses above to cope with (13). One way would be to invoke a feature introduction rule that transforms a syntactic singular configuration into a morphological plural form in the case of *haʕtəra* and *c'aj* and a plural configuration into a singular in the case of *χʕon*.[13] This would capture the fact that the oblique markers seem to occur in the wrong number in these items. Such an operation would have to be restricted to the case marker in order to ensure that, first, the plural marker *-mul* does not appear in singular forms of *haʕtəra*, second, no plural stem form shows up in singular forms of *c'aj*, and, third, insertion of a singular feature in the case of *χʕon* does not affect the stem form. The overarching generalization is that it is only the oblique markers that appear in the 'wrong' cells. Invoking an operation that altogether changes the input specification of vocabulary insertion leads one to expect other number-sensitive markers to occur in the 'wrong' cells, contrary to fact. From a more conceptual perspective, it is noteworthy that two unrelated operations are necessary to account for (12) and (13): Some operation modifying the feature structure that gives rise to multiple exponence in (12) and some other feature-modifying operation that results in deponency (13). The analysis is thus hybrid, in contrast to the accessibility-based account advanced here.

[13] Operations of this type will be the subject of Sect. 5.

In sum, in this section I have discussed how (apparent) multiple exponence can be recast in an accessibility-based system. The analytic intuition is that multiple exponence arises if some marker A is accessible only from some other markers that realize some feature. Insertion of A is then only possible in configurations that contain this feature, giving rise to the impression that A was a direct exponent of this feature. Under the present analysis, it is not. This renders the phenomenon of multiple exponence compatible with the strict feature discharge theorem (11). In addition, I have contrasted the accessibility-based account to feature-based analyses adhering to (1). It turned out that while the accessibility relation provides a unified treatment of both the multiple exponence data in (12) as well as the deponency pattern in (13), feature-based approaches are forced to employ additional machinery in order to be extended to (13).

4 Multiple exponence in non-adjacent positions: the case of Dumi

In the preceding section I have proposed an analysis of multiple exponence in terms of marker accessibility. The accessibility relation is local in that it only affects derivationally adjacent exponents. Long-distance interactions across other exponents are not possible.[14] This is formally implemented in the definitions of states (4) and the insertion process (5). As only the information regarding the exponent inserted in the previous derivation step is stored, exponents inserted prior to that may not have an affect on vocabulary insertion at any given point. If multiple exponence is the result of accessibility, it should also be local, holding only between adjacent markers. The account thus makes the prediction in (19).[15]

(19) *Prediction*
Multiple exponents of a feature may not be separated by an exponent that is compatible with the absence of this feature.

(19) alone does not have much empirical force. Concrete predictions emerge only in conjunction with a particular feature inventory. This section will illustrate the interaction of accessibility relations and feature structures by means of a case study on multiple exponence in the Kiranti language Dumi (van Driem 1993).

Consider the verb agreement in example (20). There are two 1SG markers, separated by the non-past tense marker *-t*. Importantly, this non-past tense marker is sensitive to neither person nor number but occurs across the board. If there is precisely one feature corresponding to first person and precisely one corresponding to singular, an accessibility-based account does not accommodate this fact. As I will show, no such problem arises under a more fine-grained feature system.

[14]Notice that the definition of the accessibility relation requires exponents to be derivationally adjacent rather than linearly. Multiple exponence between a prefix and a suffix is thus unproblematic as long as one of the markers is inserted right after the other. The derivational formulation of the accessibility relation contrasts with, e.g., the theory suggested by Hankamer (1986), which is based on linear adjacency.

[15]I am grateful to an anonymous reviewer and Peter Arkadiev for raising this issue.

(20) waʔwaʔ ma-ŋ-t-ə
vomit do-1SG-NPAST-1SG
'I shall throw up.' (van Driem 1993:134)

The general analytic idea here is that the apparent 1SG marker *-ə* is not inherently specified for 1SG, while *-ŋ* is. As consequence, *-ə* is in principle compatible with configurations other than 1SG. The observation that it nevertheless does not show up in these configurations is implemented by the independently motivated presence of other exponents that bleed insertion of *-ə* in forms that are not 1SG.

To elaborate this analysis, I will assume that number and person features are decomposed into SUBFEATURES as in (21).[16] The morpho-syntactic specification of *-ŋ* and *-ə* is given in (22). The two specifications do not overlap. Technically speaking, *-ŋ* and *-ə* are not multiple exponents of some feature.

(21) a.

singular:	[+sg, –pl]
dual:	[–sg, –pl]
plural:	[–sg, +pl]

b.

1.EXCL:	[+1, –2]
1.INCL:	[+1, +2]
2:	[–1, +2]
3:	[–1, –2]

(22) a. ⟨-ŋ, {+1, +sg}⟩ b. ⟨-ə, {–pl}⟩

Given the feature decomposition in (21), *-ŋ* is confined to 1SG environments, as desired. This is not the case for *-ə*, which is in principle compatible with any singular or dual specification. Empirically, however, *-ə* does not occur in all of these configurations, as illustrated by the paradigm in (23).[17]

(23) Expected and actual distribution of *-ə*

	PAST			NON-PAST		
	singular	dual	plural	singular	dual	plural
1.EXCL	Σ-*ŋ-u*	Σ-*i*	Σ-*k-a*	Σ-*ŋ-t-ə*	Σ-*t-i*	Σ-*k-i-t-a*
1.INCL	—	Σ-*i*	Σ-*k-i*	—	Σ-*t-i*	Σ-*k-i-t-i*
2	Σ-*a*	Σ-*i*	Σ-*ini*	Σ-*t-a*	Σ-*t-i*	Σ-*t-ini*
3	Σ-*a*	Σ-*i*	*ham*-Σ-*a*	Σ-*t-a*	Σ-*t-i*	*ham*-Σ-*t-a*

As is evident from (23), *-ə* appears only in 1st person non-past forms. Further restrictions on its distribution are thus required. To this end I will capitalize on the fact that in all cells compatible with *-ə* but lacking it there is some other exponent. By assumption, then, insertion of these markers bleeds insertion of *-ə*.

Consider the analysis in Fig. 2. Insertion of *-u, -i* or *-a* prevents subsequent insertion of *-ə* as the latter is accessible from neither of these markers. It is noteworthy that at least in the case of *-u* and *-a* this bleeding relation is an effect of the accessibility relation and, under the specification in Fig. 2, cannot be attributed to feature discharge.

[16] Feature decomposition has a long tradition in morphological theory, going back to Jakobson (1936) and Bierwisch (1967). The feature decomposition in (21) will also play a role in the analysis of Nimboran in Sect. 5.

[17] 'Σ' designates the verbal root in (23).

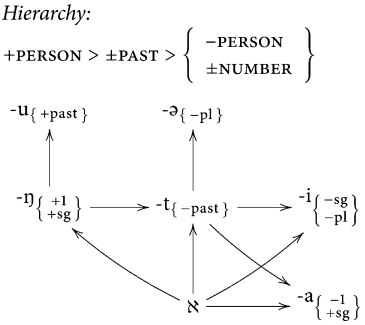

Fig. 2 Partial analysis of Dumi verb inflection

As a result, -*ə* is inserted in fewer configurations than its inherent feature specification in (22b) would lead one to expect. In fact, it will be preempted by some marker in all cases expect for 1st singular non-past environments. This precisely matches its distribution in (23).

In sum, while the accessibility-based framework developed here has (19) as a general consequence, its concrete empirical impact depends on the adopted theory of feature structures. An analysis incorporating feature decomposition allows for more analytic leeway than one without. The case of long-distance multiple exponence in Dumi provides reason to believe that the additional flexibility that feature decomposition yields is empirically desirable. The exact nature of the feature system that accessibility relations should be combined with is ultimately an empirical question and must await further research.

5 Apparent feature changing in Nimboran

Based on verbal agreement in Nimboran, Noyer (1998) argues that systems with monotonic reduction of morpho-syntactic feature sets are revealed to be too restrictive and thus disconfirmed empirically. Noyer concludes that any theory of morphology must necessarily contain *feature-introducing* operations or an equivalent device determining exponence on the basis of a set of features different from the set provided by syntax.[18] In other words, morphology must be powerful enough to not only reduce syntactically determined feature sets but positively overwrite them. As it will turn out, restricting oneself to feature reduction is problematic only for approaches adhering to the position (1) that the distribution of exponents is only constrained by morpho-syntactic feature sets. Therefore, Noyer's argument is valid only in theories that determine exponence by inspecting feature sets alone.

The verbal agreement paradigm that Noyer's (1998) argument is based on are given in (24a) and (24b) (see also Anceaux 1965; Inkelas 1993, and Trommer 2001, 2003). The subject agrees with the verb in person and number. In both tables, the exponents before the dots are pure person markers. As Noyer's (1998) argument rests

[18]Rules of referral as conceived by, e.g., Stump (2001) do not change a given feature set Σ present in the input. Rather, exponence is calculated on the basis of a feature set Σ' equaling Σ *modulo* some feature(s) σ. As far as expressive power is concerned, this view is equivalent to actual feature introduction.

on the distribution of the number exponents alone, I will abstract away from the person markers here. The analysis proposed below may however be conservatively extended to include them as well.[19]

(24) a. Subject agreement affixes in the 'normal' environment

	singular	dual	plural
1.EXCL	*. . . u*	*k. . . u*	*i. . . u*
1.INCL	*maN. . . ám*	*k. . . ám*	*k. . . ám*
2	*. . . e*	*k. . . e*	*k. . . e*
3.MASC	*. . . am*	*k. . . am*	*i. . . am*
3.FEM	*. . . um*	*k. . . um*	*i. . . am*

b. Subject agreement affixes in the 'special' environment

	singular	dual	plural
1.EXCL	*. . . u*	*i. . . u*	*i. . . u*
1.INCL	*maN. . . ám*	*i. . . ám*	*i. . . ám*
2	*. . . e*	*i. . . e*	*i. . . e*
3.MASC	*. . . am*	*i. . . am*	*i. . . am*
3.FEM	*. . . um*	*i. . . um*	*i. . . um*

(24a) illustrates morphological marking in the 'normal' environment (Noyer 1998: 271); (24b) provides the exponents used in the 'special' environment (Trommer 2001:152), which occurs in the presence of certain particles, the plural object morpheme *-dar* and the durative affix *-tam*. For expository purposes I will restrict may attention to the durative affix. With this simplification in place, the distribution in (24a) is used in non-durative contexts, whereas a durative environment induces the distribution in (24b).

To appreciate Noyer's (1998) argument, consider the distribution of the number exponents *-i* and *-k* in both environments.[20] Every morpho-syntactic specification of *-i* and *-k* leads to a contradiction:

(25) a. In the NORMAL ENVIRONMENT (24a) *-i* occurs in 1PL and 3PL cells; *-k* fills up the remaining dual and plural cells. As the distribution of *-k* does not form a natural class, it has to be regarded as the elsewhere marker for non-singular contexts. It follows that *-k* is the default marker, subject to overwrite by the more specific *-i*.

b. In the SPECIAL ENVIRONMENT (24b) *-k* does not appear at all. Instead all dual and plural cells are marked with *-i*. This distribution entails that *-i* is the elsewhere exponent for non-singular.

[19] For reasons that need not concern us here, an inclusive dual form appears in the form labelled 'singular' in (24). See footnote 21.

[20] The exponent *-i* is an autosegmental item which induces palatalization of adjacent segments. It is notated as ⟨*i*⟩ by Inkelas (1993) and as [^{i}] by Noyer (1998).

(25a) and (25b) yield contradictory results: While in the normal environment *-k* is the elsewhere non-singular exponent, it is *-i* in the special environment. The paradox lies in the BIDIRECTIONAL SPREADING of *-k* over *-i* in the normal environment (i.e. *-k* marks all cells not occupied by *-i*), and of *-i* over *-k* in the special environment. As Noyer (1998) demonstrates, it is impossible for an account relying solely on underspecification and impoverishment to capture this distribution.

As discussed by Inkelas (1993) and Noyer (1998), number features have a second effect on exponence. Inkelas (1993) identifies three stem allomorphs, which she terms A, B and C. Stem B is the default, from which stem A is derived by metathesis of the final syllable nucleus, and stem C by means of ablaut. The use of these stem forms is conditioned by number of the subject. In the normal environment, the A stem is used in the singular, the B stem in the dual, and stem C occurs in the plural, as illustrated in (26).[21]

(26) a. ŋgedúo-d-u
draw[A]-FUT-1
'I will draw (here).'

b. ŋgedóu-k-d-u
draw[B]-DL-FUT-1
'We two (=I and (s)he) will draw (here).'

c. ŋgedói-i-d-u
draw[C]-PL-FUT-1
'We (more than two) will draw (here).' (Inkelas 1993:567f.)

In the special environment, on the other hand, the distribution of the stem allomorphs differs. Here singular contexts are marked with the B stem, while dual and plural configurations lead to the C stem. This is exemplified in (27).

(27) a. ŋgedói-tam-t-u
draw[C]-PL-DUR-PRES-1
'We two are drawing.' *or*
'We (many) are drawing.'

b. ŋgedóu-tam-t-u
draw[B]-DUR-PRES-1
'I am drawing.' (Inkelas 1993:606)

For expository purposes, (28) summarizes the distribution of the number affixes *-i* and *-k* as well as the stem allomorphs.

[21] There is in fact a slight complication. Some dual inclusives appear in their singular form, i.e. with the A stem and without a number affix, as illustrated in (i):

(i) ŋgedúo-maN-d-ám
draw[A]-INCL.DL-FUT-INCL
'You (sg) and I will draw (here).' (Inkelas 1993:567)

Noyer (1998) does not explicitly discuss these cases but seems to assume that they bear a syntactic singular feature. This line of reasoning accounts for the otherwise puzzling singular inclusive cell in (24a) and (24b). I will follow this assumption.

(28) Distribution of number markers and stem allomorphs

	–DURATIVE			+DURATIVE *(-tam)*		
	singular	dual	plural	singular	dual	plural
1.EXCL	Ø, A	*k*, B	*i*, C	Ø, B	*i*, C	*i*, C
1.INCL	Ø, A	*k*, B	*k*, C	Ø, B	*i*, C	*i*, C
2	Ø, A	*k*, B	*k*, C	Ø, B	*i*, C	*i*, C
3	Ø, A	*k*, B	*i*, C	Ø, B	*i*, C	*i*, C

Noyer (1998) accounts for these facts by means of the system in (29), which is based on decomposition of the number feature as in (21a) above.

(29) Noyer's (1998) analysis

a. *vocabulary items*
/-i/ ↔ [+pl]
/-k/ ↔ [–sg]

b. *allomorphy rules*
[+sg] ↔ metathesis rule (⇝ A)
[+pl] ↔ ablaut rule (⇝ C)

c. *normal environment*
$[+\text{pl}] \rightarrow \emptyset \;/\; [+2, -\text{sg}]$

d. *special environment*
(i) $[-\text{pl}] \rightarrow \emptyset$
(ii) $[\alpha\text{sg}] \rightarrow \emptyset$
(iii) $[-\text{sg}] \rightarrow [+\text{pl}]$ (feature change/introduction)

Noyer (1998) assumes that *-i* is an exponent of [+pl], whereas *-k* realizes [–sg] (see (29a)). The A and C stems are brought about by the morphophonological stem formation rules in (29b). In the normal environment, *-i* is barred from 2nd person configurations because the feature [+pl] is deleted by the impoverishment operation (29c). Crucially, impoverishment alone will never be able to make *-i* occur in the dual since *-i* is inherently specified for [+pl]. This is, however, precisely what happens in the special environment. Noyer's (1998) argument is that the only way to cause *-i* to pop up in the dual is by *introducing* a [+pl] feature. This is achieved by the REDUNDANCY RULE in (29d.iii), which interacts with the two impoverishment operations (29d.i) and (29d.ii).

The morphological derivation in the dual of the special environment proceeds as follows: The input configuration is [–sg,–pl]. (29d.i) deletes the [–pl] subfeature, leaving behind [–sg]. Applying the redundancy rule (29d.iii) yields [–sg,+pl], in fact a dual specification, which acts as the input to vocabulary insertion. As a last step, the feature [–sg] is deleted by the impoverishment rule (29d.ii). This derivation is shown in (30).

(30)
	[–sg,–pl]	*underlying:* dual
→	[–sg]	(29d.i)
→	[–sg,+pl]	(29d.iii)
→	[+pl]	(29d.ii)

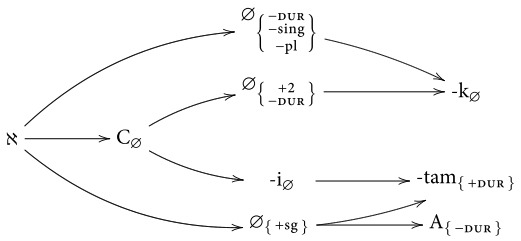

Fig. 3 Analysis of Nimboran (table in (28))

In Noyer's (1998) account, the combined force of impoverishment and redundancy operations transforms a syntactic dual into a morphological plural configuration, which consequently receives the same exponence as 'genuine' plurals. What is crucial is that exponence is determined for a feature set distinct from, and not contained in, the feature set operating in syntax (and semantics).

Notice, incidentally, that although Noyer (1998) offers no discussion of this issue, the interaction of the operations involved has apparently to be restricted by an extrinsic ordering. Specifically, the redundancy rule (29d.iii) has to apply before (29d.ii), as deletion of [–sg] would destroy the context of [+pl]-insertion. Correspondingly, the two impoverishment rules (29d.i) and (29d.ii) have to be ordered, again because application of (29d.ii) before (29d.i) would otherwise preempt the redundancy rule (29d.iii).

It is evident that Noyer's analysis conforms to the view in (1) that exponence is determined on the basis of morpho-syntactic features alone. Moreover, Noyer's argument that feature introduction is empirically necessary implicitly presupposes the validity of (1). There is a need to modify the morpho-syntactic feature set that forms the input to vocabulary insertion only if this feature set is the sole determiner of exponence. Once (1) is abandoned, the need for feature insertion disappears.

To demonstrate this claim, I will lay out an analysis of the Nimboran data in the accessibility framework presented here. In a nutshell, the peculiar distribution of the number exponents *-k* and *-i* is treated as a result of the accessibility relation rather than feature insertion.

The basic problem associated with *-i* and *-k* in (28) is that both exponents may in principle occur in all non-singular cells. The most straightforward analysis is to mirror this distribution directly in their feature specification: Both *-i* and *-k* are insensitive to the dual/plural distinction; i.e., they are morpho-syntactically underspecified. In a way similar to the implementation of Archi in Sect. 3, the distribution of the two exponents is then to be restricted by the accessibility relations between them and the other exponents in the system.

An accessibility-based analysis of the Nimboran facts summarized in (28) is provided in Fig. 3. Both *-i* and *-k* are pure elsewhere markers, constrained only by accessibility relations. The labels 'A' and 'C' are shorthands for the respective phonological metathesis and ablaut rule. As a consequence of the accessibility relations and the competition with the other exponents, the system in Fig. 3 captures the fact that *-i* appears only in cells that are neither [+sg] nor [–DUR,–sg,–pl] nor [+2,–DUR]: 1st and 3rd person plural non-duratives and non-singular duratives. The distribution of *-k*, on the other hand, follows because its insertion is possible only in [+2,–DUR] and

[–DUR,–sg,–pl]. A distinction between these two insertion roots is warranted because in one case stem C appears, whereas in the other the stem is of form B.

To sum up, I have argued that Noyer's (1998) claim that the distribution of the verbal number markers in Nimboran can only be accounted for by feature-introducing operations is only valid if there is no other factor constraining the competition of exponents. Once accessibility relations are taken to be part of morphological inventories, no redundancy rules are necessary.

6 Obligatory co-occurrence and Spanish object clitics

Noyer's (1998) account of bidirectional spreading in Nimboran discussed in the previous section makes use of feature-introducing *rules*. A related proposal for another type of phenomenon has been made by Halle and Marantz (1994) on the basis of Spanish object clitics. Here certain exponents stand in an implicational relationship. To derive the observation that some exponent α is invariably followed by an exponent β, Halle and Marantz (1994) make use of features introduced by *exponents*. In our abstract example, α would introduce a class feature which can only be discharged by β. In this section I will briefly discuss Halle and Marantz's (1994) proposal and argue that co-occurrence restrictions can be straightforwardly handled as the effect of accessibility relations. The mechanism of feature introduction involved by Halle and Marantz (1994) is thus unnecessary under present assumptions.[22]

The object clitic paradigm for Peninsular Spanish is given in (31) (Bonet 1991, 1995; Harris 1994). The following co-occurrence implications hold:

(31) Object clitics in Peninsular Spanish

		3		2	1
		MASC	FEM		
singular	ACC	*lo*	*la*	*te*	*me*
	DAT	*le*	*le*	*te*	*me*
	REFL	*se*	*se*	*te*	*me*
plural	ACC	*los*	*las*	*os*	*nos*
	DAT	*les*	*les*	*os*	*nos*
	REFL	*se*	*se*	*os*	*nos*

[22] An anonymous reviewer asks what is gained by a fine-grained morphological analysis of a closed class clitic system. These clitics might, as the reviewer suggests, be simply learned as whole forms. Note, however, that the forms in (31) involve either a significant segmental overlap or altogether complete syncretism. This distribution gives rise to the intuition that they consist of recurring smaller markers. This is precisely what a morphological analysis of these clitics is meant to capture. Treating these elements as unanalyzable, on the other hand, must consider accidental any similarity between different clitics. More importantly, I should emphasize that the claim of this section is first and foremost a technical one: The effects of feature introduction by exponents can be modelled as an effect of the accessibility relation. As Spanish object clitics happen to be a system that has been taken to motivative this type of feature introduction, I will base the discussion on them. The main claim is not so much about Spanish clitics per se but about the analytic power of the concept of accessibility.

(32) *Implications in (31)*

a.	*m*	→	*e*	c.	*n*	→	*o*
b.	*s*	→	*e*	d.	*t*	→	*e*

To account for this system, Halle and Marantz (1994) assume the set of syntactic heads in (33). Into these three heads insertion takes place, in principle independent of each other. The system comprises the vocabulary items, redundancy rules and the extrinsic ordering in (34).[23]

(33) [$_{\text{Det}}$] [$_{\text{Theme}}$] [$_{\text{Number}}$]

(34) Halle and Marantz's (1994) analysis of Peninsular Spanish

a. *Vocabulary items*

DET:			THEME:			NUMBER:		
/n/$_{[I]}$	↔	[1]/[+PL]	/e/	↔	[III]	/s/	↔	[+PL]
/m/$_{[III]}$	↔	[1]	/a/	↔	[II]	/∅/	↔	[ ]
/∅/	↔	[2]/[+PL]	/o/	↔	[ ]			
/t/$_{[III]}$	↔	[2]						
/l/	↔	[ ]/CASE						
/s/$_{[III]}$	↔	[ ]						

b. *Redundancy rules*

(i) [ ] → [CLASS II] / [+FEM]

(ii) [ ] → [CLASS III] / [DAT]

c. *Extrinsic ordering*

Insertion into DET → redundancy rule (i) → redundancy rule (ii) → insertion into THEME and NUM

Crucially, the exponents *n*, *m*, *t* and *s* in (34a) carry a morpho-syntactic class feature, which is not subject to the Subset Principle, i.e. it is not required to be part of the feature set of the syntactic DET node. Instead, these exponents introduce the class feature upon insertion into the feature set of the THEME head, where it triggers insertion of a class-specific vowel. If no class feature is introduced by the THEME exponent, one of the redundancy rules in (34b) applies. If both redundancy rules are applicable, (34b.i) takes priority as a result of an extrinsic ordering between the two. To ensure that the redundancy rules do not interfere with feature insertion by DET exponents, another extrinsic ordering is required, constraining the redundancy rules to apply after vocabulary insertion into DET but before insertion into THEME.[24]

As there is one type of feature for which the subset requirement holds (i.e., which has to be present in the syntactic head prior to insertion), and another type which is newly inserted into the syntactic feature structure, the analysis in (34) is *realizational*

[23]The context specification CASE of the DET exponent *l* preempts its insertion into reflexive configurations, as these are by assumption case-less.

[24]It remains unclear how the distribution of the number markers in the reflexive is derived in this analysis. As nothing prevents insertion of the plural *s*, the result would be **ses* instead of *se*. The problem could be addressed by invoking an impoverishment rule. Alternatively, reflexives may be treated as inherently numberless.

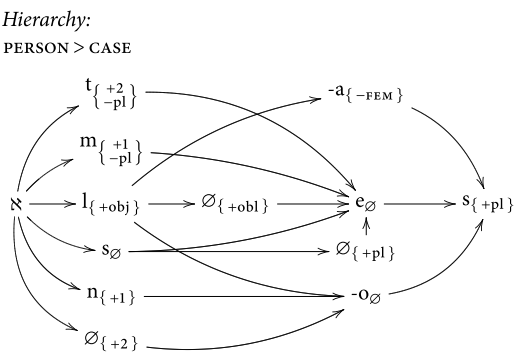

Fig. 4 Analysis of Peninsular Spanish (table in (31))

and *incremental* at the same time. The empirical reason for doing this lies in the co-occurrence implications in (32). That insertion of *m* always leads to subsequent insertion of *e* follows from the fact that *m* introduces the class feature [III], which can only be realized by *e*.

Feature introduction by exponents, and thus implicational relations between vocabulary items, can be recast as an effect of the accessibility relation. To capture the fact that, e.g., *m* is invariably followed by *e*, it suffices to assume that (i) *e* is accessible from *m*, (ii) there is no other exponent accessible from *m*, and (iii) *e* is an elsewhere exponent. Feature introduction and, in fact, class features altogether are unnecessary. The full analysis of the Peninsular Spanish paradigm is given in Fig. 4. Dative and accusative case is decomposed as in (35).

(35) *Case feature decomposition*

ACCUSATIVE:	[+obj(ect), –obl(ique)]
DATIVE:	[+obj(ect), +obl(ique)]

Figure 4 accounts for the empirical facts without any appeal to feature introduction or contextual features. The co-occurrence restrictions in (32) follow straightforwardly: Once *t* is inserted, it is mandatory to insert *e* in the next step, as *e* is an elsewhere marker there is no other accessible exponent.

A remark is in order concerning the item $\emptyset_{+\text{pl}}$. Its purpose is to prevent surface reflexives to come out as **ses* instead of *se*. A plural reflexive will run through $\emptyset_{+\text{pl}}$ after insertion of $s_{\emptyset}$ and its plural feature be discharged as a result. After transition into $e_{\emptyset}$, insertion of $s_{+\text{pl}}$ is not possible because the plural input feature has been deleted. The item $\emptyset_{+\text{pl}}$ thus has the effect of an impoverishment operation. See Trommer (1999) for the original proposal of recasting the effects of impoverishment as insertion of zero markers. Also see footnote 24.

Before closing this section, let us consider a slight extension of this system. In addition to the Peninsular Spanish paradigm in (31), Halle and Marantz (1994) consider object clitics in Latin American Spanish. The Latin American Spanish paradigm is in general identical to the Peninsular one, with a crucial difference in 2nd person plural cells, which are just as the respective third person plural forms (cf. (36)).

(36) 2PL clitics in Latin American Spanish

	MASC	FEM
ACC	*los*	*las*
DAT	*les*	*les*
REFL	*se*	*se*

Halle and Marantz (1994) develop an argument in favor of their system that the variation between Peninsular and Latin American Spanish can be meaningfully addressed as the absence vs. presence of an impoverishment rule. They note that the Latin American paradigm (36) follows from the system in (34) plus the impoverishment operation in (37). Deletion of the 2nd person feature automatically yields the same exponents as a syntactic 3rd person configuration, thus accounting for the striking syncretism.

(37) *Impoverishment rule for Latin American Spanish* (Halle and Marantz 1994)
$[2] \rightarrow \emptyset$ / [+PLURAL]

As the system in Fig. 4 is intended to be an alternative to Halle and Marantz's (1994) account, it is worth exploring what the present proposal has to say about this dialectal variation. While Halle and Marantz (1994) *extend* their system for Peninsular Spanish, the present analysis yields the Latin American paradigm by *reducing* the system in Fig. 4. The desired distribution follows immediately if the exponent $\langle \emptyset, +2 \rangle$ is deleted. Once this adjustment is made, 2PL configurations are not invariably mapped onto *os* but on the respective default exponents, which are, just as in Halle and Marantz's (1994) system, the markers employed in third person contexts.

To summarize, I have proposed that implicational relations between exponents can be modelled as a straightforward effect of the accessibility relation. The concept of feature introduction by vocabulary items is thus unnecessary in a theory adopting the notion of accessibility. Combined with the results of the discussion of Nimboran, no feature-introducing devices of any sort—by rule or by exponents—are required in such a framework. Rather, the peculiar marker distributions that have been taken to demonstrate the need for feature introduction can be fruitfully addressed as the effects of accessibility relations on the availability of exponents.

7 Conclusion

This paper has made some initial explorations of the idea that the availability of exponents for insertion not only depends on their morpho-syntactic specification, but, in addition, on an accessibility relation holding between exponents. This relation constrains the competition between exponents in a highly local manner, i.e. under derivational adjacency. As a consequence, the insertion of different exponents is highly related, with markers being able to feed or bleed the insertion of subsequent markers. I have argued that the concept of the accessibility relation affords a unified account of several phenomena that have previously been taken to require several distinct operations on the morpho-syntactic feature structure that vocabulary insertion applies to. The system was illustrated for extended exponence in Archi and Dumi, bidirectional

spreading in Nimboran, and obligatory marker co-occurrence in Spanish clitics. In all of these cases, an initially surprising distribution of an exponent follows from the fact that its insertion is not only regulated by morpho-syntactic features but, in addition, by the accessibility relation.

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