Morphotactics in an information-based model of realisational morphology

Olivier Bonami & Berthold Crysmann
Laboratoire de linguistique formelle
{bonami,crysmann}@linguist.jussieu.fr

In most recent work, Crysmann and Bonami (2012) suggest to reconcile the insights of inferential-realisational morphology (Anderson, 1992; Stump, 2001; Brown and Hippisley, 2012) with the full typology of variable morphotactics: situations where the expression of analogous feature sets can appear in various positions in the string. The authors proposed to account for these facts by importing, into HPSG, a variant of Paradigm Function Morphology (Stump, 2001) where realisation rules are doubly indexed for linear position and paradigmatic opposition. In this paper we first introduce more empirical challenges for theories of morphotactics that neither PFM nor the reformist approach of Crysmann and Bonami (2012) can accommodate. We then argue for a reappraisal of methods for morph introduction, and propose a new approach that replaces stipulation of classes of paradigmatic opposition with a general distinction between expression and conditioning (Carstairs, 1987; Noyer, 1992) which greatly expands the scope of Pāṇini's Principle.

1 Variable morph ordering

1.1 Types of non-canonical morphotactics

In the inflection of a particular lexical category in a given language, morphs are most canonically organised in a sequence of position classes: morphs expressing different values for the same feature cluster in a single linear position, strictly ordered with respect to positions serving for the realisation of other features. Of course, deviations from this canonical ideal are very common, and come in many varieties; most well-known are fused exponence (a single position realises more than one feature), extended exponence (the same feature is realised simultaneously in multiple positions), and zero exponence (some feature is not expressed at all); these famously motivate the Word and Paradigm family of approaches to inflection (Matthews, 1972).

A family a deviations of particular interest is that of variable morph ordering. This again comes in multiple varieties. In positional disambiguation, the same morph expresses related but distinct morphosyntactic property sets in different positions. A nice example is that of subject and object markers in Swahili (Stump, 1993): these markers are homophonous for most nominal classes, but do not appear in the same position within the verb.

per	gen	subject sg	subject pl	object sg	object pl
1		ni	tu	ni	tu
2		u	m	ku	wa
3	m/wa	a	wa	m	wa
	m/mi	u	i	u	i
	ki/vi	ki	vi	ki	vi
	ji/ma	li	ya	li	ya
	n/n	i	zi	i	zi
	u	u	—	u	—
	u/n	u	zi	u	zi
	ku	ku	—	ku	—

Table 1: Subject and object prefixes in Swahili

In misaligned exponence, morphs that are in paradigmatic opposition appear in different linear positions. Laz subject markers exemplify (Lacroix, 2009): with intransitive verbs, subject agreement is marked suffixally by default, prefixally in the first person, and both prefixally and suffixally in the 1pl.

lal 'bark'	sg	pl
1	b-lalum	b-lalum-t
2	lalum	lalum-t
3	lalum-s	lalum-an

Table 2: Subject marking on simple intransitive verbs in Laz

In conditioned reordering, one and the same morph expressing the same property set appears in different linear positions depending on some (phonological, morphosyntactic, or semantic) condition.[1] Mari nominal declension offers a relevant example (Luutonen, 1997): in the accusative , the possessor marker precedes the case marker, while in the lative, it is the other way round. In free reordering, the expression of some combination of morphosyntactic properties, relies on two morphs whose relative order is not constrained by the grammar. This is also found in Mari declension, in the dative.

	noposs	1pl.poss	
		poss ≺ case	case ≺ poss
nom	пӧрт	пӧрт-на	
acc	пӧрт-ым	пӧрт-**на**-м	*
dat	пӧрт-лан	пӧрт-**на**-лан	пӧрт-лан-**на**
lat	пӧрт-еш	*	пӧрт-еш-**на**

Table 3: Partial paradigm of Mari possessed nouns (Riese et al., 2010)

From a theoretical point of view, the Mari data are highly informative, since they actually provide the missing typological link between free ordering, as observed for Chintang (Bickel et al., 2007) and conditioned reordering, as manifest in Laz or Fula (Stump, 1993): systems that feature essentially free permutation, but are constrained for some cells, lend themselves quite naturally to an analysis in frameworks that build on the accumulation of partial descriptions.

1.2 Approaches to variable morphotactics

Within the Word and Paradigm tradition, the most prevalent view of morphotactics rests on three crucial assumptions (Anderson, 1992; Stump, 2001): (i) morphological composition is stem-centric: it starts from the lexeme's basic stem which it modifies incrementally through the sequential application of morpholexical rules; (ii) morpholexical rules operate on morphologically unstructured ('a-morphous') phonological representations; (iii) morpholexical rules are organised into blocks of mutual exclusivity.

[1] Reversible and ambifixal position classes (Stump, 1993) are two subcases of conditioned reordering.

This set of assumptions gives rise to a view of morphotactics where exponents in paradigmatic opposition are expected to linearise in onion-like fashion, as outlined in Fig. 1. Deviations from this expectation have been recognised early on, and dealt with using different analytic devices over the years: metarules (Stump, 1993), rules of referral (Stump, 2001), or conditional operators of composition and linearisation (Stump, 2012a). Still, all these proposals share the view that the kind of morphotactic structure illustrated by Fig. 1 is the least marked.

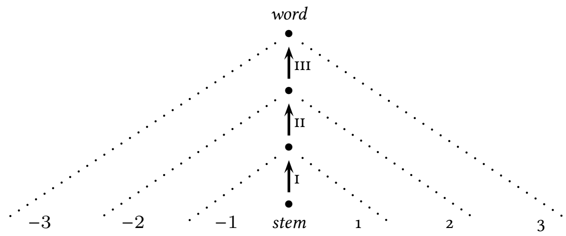

Figure 1: The interaction of rule blocks and morphotactics

Crysmann and Bonami (2012) challenge this assumption, and argue that the types of variable morphotactics found in the languages of the world do not warrant taking any type of variable morphotactics as less marked: what is less marked is to not have any variation in order, but there is no preference for variations that occur in onion-like fashion around the stem. Crucial to their argumentation is the pattern commonly found with Romance pronominal affixes, here illustrated with Italian (Monachesi, 1999), where sequences of affixes occur in the same order on either side of the stem (see also Luís and Spencer, 2005).

(1) a. me-lo-dai
DAT.1SG-ACC.3SG.M-give.PRS.2SG
'You give it to me.'
b. dá-me-lo!
give.IMP.2SG-DAT.1SG-ACC.3SG
'Give it to me!'

Crysmann and Bonami (2012) propose a reformist modification of standard assumptions amounting to dropping (i) above: instead of licensing inflected words starting from the stem, they start from the left edge of the word and delay the introduction of the stem. Morpholexical rules carry an explicit position class index, and order variability is dealt with by underspecification of position class. Crucially, this analytic setup enables Crysmann and Bonami to deal with a wider typology of variable morphotactics while keeping two central analytic assumptions: the a-morphous hypothesis and the organisation of rules into blocks.

2 New challenges

2.1 Rule blocks and position classes

While Crysmann and Bonami (2012) arguably provides for a more refined analysis of variable morphotactics than its predecessors, the formal analysis it provides is a hybrid, which ends up having unsatisfactory design properties. Particularly inelegant is the double indexing of morpholexical rules for rule blocks (encoding paradigmatic opposition) and position class (encoding syntagmatic order). While some indexing scheme for positions is indisputably necessary, the necessity of block indices is far less clear in a system where these indices are dissociated from linear order.

When stripped of their function of deriving linear order, what rule blocks appear to do is just ascertain morphological wellformedness: in inferential-realisational models of morphology and constraint-based grammar alike, a bare stem, being underspecified, may denote any cell of the paradigm, the only problem being that such a stem more often than not fails to constitute a legitimate morphologically well-formed word. Thus, one of the two remaining functions of rule blocks is to ensure that any inflectional feature that has some expression must be expressed and that cases of zero exponence are limited to the cells in the paradigm for which the system provides no exponent.

The other remaining function rule blocks were originally invoked for was to limit the scope of Pāṇinian competition, in order to permit instances of extended exponence, i.e., multiple expression of same or overlapping morphosyntactic properties (see section 3.2).

Another problematic issue with Crysmann and Bonami (2012) — actually a defect inherited from the PFM model — concerns their treatment of the identity function default (*ifd*), i.e., the morpholexical rule to account for zero exponence: ideally, there should only be one such default realisation rule that captures every morphosyntactic property that does not have an independent overt realisation. However, owing to the logic of rule blocks, Crysmann and Bonami (2012) need to postulate not only multiple instances of the same default rule, but also need to ensure that such an instance exists for every rule block.

More generally, within the context of information-based syntax and semantics, the idea of stipulating a system of ordered or unordered rule blocks merely for the purposes of ensuring morphological wellformedness should come as a bit of an embarrassment, even more so, if wellformedness can be simply captured by a straightforward principle: every property that can be expressed, needs to be expressed. In this paper, we shall develop a model of realisational morphology within HPSG that replaces stipulated static blocks of paradigmatic opposition with a general principle that manages the expression of morphosyntactic resources. We will show that this approach is not only preferable on a conceptual level, but also supported by an increase in analytical elegance and empirical coverage.

2.2 Challenging a-morphousness

Wackernagel affixes are affixes that are constrained to be the second realised morph in the word (Nevis and Joseph, 1992). A clear example is provided by Sorani Kurdish (Samvelian, 2007). In past transitive verbs, if the verb is VP initial, the set of markers realising subject agreement are realised immediately after the first other morph, irrespective of whether that morph is the basic stem, a negative prefix, or an aspectual prefix.[2]

1	2	3	4	
		nard=**jân**	im	'they sent me'
na=**jân**		nard	im	'they did not send me'
	da=**jân**	nard	im	'they were sending me'
na=**jân**	da	nard	im	'they were not sending me'

Table 4: Sorani Kurdish past person markers

Wackernagel affixes pose a serious challenge to the a-morphous assumption. In order to know where to linearise the affix, one needs to keep track of the position of the first overtly realised morph in the word. Both in conventional stem-centric approaches and in Crysmann and Bonami (2012)'s left-to-right approach, this information is inaccessible: the morpholexical rule introducing **jân** can only access phonological properties of its input, not morphological properties; thus irrespective of the order in which rules apply, there is no way of checking what the morphological structure of the sequence on the right of the affix is.[3] Stump (2012b) circumvents this problem by redefining

[2] See section 3.4 for a more detailed description.

[3] This is not literally true of Crysmann and Bonami (2012)'s approach, because of a technical defect in the formulation of realisation rules: the authors code recursion of realisation rules through the HPSG-standard use of a DTR feature. Thus in fact the whole derivation history is accessible to later rule ap-

realisation rules so that they construct two phonological strings in parallel: in addition to the full phonological representation, realisation rules recursively define the *pivot*, the substring of the whole phonology at whose edge Wackernagel affixes are to be realised. We would argue that this amounts to abandoning the spirit, if not the letter, of the amorphous hypothesis: using morphologically segmented phonological strings or recording separately the location of morph boundaries are just two equivalent ways of remembering where those boundaries are. In the remainder of this abstract we suggest a more direct approach to this phenomenology.

3 Analysis

3.1 Information-based realisational morphology

Inferential-realisational models of morphology typically draw a distinction between morpholexical rules (or realisation rules), which provide recipes for the introduction of exponents, and a system of paradigm functions that concert the way in which these recipes are applied to yield a well-formed word. In a-morphous approaches, such as Anderson (1992); Stump (2001); Crysmann and Bonami (2012), morpholexical rules are formulated as (potentially recursive) unary rules. Paradigm functions then guarantee that exactly the right number of rules are invoked, in the right order. Choice between competing rules is currently understood as being governed by Pāṇinian competition. This division of labour between morpholexical rules and paradigm function has proven quite successful, since it permits reuse of resources, as needed, e.g., for the treatment of positional disambiguation (cf. table 1; Stump, 1993; Crysmann and Bonami, 2012).

While keeping this general division, we shall revise the formal nature of morpholexical rules: instead of rule cascades successively transforming a basic stem into a complete word, rules will be considered instead as pairings between morphosyntactic properties and lists of exponents. Building on ideas proposed in Crysmann (2002), we postulate a flat structure of segmentable morphs (not morphemes) which are indexed for position. In essence, we are moving structure away from the derivation history into morphological representations. This move actually provides for a more restrictive model, since it systematically disallows reference to the derivation history.

Morpholexical rules are represented by feature structures organised in a type hierarchy of conjunctive dimensions and disjunctive types (Koenig, 1999), providing a pairing of a list of MORPHS with the morphosyntactic features they express (M(ORPHOLOGY) U(NDER) D(ISCUSSION)). In order to capture allomorphic conditioning, morpholexical rules may impose constraints on morphosyntactic properties they do not strictly realise, e.g. the negative allomorph of the Swahili past marker in (2). The morphs thus introduced consists of a phonological description (PH) together with a position class index (PC).

(2) $$\begin{bmatrix} \text{MUD} & \boxed{1}\{\textit{past}\} \\ \text{MORSYN} & \boxed{1} \cup \{\textit{neg}, \ldots\} \\ \text{MORPHS} & \left\langle \begin{bmatrix} \text{PH} & \text{<ku>} \\ \text{PC} & \textit{3} \end{bmatrix} \right\rangle \end{bmatrix}$$

Since morpholexical rules "know" what features they express (MUD), we can define morphological completeness and coherence in terms of resource consumption: as stated in (3), the morphosyntactic features expressed by morphological rules must match up to produce the morphosyntactic property set of the word. As for exponence, we compute the MORPHS list of a word by concatenating (or rather: shuffling) all the morphs contributed by the morpholexical rules in the order of their position class indices.

plication. This is clearly a bad design choice that does not correspond to the intended a-morphous interpretation of rules.

(3) $$\textit{word} \rightarrow \begin{bmatrix} \text{MORPHS} & \boxed{e_1} \bigcirc \cdots \bigcirc \boxed{e_n} \\ \text{MORSYN} & \boxed{0} \; (\boxed{m_1} \uplus \cdots \uplus \boxed{m_n}) \\ \text{RULES} & \left\langle \begin{bmatrix} \text{MORPHS} & \boxed{e_1} \\ \text{MUD} & \boxed{m_1} \\ \text{MORSYN} & \boxed{0} \end{bmatrix}, \ldots, \begin{bmatrix} \text{MORPHS} & \boxed{e_n} \\ \text{MUD} & \boxed{m_n} \\ \text{MORSYN} & \boxed{0} \end{bmatrix} \right\rangle \end{bmatrix}$$

Following Crysmann and Bonami (2012), we shall assume that the position class index of a morph PC can be constrained in absolute and relative terms. Minimally, one wants to recognise stem-relative positioning in addition to absolute positioning. We therefore propose the following constraint to distribute the ST(E)M index over the entire list of morphs. Stem introduction rules then make their PC value reentrant with their STM value.

(4) $$\textit{word} \rightarrow \begin{bmatrix} \text{MORPHS} & \left\langle [\text{STM} \; \boxed{s}], [\text{STM} \; \boxed{s}], \ldots, [\text{STM} \; \boxed{s}] \right\rangle \end{bmatrix}$$

Compared to Crysmann and Bonami (2012), position class information is considered a property of the morphs here, rather than a property of rules. Note further that there are no rule block indices (or POI), ensuring morphological completeness and coherence entirely in terms of the principle in (3). As a direct consequence, we extend the scope of Pāṇinian competition to all maximally specific types:

(5) a. For any leaf type t_1[MUD μ_1,MORSYN σ], t_2[MUD μ_2,MORSYN $\sigma \wedge \tau$] is a morphological competitor, iff $\mu_1 \subseteq \mu_2$.

b. For any leaf type t_1 with competitor t_2, expand t_1's MORSYN σ with the negation of t_2's MORSYN $\sigma \wedge \tau$: $\sigma \wedge \neg(\sigma \wedge \tau) \equiv \sigma \wedge \neg\tau$.

Essentially, we formulate Pāṇini's Principle solely in terms of the information being expressed: morpholexical rules that express more properties (MUD) compete with those that express less, and those that have more specific conditioning (MORSYN) compete with those that are less strictly conditioned. Our version of Pāṇini's Principle has the further benefit that we only need a single instance of the identity function default (*ifd*), the morpholexical rule that deals with zero exponence:

(6) $$\begin{bmatrix} \text{MORPHS} & \langle\, \rangle \\ \text{MUD} & \boxed{1}\{[\;]\} \\ \text{MORSYN} & \boxed{1} \cup \textit{set} \end{bmatrix}$$

Since the *ifd* specifies one completely underspecified MUD value, it is in competition with every other morpholexical rule, having its MORSYN value restricted to exactly those morphosyntactic features that do not have any independent expression, which is clearly a desirable result.

In the following three subsections, we shall investigate how this approach not only provides for a more general and less stipulative approache to competition, but also paves the way for a more parsimonious account of conditioned reordering and Wackernagel affixes.

3.2 Swahili negative marking

The first set of data we are going to investigate in detail pertains to Pāṇinian competition between different position classes and the treatment of extended exponence.

In Swahili, sentential negation is regularly marked by means of the prefix *ha* in slot 1 of the verb (cf. (7a)). However, if the verb is inflected for relative agreement, negation is expressed instead by the marker *si* in slot 3. Since *si* in (7b) is the only overt exponent of negative marking, we must conclude that negative relative *si* expresses negation, preempting the use of the regular negative marker *ha* (7c).

(7) a. **ha-** wa- ta- taka
NEG 3PL FUT want
'they will not want'

b. watu wa- **si-** o- soma
people 3PL NEG.REL REL.PL read
'people who do not read'

c. * watu **ha-** wa- ***(si-)** o- soma
people NEG 3PL NEG.REL REL.PL read

In PFM, where Pāṇini's principle is limited to individual rule blocks, and rule blocks are tied to linear position, there is no way to capture this directly. Under a purely information-based approach, preemption of *ha* by *si* follows directly given the proper subsumption of MORSYN specifications.

(8) a. $\begin{bmatrix} \text{MUD} & \{neg\} \\ \text{MORSYN} & set \\ \text{MORPHS} & \left\langle \begin{bmatrix} \text{PH} & \text{<ha>} \\ \text{PC} & 1 \end{bmatrix} \right\rangle \end{bmatrix}$ b. $\begin{bmatrix} \text{MUD} & \{neg\} \\ \text{MORSYN} & \{rel\} \cup set \\ \text{MORPHS} & \left\langle \begin{bmatrix} \text{PH} & \text{<si>} \\ \text{PC} & 3 \end{bmatrix} \right\rangle \end{bmatrix}$

Similarly, we can also derive competition between regular markers and portmanteaux without any stipulation in terms of rule block indices, contrary to Stump (1993) and Crysmann and Bonami (2012): as witnessed in (9), the 1SG negative portmanteau *si* simultaneously preempts the regular marker of negation *ha* and the regular marker of 1st singular subject agreement *ni*.

(9) a. (ha-) a- ta- ku- taka
(NEG) 3SG.SUBJ FUT 2SG.OBJ pay
'He will (not) pay you.'

b. (*ha-) ni- ta- ku- taka
(*NEG) 1SG.SUBJ FUT 2SG.OBJ pay
'I will (*not) pay you.'

c. si- ta- ku- taka
NEG.1SG.SUBJ FUT 2SG.OBJ pay
'I will not pay you.'

Again, Pānini's principle directly accounts for preemption, based on the subset relation of MUD values.

(10) a. $\begin{bmatrix} \text{MUD} & \left\{ \begin{bmatrix} subj \\ \text{PER} & 1 \\ \text{NUM} & sg \end{bmatrix} \right\} \\ \text{MORPHS} & \left\langle \begin{bmatrix} \text{PH} & \text{<ni>} \\ \text{PC} & 2 \end{bmatrix} \right\rangle \end{bmatrix}$ b. $\begin{bmatrix} \text{MUD} & \left\{ neg, \begin{bmatrix} subj \\ \text{PER} & 1 \\ \text{NUM} & sg \end{bmatrix} \right\} \\ \text{MORPHS} & \left\langle \begin{bmatrix} \text{PH} & \text{<si>} \\ \text{PC} & 1 \vee 2 \end{bmatrix} \right\rangle \end{bmatrix}$

Having established how the extended domain of competition benefits the treatment of preemption across position classes, we shall now address how we integrate cases of extended exponence.

Consider the examples in (11): here, *ha* is clearly the only overt exponent of negation, so we can conclude that it actually expresses negation. In (12), we find extended exponence of negative marking, triggering the presence of *ha* together with a special negative past marker *ku*. However, since we have already established independently *ha* as the expression of negation, and furthermore, since negative past *ku* cannot independently signal negation, it follows that choice of the past marker is merely conditioned by negation.

(11) a. tu- *ta-* taka
1PL FUT want
'we will want'

b. **ha-** tu- *ta-* taka
NEG 1PL FUT want
'we will not want'

(12) a. tu- li- taka
1PL PST want
'we wanted'

b. ***(ha-)** tu- **ku-** taka
NEG 1PL PST.NEG want
'we did not want'

Drawing on our distinction between MUD and MORSYN, we can capture this situation straightforwardly:

(13) a. $\begin{bmatrix} \text{MUD} & \{past\} \\ \text{MORSYN} & set \\ \text{MORPHS} & \left\langle \begin{bmatrix} \text{PH} & \text{<li>} \\ \text{PC} & 3 \end{bmatrix} \right\rangle \end{bmatrix}$ b. $\begin{bmatrix} \text{MUD} & \{past\} \\ \text{MORSYN} & \{neg\} \cup set \\ \text{MORPHS} & \left\langle \begin{bmatrix} \text{PH} & \text{<ku>} \\ \text{PC} & 3 \end{bmatrix} \right\rangle \end{bmatrix}$

Because *ku* is merely allomorphically conditioned on negation, it is not a competitor of *ha*, owing to disjoint MUD values. With respect to TAM marking, however, *ku* is a competitor of *li*, given identity of MUD and subsumption of MORSYN specification. Thus, based on a principled distinction between realising a property and being conditioned on some property, we can actually dispense with rule blocks and extend the scope of Pāṇini's Principle, without facing problems with extended exponence.

3.3 Mari declension (variable morphotactics)

To illustrate how the present account deals with reordering phenomena, let us turn back to the partial paradigm of Mari nouns illustrated in Table 3. This phenomenology is best described by stating that the relative order of case and possessor markers in Mari nominal declension in unconstrained by default; only specific case values call for one or the other order. This can easily be done within the current framework by undespecifying the position index of all possessor and some case affixes, only stating that it has to be higher than that of the stem, here 1. In the accusative (resp. lative), the possessor is forced to occur in position 2 (resp. 3) because the other position is already occupied by the case marker; in the dative, both orders are possible because neither affix is constrained to a specific slot. Arguably such a view is preferable to any view that arbitrarily chooses one relative ordering as basic and takes special measures to authorise reordering in particular instances (cf. e.g. Stump, 2012b, use of a conditional composition operator).[4]

(14) Variable position affixes

a. $\begin{bmatrix} \text{MORPHS} & \left\langle \begin{bmatrix} \text{PC} & 1+n \\ \text{PHON} & \text{<на>} \end{bmatrix} \right\rangle \\ \text{MUD} & \left\{ \begin{bmatrix} poss \\ \text{PER} & 1 \\ \text{NUM} & pl \end{bmatrix} \right\} \end{bmatrix}$ b. $\begin{bmatrix} \text{MORPHS} & \left\langle \begin{bmatrix} \text{PC} & 1+n \\ \text{PHON} & \text{<лан>} \end{bmatrix} \right\rangle \\ \text{MUD} & \left\{ \begin{bmatrix} \text{CASE} & dat \end{bmatrix} \right\} \end{bmatrix}$

(15) Fixed position affixes

a. $\begin{bmatrix} \text{MORPHS} & \left\langle \begin{bmatrix} \text{PC} & 3 \\ \text{PHON} & \text{<м>} \end{bmatrix} \right\rangle \\ \text{MUD} & \left\{ \begin{bmatrix} \text{CASE} & acc \end{bmatrix} \right\} \end{bmatrix}$ b. $\begin{bmatrix} \text{MORPHS} & \left\langle \begin{bmatrix} \text{PC} & 2 \\ \text{PHON} & \text{<еш>} \end{bmatrix} \right\rangle \\ \text{MUD} & \left\{ \begin{bmatrix} \text{CASE} & lat \end{bmatrix} \right\} \end{bmatrix}$

3.4 Sorani Kurdish (second position)

We finally present an analysis of Sorani Kurdish person marking, illustrating how the current approach can deal with Wackernagel affixes.[5] Sorani Kurdish possesses two sets of person markers for verbs, which Bonami and Samvelian (2008) call respectively *verbal person endings* (VPEs) and *mobile person markers* (MPMs). In terms of content, the function of these markers is not uniform. In the present, VPEs function as subject agreement markers (16a), whereas MPMs are object pronominal affixes (16b). In the past the situation is much more intricate. With strictly intransitive verbs, only VPEs are used, and they function as subject agreement markers (17). With transitive verbs the form-function mapping is reversed: MPMs now function as

[4] Notice that this gives rise to a spurious positioning ambiguity in the nominative, where there is no case marker, and the possessor could be realised in position 2 or 3.

[5] This analysis builds heavily on Samvelian (2007) and Bonami and Samvelian (2008).

subject agreement (18a), and VPEs function as object pronominal affixes (18b).[6]

(16) a. Bâzirgân-akân asp-akân da-kir-in.
merchant-DEF.PL horse-DEF.PL IPFV-buy.PRS-3PL
'Narmin is buying the horses.'

b. Bâzirgân-akân da=jân=kir-in
merchant-DEF.PL IPFV=3PL=buy.PRS-3PL
'The merchants are buying them.'

(17) Bâzirgân-akân hât-in.
merchant-DEF.PL arrive.PST-3PL
'The merchants arrived.'

(18) a. (Ema) asp-akân=mân kirî.
1PL horse-DEF.PL=1PL buy.PST
'We bought the horses.'

b. (Ema) kirî=mân=in.
1PL buy.PST=1PL=3PL
'We bought them.'

Turning now to morphotatics, VPEs have a simple distribution: they occur in a fixed position to the right of the stem. MPMs exhibit a much more intricate pattern. First, they behave as ENDOCLITICS (Harris, 2002). They are always realised on the word at the right edge of the first constituent of the VP (18a). In general, this means being realised as the last morph of that word. If however that word is a verb, then the MPM interacts with verb-internal morphotactics. By default it is the second morph in the word, as evidenced in Table 4. There are however some contexts where the MPM is realised instead in a fixed position to the right of VPEs: if the MPM is 3SG (19a) or if it is plural and cooccurs with a 1SG VPE (19b).[7]

(19) a. kirî-n-î.
buy.PST-3PL=3SG
'He bought them.'

b. kirî-m-tân.
buy.PST-1SG=2PL
'You (pl.) bought me.'

Three ingredients are crucial to account for this dataset.[8] First, we account for the form-function reversal in the use of the two sets of person markers by appealing to an indirection between argument structure and MORSYN sets. Specifically, we assume that MORSYN sets may contain structures of type *agr1* or *agr2*, and that these are not associated with the same argument structure positions depending on tense and transitivity. Second, we rely on a cross-classification of morpholexical rules in two dimensions: MORPHOTACTICS is responsible for the placement of morphs whose phonology is specified in EXPONENCE. Third, to account for the default verb-internal positioning of MPMs, we need to be able to reference the position of the first realised morph; this is done here through the feature 1ST that is part of the position class information associated with morphs (20).

(20)
$$word \rightarrow \left[\text{MORPHS} \ \left\langle \begin{bmatrix} \text{1ST} & \boxed{1} \\ \text{PC} & \boxed{1} \end{bmatrix}, \left[\text{1ST} \ \boxed{1}\right], \ldots, \left[\text{1ST} \ \boxed{1}\right] \right\rangle \right]$$

(21) MORPHOTACTICS types

a.
$$\begin{bmatrix} \text{MORPHS} & \left\langle \begin{bmatrix} \text{1ST} & \boxed{1} \\ \text{PC} & \boxed{1}+1 \end{bmatrix} \right\rangle \\ \text{MUD} & \left\{ \left[agr2 \right] \right\} \end{bmatrix}$$

b.
$$\begin{bmatrix} \text{MORPHS} & \left\langle \left[\text{PC } 9 \right] \right\rangle \\ \text{MUD} & \left\{ \begin{bmatrix} agr2 & \\ \text{PER} & 3 \\ \text{NUM} & sg \end{bmatrix} \right\} \end{bmatrix}$$

c.
$$\begin{bmatrix} \text{MORPHS} & \left\langle \left[\text{PC } 9 \right] \right\rangle \\ \text{MUD} & \left\{ \begin{bmatrix} agr2 & \\ \text{NUM} & pl \end{bmatrix} \right\} \\ \text{MORSYN} & \left\{ \begin{bmatrix} agr1 & \\ \text{PER} & 1 \\ \text{NUM} & sg \end{bmatrix} \right\} \cup set \end{bmatrix}$$

(22) EXPONENCE types

a.
$$\begin{bmatrix} \text{MORPHS} & \left\langle \left[\text{PH <jân>} \right] \right\rangle \\ \text{MUD} & \left\{ \begin{bmatrix} agr2 & \\ \text{PER} & 3 \\ \text{NUM} & pl \end{bmatrix} \right\} \end{bmatrix}$$

a.
$$\begin{bmatrix} \text{MORPHS} & \left\langle \left[\text{PH <î>} \right] \right\rangle \\ \text{MUD} & \left\{ \begin{bmatrix} agr2 & \\ \text{PER} & 3 \\ \text{NUM} & sg \end{bmatrix} \right\} \end{bmatrix}$$

The MORPHOTACTICS dimension will then contain a type (21a) using that information to position MPM exponents (22). The type in (21a) is in competition with the more specific types in (21b) and (21c). Notice how (21c) relies on the MUD/MORSYN distinction to account for the fact that the realisation of an MPM depends on properties of another argument.

Conclusion

In this paper we have argued on the basis of complex morphotactic systems for a new model of realisational morphology that is characterised by two central properties: first, an information-based view of morphological completeness and coherence that crucially relies on a distinction of expression (MUD) and conditioning (MORSYN), enabling us to dispense with stipulated rule block altogether and extending considerably the scope of Pāṇini's Principle. Second, by moving positional indexing from the rule system into morphological representations, we were able to provide a straightforward account of second position affixes within a much more constrained theory of inflectional morphology which denies morpholexical rules access to the full derivation history, permitting only reference to pivotal positions like that of the stem (for Italian; Crysmann and Bonami, 2012) and the left edge (for Sorani Kurdish).

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[6]Notice that this is not quite a split ergative system: in terms of grammatical functions it is, but not in terms of the agreement/pronoun opposition. There are complications with intransitive verbs taking a prepositional complement; see Samvelian (2007).

[7]More fine points of Sorani morphotactics are discussed in (Walther, 2012).

[8]We focus on realisation of MPMs within the verb. Realisation at a distance can be dealt with using e.g. an edge feature mechanism, and is an issue orthogonal to our current concerns.

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