Syncretism, Impoverishment, and the Structure of Person Features[1]

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Syncretism between 1sg and 3sg verb forms outside the present tense is ubiquitous in the Germanic languages. The primary purpose of this paper is to show that this syncretism gives evidence that syncretism is a natural consequence of a less than faithful syntax-morphophonology interface.[2] Secondarily, the syncretism will be used to support the idea that the person system is organized around a pair of binary features, not the commonly assumed trivalent feature.[3]

1 Syncretism in English verbal morphology

Although English verbal morphology is relatively simple, the past and present tense paradigms of the verb *be* have complex patterns of syncretism.

(1) a. *present*

	sg	pl
1	am	are
2	are	are
3	is	are

b. *past*

	sg	pl
1	was	were
2	were	were
3	was	were

c. *past*

	sg	pl
1	was	were
2	were	were
3	was	were

The full array of forms can be viewed as the result of applying morpheme realization rules (sometimes called here *vocabulary items* or simply VIs) to the *abstract paradigm* (2).

(2)

$⟦BE⟧ ∘$

{P:1,–Pl,–Past}	{P:1,+Pl,–Past}	{P:1,–Pl,+Past}	{P:1,+Pl,+Past}
{P:2,–Pl,–Past}	{P:2,+Pl,–Past}	{P:2,–Pl,+Past}	{P:2,+Pl,+Past}
{P:3,–Pl,–Past}	{P:3,+Pl,–Past}	{P:3,–Pl,+Past}	{P:3,+Pl,+Past}

$⟦BE⟧$ denotes the root morpheme, which combines with bundles of agreement and tense features to produce the inflected forms of the verb. A∘B is used to denote the combination of A and B. P denotes the person feature, which can have any of the three values 1, 2, or 3. The notion of a "paradigm" that is used here is meant only as a descriptive device that is useful in probing the morphological computation. There is no implication that morphology refers to such arrays.[4]

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[1] Thanks to Jonathan Bobaljik, Rolf Noyer, and the CLS38 audience for helpful comments.
[2] See Bobaljik (2002) for related discussion of the important role of impoverishment in many cases of syncretism.
[3] See Noyer (1992) for an extensive discussion of person feature structure.
[4] My own belief is that paradigms are epiphenomenal and play no role in the structure or operation of morphology. But the material in this paper does not bear directly on the issue.

In most theories of morphology, the present tense stem suppletion rules for the verb *be* have roughly the form in (3). The viewpoint of Distributed Morphology (DM) is adopted in this paper, so realization is a substitution operation, context-dependent in this case.[5]

(3)   1.   ⟦BE⟧   →   *am*   /___ P:1,–Pl,–Past
       2.   *ɪ*   /___ P:3,–Pl,–Past
       3.   *are*   /___ –Past

A later rule supplies the 3sg root allomorph / ɪ / with the standard 3sg present ending /-z/ to produce /ɪ-z/. The Principle of Decreasing Specificity (PDS), also know as Panini's Principle or the Subset Principle, is assumed: the most highly specified rule whose structural description is satisfied applies.

The syncretism (1a) is a consequence of the fact that Rule 3 in (4) is the only realization rule that applies to –Past morphemes that are neither 1sg nor 3sg. A syncretism of this kind is the consequence of a sparse vocabulary that forces some VIs to realize multiple cells in the abstract paradigm. It is not trivial, however, to extend the same account to the syncretisms in the past tense paradigm. In order to reproduce the account of the present tense syncretism for the past tense, the vocabulary (4) is required.

(4)   1.   ⟦BE⟧   →   *was*   /___ P:1,–Pl,+Past
       2.   *was*   /___ P:3,–Pl,+Past
       3.   *were*   /___ +Past

Although this gives empirically adequate results, it is unsatisfactory in two respects. In the first place, it is implausible that 1sg *was* and 3sg *was* are two different vocabulary items, only accidentally homophonous. In the second place, it gives no account of why the same 2sg/pl syncretic grouping appears in both the present and past tense forms, (1b) and (1c). It is simply an accidental fact about the lexicon (the available VIs).

Halle (1997), using ideas that were introduced by Bonet (1992) in her study of Romance clitics, proposed that the rules (5) interact with the "impoverishment rule" (6) that deletes –Pl in the context of 2nd person.

(5)   1.   ⟦BE⟧   →   *was*   /___ –Pl,+Past
       2.   *were*   /___ +Past

(6)   –Pl → ∅ /___ P:2

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[5] Halle and Marantz (1993) is the foundational statement of the DM approach to morphology.

Crucially, impoverishment rules apply before vocabulary insertion (i.e. morpheme realization). Because of (6), the realization rules apply to (7) rather than (2).

(7)

[[BE]] o			
{P:1,–Pl,–Past}	{P:1,+Pl,–Past}	{P:1,–Pl,+Past}	{P:1,+Pl,+Past}
{P:2,–Past}	{P:2,+Pl,–Past}	{P:2,+Past}	{P:2,+Pl,+Past}
{P:2,–Pl,–Past}	{P:3,+Pl,–Past}	{P:3,–Pl,+Past}	{P:3,+Pl,+Past}

The impoverishment prevents (5.1) from applying in the 2sg past. Rule 5.2 therefore applies and the correct forms result. Although the solution is empirically adequate, note that it depends upon a delicate conspiracy between the results of impoverishment and the particularities of the vocabulary. Even with the impoverishment (6), a vocabulary item which realized {P:2, –Past}, for example, would break the syncretism.

If 1-3 syncretism is considered more broadly in the context of the entire family of Germanic languages, there is reason to be suspicious of an account based on the very special rule (6). 1-3 syncretism has been a stable feature of East and West Germanic since shortly after they developed out of Proto-Germanic. Old Norse did not have the syncretism, but it has developed in force in Modern Icelandic, as the paradigms below demonstrate. The paradigms of an variety verb types are given below. Included are the paradigms of a regular weak verb (*tala* 'speak'), two strong verbs (*bit* 'bite'; *fa* 'be able') of different types, and a verb with stem suppletion (*vera* 'be').

(8)

	present		past		pres. subjunctive		past subjunctive	
	sg	*pl*	*sg*	*pl*	*sg*	*pl*	*sg*	*pl*
1	tala	tölum	talaði	töluðum	tali	tölum	talaði	töluðum
2	talar	talið	talaðir	töluðuð	talir	talið	talaðir	töluðuð
3	talar	tala	talaði	töluðu	tali	tali	talaði	töluðu
1	bít	bítum	beit	bitum	bíti	bítum	biti	bitum
2	bítur	bítið	beitst	bituð	bítir	bítið	bitir	bituð
3	bítur	bíta	beit	bitu	bíti	bíti	biti	bitu
1	fæ	fáum	fékk	fengum	fái	fáum	fengi	fengum
2	fæð	fáid	fékkst	fenguð	fáir	fáid	fengir	fenguð
3	fær	fá	fékk	fengu	fái	fái	fengi	fengu
1	eum	er	var	vorum	veri	verum	væri	værum
2	erud	ert	varst	voruð	verir	verið	vær	væruð
3	eru	er	var	voru	veri	veri	væri	væru

Note that the 1-3 singular syncretism extends to all of the nonpresent tense paradigms, including present and past subjunctive and extends to the inflectional

suffix, stem modification, and to stem allomorphy. Note also that it is the only systematic syncretism that occurs.

Paradigms for Modern German and Old English will be given in Section 4. Each clearly display 1-3 syncretism. The widespread appearance of 1-3 syncretism in the Germanic languages suggests that there are deeper properties of their morphology at work than special impoverishment rules and accidents of vocabulary choice.

2 The fine structure of person features

Noyer (1992) discusses the structure of person features and their decomposition into binary and privative features. Halle (1997) applies those ideas to English and Warlpiri. I follow these ideas, with some modifications.[6] I will suppose that there is a pair of binary person features P_1 and P_2. It risks some confusion, but 1 and 2 will sometimes be used as the names of the features when the context makes it clear that the reference is a feature, not the value of a feature. Whereas in the old system, 1 and 2 were values that a feature P could take on, P_1 and P_2 are now features which take on the values + or −.

In order to understand the semantic interpretation of P_1 and P_2, suppose some nominal X uttered in some speech act is intended to refer to a set (perhaps singleton) of individuals E. Suppose further that we distinguish the author of the speech act (*Auth*) and the set of individuals (*Adds*) to which the speech act is formally addressed. (Complications of people talking to themselves or speech acts in which the author covertly addresses individuals who are not formally addressed are ignored.) The interpretation of P_1 is straightforward. E is understood to contain *Auth* if and only if X is +1 (i.e. P_1 has the value +). The interpretation of P_2 is more complex. I assume that the features P_1 and P_2 are universal; the interpretation of P_1 is universal; but that there are two options for the interpretation of P_2.

One option gives what I call the *four-person system*:

(9) Four-person system: X is +2 if and only if E contains *Adds*

+1,+2	$Auth \in E$ and $Adds \subseteq E$	1st inclusive
+1,−2	$Auth \in E$ and $Adds − E \neq \varnothing$	1st exclusive
−1,+2	$Auth \notin E$ and $Adds \subseteq E$	2nd
−1,−2	$Auth \notin E$ and $Adds − E \neq \varnothing$	3rd

This is the person system in languages like Warlpiri, which differentiate between 1st inclusive and 1st exclusive.

The other option, which I will call the *three-person system,* gives the familiar system employed in the Indo-European languages.

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[6] The similarities and differences with their proposals merits discussion, but space precludes it.

(10) Three-person system: X is $+2$ if and only if $Adds \subseteq E$ and $Auth \notin E$

+1,+2	semantically incoherent	
+1,–2	$Auth \in E$	1st
–1,+2	$Auth \notin E$ and $Adds \subseteq E$	2nd
–1,–2	$Auth \notin E$ and $Adds - E \neq \varnothing$	3rd

Halle notes that the existence of person systems like that in Warlpiri argues strongly in favor of the fact that UG allows binary person features, at least as an option. The analysis below of various inflectional systems in which there is not a 1st inclusive/exclusive distinction in terms binary features is evidence that the system is not only an option, but is universal.

The 1-3 syncretism has a featural basis in this system. 1st/3rd share the feature –2. The vocabulary for *be* stem suppletion can now be written straightforwardly.

(11) $\llbracket BE \rrbracket \rightarrow$ *am* /___ +1,–2,–Pl,–Past $\llbracket BE \rrbracket \rightarrow$ *was* / ___ –2,–1,+Past
  $\rightarrow$ *ɪ* / ___ –2,–Pl,–Past $\rightarrow$ *were* / ___ +Past
  $\rightarrow$ *are* / ___ –Past

This vocabulary makes it appear that 1-3 syncretism is a consequence of the particularities of the lexicon rather than impoverishment. This will be called into question in what follows.

3 The syntax-morphophonology interface (SMPI) and its unfaithfulness
At the level of words, syntax produces complex heads, hierarchically organized structures built from morphemes (bundles of features). Morphophonology (MP) recursively translates structures built from morphemes into phonological structure. It could be that the input to MP is precisely the output of syntax, so that the SMPI is simply a "level" in the derivation of surface form from the underlying syntax. Some theories of morphology attribute some limited computation to the SMPI, so that it should be viewed as a stage in the derivation rather than a single level. Of particular interest to the concerns of this paper are departures from faithfulness in the SMPI, since featural distinctions which are lost in the SMPI will be reflected as syncretism in the inflectional morphology.

Most theories of morphology suppose that the SMPI is structurally unfaithful, in one way or another. Anderson's A-morphous Morphology (1992) and its descendents (Stump, 2002, for example) suppose that the SMPI wipes out hierarchical syntactic structure by amalgamating morphemes. Since in numerous cases the effect of hierarchical structure is still clearly visible at the surface, DM rejects the idea that the SMPI default is to obliterate the syntactic structure. Instead the default is taken to be direct translation of syntactic hierarchy into the order in which MP combines morphemes. Structural unfaithfulness is recognized as a possibility, but it demands special operations.

In the syntax of many Germanic languages, our concern here, the verb raises to a tense head (Tns) and the resulting complex head raises further to an agreement head (Agr).[7] The resulting syntactic structure translates directly to a MP computation organized as in (12), with "∘" symbolizing the combination operation and the computation carried out recursively from left to right.

(12)   V ∘ Tense ∘ Agreement

The order of morpheme combination (12) interacts with the properties of the affixes that realize the morphemes to determine the linear order. If the affixes which realize Agr and Tns are specified in the lexicon as suffixes, for example, the order of combination (12) yields the surface order:

(13)   V + Tense + Agreement

The default mapping from the syntactic structure to the structures which are the input to the MP computation can be thought of as producing the abstract paradigm below, which refines (12) above.

(14)

{+1,–2,–Pl}	{+1,–2,+Pl}
V ∘ {–Past} ∘ {–1,–2,–Pl}	{–1,+2,+Pl}
{–1,–2,–Pl}	{–1,–2,+Pl}

{+1,–2,–Pl}	{+1,–2,+Pl}
V ∘ {+Past} ∘ {–1,+2,–Pl}	{–1,+2,+Pl}
{–1,–2,–Pl}	{–1,–2,+Pl}

4 Featural unfaithfuless, impoverishment, and syncretism

Curiously, although A-Morphous Morphology assumes that the SMPI is structurally unfaithful, it supposes that the SMPI is featurally faithful, so that it preserves all morpheme features. DM, on the other hand, recognizes both structural and featural unfaithfulness as possible exceptions to the transparent syntax-MP mapping, and makes understanding the devices employed by the SMPI which introduce opacity into its computation a core concern of morphology. One such device is impoverishment, which was introduced in Section 1. The SMPI may delete certain features in certain contexts.

Impoverishment can force syncretism, independent of the particularities of the lexicon. Suppose, for example, that instead of the default mapping which produces (14), the impoverishment

$$\pm1,\pm2 \rightarrow \varnothing \,/\, V \underline{\quad} +Pl$$

applies in the SMPI. In place of the abstract paradigm (14), MP operates on:

(15)

{+1,–2,–Pl}	{+Pl}
V ∘ {–Past} ∘ {–1,–2,–Pl}	{+Pl}
{–1,–2,–Pl}	{+Pl}

{+1,–2,–Pl}	{+Pl}
V ∘ {+Past} ∘ {–1,+2,–Pl}	{+Pl}
{–1,–2,–Pl}	{+Pl}

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[7] See Bobaljik (2001) and references cited there to some of the large literature on this syntax.

Syncretism is introduced into the computation before the contents of the lexicon have any effect on the computation. All the plural present tense verb forms will be identical and all the plural past tense verb forms will be identical, regardless of the contents of the lexicon. The syncretism will apply to all varieties of verb realization: suppletive realization of V, regular affixation, and affix allomorphy triggered by tense or root verb class.

Old English and Modern German provide clear examples of the relationship between syncretism and impoverishment.

4.1 Old English

The past and present tense paradigms of a variety of verbs is given below: the regular weak verb *dēmen* 'deem'; the strong verb *singan* 'sing'; and the suppletive verb *sindon* 'be'. The 1sg/3sg past tense syncretism includes the regular suffix, the null suffix which the strong verbs take, and suppletion. The data is from Kispert (1971).

(16)

	pres.	*past*	*pres.*	*past*	*pres.*	*past*
$+1,-2,-pl$	dēm-e	dēm-d-e	sing-e	sang	eam	wæs
$-1,+2,-pl$	dēm-est	dēm-d-est	sing-est	sung-e	eart	wǣr-e
$-1,-2,-pl$	dēm-eþ	dēm-d-e	sing-eþ	sang	is	wæs
$+pl$	dēm-aþ	dēm-d-on	sing-aþ	sung-on	sindon	wǣr-on

Assuming that the computational structure is V ∘ Tns ∘ Agr, the vocabulary (17) generates the regular and strong verb paradigms and the past tense suppletive forms of the *sindon*. We delay consideration of the full suppletive paradigm until later. Realization rules for the nonsuppletive roots are omitted.

(17)　Stem realization (partial)
　　　1.　⟦SINDON⟧　→　*wæs* / ___ −2,−Pl,+Past
　　　2.　⟦SINDON⟧　→　*wær* / ___ +Past
　　　Tns realization
　　　3.　{+Past}　→　∅　/ V$_{strong}$ ___
　　　4.　{+Past}　→　*-d*
　　　Agr realization
　　　5.　{−2,−Pl}　→　∅　/ V$_{strong}$, +Past ___
　　　6.　{+2,−Pl}　→　*-e*　/ V$_{strong}$, +Past ___
　　　7.　{−1,−2,−Pl}　→　*-eþ*　/ −Past ___
　　　8.　{+2, −Pl}　→　*-est*
　　　9.　{−2,−Pl}　→　*-e*
　　　10.　{+Pl}　→　*-on*　/ +Past ___
　　　11.　{+Pl}　→　*-aþ*

In a vocabulary insertion rule of the form

$$morpheme \rightarrow exponent \: / \: X \rule{1cm}{0.4pt} Y \:,$$

the left context X refers to the stem and the right context Y refers to the still unrealized morphological features. I assume that already realized morphological features that have been incorporated into the stem are still visible to later realization rules.[8]

This vocabulary correctly produces 1sg/3sg past tense syncretism, but the syncretism is not encoded directly in the vocabulary or in the grammar more generally. It is an accidental fact that the relevant realization rules conspire to yield the syncretism, which is evident in the regular paradigm, its modifications for strong verbs, and the stem suppletion rules for *sindon*. I have argued (Frampton, 2002) with respect to phonology that rule conspiracies are not necessarily directly reflected in the grammar. There is good reason to believe, however, that this kind of syncretism is directly reflected in the grammar. In the first place, it is hard to see why the 1-3 singular past tense syncretism should have been such a permanent feature of the main branch of the Germanic languages for almost 2000 years if it is based only on accidents of vocabulary choice. In the second place, as I will demonstrate in what follows, the introduction of impoverishment into the SMPI not only gives an immediate explanation for the conspiracy, but simplifies the formal statement of the grammar and improves the computational efficiency of lexical access.

Suppose we assume that morphemes (at least in verbal morphology) are subject to the impoverishment rules (18) in the SMPI.

(18) 1. +Past privatized
      2. +Pl privatized
      3. $\pm 1 \rightarrow \varnothing \:/$ Past $\rule{0.8cm}{0.4pt}$
      4. $\pm 1, \pm 2 \rightarrow \varnothing \:/ \rule{0.8cm}{0.4pt}$ Pl

Privatization changes a binary feature into a monovalent feature by retaining the instances which have marked value and deleting instances with the unmarked value. I assume that +Past and +Pl are the instances with the marked value for those two features.

In place of the abstract paradigm (14), vocabulary insertion applies to:

(19)

	{+1,–2}	{Pl}				{–2}	{Pl}
V ∘	{–1,+2}	{Pl}		V ∘ {**Past**} ∘		{+2}	{Pl}
	{–1,–2}	{Pl}				{–2}	{Pl}

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[8] Various refinements, which limit what realization rules can refer to, are possible. But this discussion is well beyond the scope of the present paper. See Bobaljik (1999) for discussion and a concrete proposal.

Crucially, syncretism now appears in the abstract paradigm, prior to MP.
There is some simplification in the vocabulary. Compare (20) with (17).

(20) $[\![$SINDON$]\!] \rightarrow$ *wæs* / ___ –2, Past $\{-1,-2\} \rightarrow$ *-eþ*
     $[\![$SINDON$]\!] \rightarrow$ *wær* / ___ Past $\{+2\} \rightarrow$ *-est*
         $\{$Past$\} \rightarrow \varnothing$ / V_{strong} ___ $\{-2\} \rightarrow$ *-e*
         $\{$Past$\} \rightarrow$ *-d* $\{$Pl$\} \rightarrow$ *-on* / Past ___
           $\{-2\} \rightarrow \varnothing$ / V_{strong}, Past ___ $\{$Pl$\} \rightarrow$ *-aþ*
           $\{+2\} \rightarrow$ *-e* / V_{strong}, Past ___

The comparative computational efficiency of the two systems will be considered below.

Finally, consider the present tense suppletive forms of *sindon*. The difficulty is not the suppletion itself, but an account of why no agreement suffixes appear in the present tense. I will suppose that $[\![$SINDON$]\!]$ and Agr fuse if adjacent.[9] Since Tns intervenes, fusion only occurs in the present tense, after ±Past has been impoverished by privatization and the intervener deleted. The realization rules are straightforward.

(21) $\{[\![$SINDON$]\!],+1,-2\}$ $\rightarrow$ *eam*
       $\{[\![$SINDON$]\!],+2\}$ $\rightarrow$ *eart*
       $\{[\![$SINDON$]\!],-2\}$ $\rightarrow$ *is*
       $\{[\![$SINDON$]\!], Pl\}$ $\rightarrow$ *sindon*

An alternative to the fusion account is to suppose that there is a special null suffixes for the present tense forms, but that would offer no explanation for why the present tense forms take null suffixes, but the past tense forms do not.

The claim above that impoverishment improves the computational efficiency of lexical access remains to be justified. Determining which vocabulary item is used to realize a given morpheme (in a given context) requires multiple evaluations of the binary predicate Subset, where Subset(A,B) is true iff A is a subset of B. For example, in order to determine if a realization rule $B \rightarrow \alpha$ can be used to realize a morpheme A, Subset(B,A) must be evaluated. Once the vocabulary items that are potentially applicable are *determined*, Subset must be used further to determine the PDS preference between VIs in order to determine which VI actually applies. Impoverishment speeds up the evaluation of Subset. Contrast, for example, the evaluation of Subset($\{-1,-2,-$Pl$\},\{+$Pl$\}$) and the evaluation of Subset($\{-1,-2,-$Pl$\},\{-1,-2,+$Pl$\}$).

Finally, note that SMPI impoverishment rules introduce a certain amount of rigidity into the morphology. In Old English verbal morphology, for example,

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[9] It is not necessary here to settle the question of whether this fusion takes place in the SMPI or in the MP computation.

consider the possibility of innovating a {+1,–Pl} inflectional suffix into the morphology. If there were no impoverishment, innovation would simply be the adoption of a new lexical item. If the grammar has incorporated a rule deleting person features in the plural, innovation is a considerably more complicated matter. Not only must the lexicon change, but the SMPI rules must *simultaneously* change. SMPI impoverishment therefore introduces a bias towards diachronic loss of inflectional morphology. If vocabulary items are lost, for one reason or another, impoverishment is free to expand its scope, making it difficult to reinstate lost featural distinctions by the innovation of new vocabulary items.

4.2 German

Since it follows closely the analysis of Old English, a summary discussion of German will suffice. Paradigms of a regular verb (*glauben* 'think'), a strong verb (*singen* 'sing'), and a suppletive verb *sein* 'be' are given.[10]

(22)

	pres.	past	pres.	past	pres.	past
+1,–2,–pl	glaub-e	glaub-te	sing-e	sang	bin	war
–1,+2,–pl	glaub-st	glaub-te-st	sing-st	sang-st	bi-st	war-st
–1,–2,–pl	glaub-t	glaub-te	sing-t	sang	is-t	war
–2,+pl	glaub-en	glaub-te-n	sing-en	sang-en	sind	war-en
+2,+pl	glaub-t	glaub-te-t	sing-t	sang-t	seid	war-t

Impoverishment (23) produces the abstract paradigm (24), which already incorporates the syncretisms, independently of vocabulary choice.

(23)   1. privatize +Past   (21)
       2. privatize +Pl
       3. ±1 → ∅ / Past ___
       4. ±1 → ∅ / ___ Pl

$$V \circ \begin{array}{|c c|} \hline \{+1,–2\} & \{–2,\mathbf{Pl}\} \\ \{–1,+2\} & \{+2,\mathbf{Pl}\} \\ \{–1,–2\} & \{–2,\mathbf{Pl}\} \\ \hline \end{array} \qquad V \circ \{\mathbf{Past}\} \circ \begin{array}{|c c|} \hline \{–2\} & \{–2,\mathbf{Pl}\} \\ \{+2\} & \{+2,\mathbf{Pl}\} \\ \{–2\} & \{–2,\mathbf{Pl}\} \\ \hline \end{array}$$

The vocabulary (25), applied to the abstract paradigm (24), produces the regular and strong verb paradigms.

(25)   1. {Past}   →   ∅   / V$_{strong}$ ___   5. {–2,Pl}   →   *-n*
       2. {Past}   →   *-te*   6. {+2,Pl}   →   *-t*
       3. {+1,–2}   →   *-e*   7. {+2}   →   *-st*
       4. {–1,–2}   →   *-t*

Note that the absence of an agreement suffix in the 1sg and 3sg cells in the past paradigm is not the consequence of a null suffix, as it was in Old English.

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[10] Like Icelandic, the syncretism also appears in the present and past subjunctive.

Instead, it is due to the fact that no vocabulary items realize {–2}.[11] Discussion of the suppletive root will be omitted.

German has a small class of verbs that fall outside both the regular and strong groupings, the so-called present-preterite verbs. They are almost all modals. The paradigm for *sollen* 'should' is given in (26). I assume that the /e/ that appears between the root and the -*n* suffix in the present tense is inserted for phonological reasons (syllable structure) and is not mentioned in the lexicon.

(26)

	pres.	*past*
+1,–2,–pl	soll	soll-te
–1,+2,–pl	soll-st	soll-te-st
–1,–2,–pl	soll	soll-te
–2,+pl	soll-(e)n	soll-te-n
+2,+pl	soll-t	soll-te-t

The puzzle for morphological theory is to properly account for the appearance of past tense agreement suffixes in the present tense. Under the present analysis, the anomalous present tense endings are naturally attributed to the exceptional impoverishment (27). The consequence of (27) is that affixes (25.3) and (25.4) do not apply, and the paradigm (26) results.

(27) $\pm 1 \rightarrow \varnothing$ / present-preterite root ___

5 Kabyle Berber
The purpose of this final section is to provide some additional evidence for the relevance of two-feature person systems to inflectional morphology that goes beyond the Germanic languages. In order to broaden the empirical basis for the far-reaching conclusions which were drawn above, a verbal paradigm in an Afroasiatic language will be analyzed in terms of the two-feature person system. The results are encouraging.

The completive verbal paradigm in Kabyle Berber is given below:

(28)

	singular	*plural*
1masc	wala-ɣ	n-wala
1fem	wala-ɣ	n-wala
2masc	t-wala-d'	t-wala-m
2fem	t-wala-d'	t-wala-m-t
3masc	i-wala	wala-n
3fem	t-wala	wala-n-t

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[11] This is not crucial to the analysis, but I see no compelling reason to assume a null suffix.

Noyer (1992) analyzed the corresponding paradigm in a closely related Berber dialect within the framework of DM. Stump (2002:156–66) discusses Noyer's analysis in considerable detail and analyzes (28) in terms of his Paradigm Function Morphology. The paradigm is from Stump, based on Hamouma (n.d.:79) and Chakar (1983:112).

A two-person feature system permits Noyer's analysis to be improved in several respects.[12] The computation which morphology must accomplish is summarized below:

(29)

{+1,–2,–Pl,–Fm}	{+1,–2,+Pl,–Fm}
{+1,–2,–Pl,+Fm}	{+1,–2,+Pl,+Fm}
{–1,+2,–Pl,–Fm}	{–1,+2,+Pl,–Fm}
{–1,+2,–Pl,+Fm}	{–1,+2,+Pl,+Fm}
{–1,–2,–Pl,–Fm}	{–1,–2,+Pl,–Fm}
{–1,–2,–Pl,+Fm}	{–1,–2,+Pl,+Fm}

V ∘ →

V-y	*n-V*
V-y	*n-V*
t-V-d'	*t-V-m*
t-V-d'	*t-V-m-t*
i-V	*V-n*
t-V	*V-n-t*

The realization rules below generate the required forms under the assumption that realization of a set of subfeatures of the agreement morpheme leaves the unrealized features as targets of subsequent realization rules. This is Noyer's crucial idea of *fission*. Rule ordering, to the extent that it is relevant, is completely determined by the PDS.

(30) 1. {–1,–2,–Pl,–Fm} → *i-*
2. {–1,–2,+Pl} → *-n*
3. {+1,+Pl} → *n-*
4. {+1} → *-y*
5. {+2,+Pl} → *-m*
6. {+2} → *-d'*
7. {–1} → *t-*
8. {+Fm} → *-t*   / –1,+Pl ___

The only context-sensitive realization rule is Rule 8. In a vocabulary insertion rule of the form

morpheme → exponent / X ___ Y ,

the left context X refers to the stem and the right context Y refers to the still unrealized morphological features. Rule 8 therefore requires the stem to have already incorporated the features –1 and +Pl. We return to this point below. Without the context for Rule 8, the vocabulary (30) would produce:

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[12] I do not find Stump's critique of Noyer's analysis convincing. The improvements on Noyer's analysis proposed here make it less so.

(31)

	singular	*plural*
1masc	wala-ɣ	n-wala
1fem	wala-ɣ, *wala-ɣ-t	n-wala, *n-wala-t
2masc	t-wala-d'	t-wala-m
2fem	*t-wala-d'-t	t-wala-m-t, *t-wala-t-m
3masc	i-wala	wala-n
3fem	*t-wala-t	wala-n-t, *wala-t-n

There is therefore massive evidence for the language learner to deduce the contextual restriction in Rule 8.

In order to illustrate the recursive computation, the complete derivation of the 2pl femine form *t-wala-m-t* is given below:

(32)   1.   ∅   ⟦WALI⟧ ∘ {−1,+2,+Pl,+Fm}

2.   wala   {−1,+2,+Pl,+Fm}   stem realization

3.   t-wala   {+2,+Pl,+Fm}   Rule 7

4.   t-wala-m   {+Fm}   Rule 5

5.   t-wala-m-t   ∅   Rule 8

Crucially, Rule 8 cannot apply on Line 3 or on Line 4 because +Pl has not yet been incorporated into the stem. Rule 8 must wait until Rule 7 and Rule 5 have applied, so that the proper context for the application of Rule 8 is established. Context-sensitivity does the work that work in this derivation that rule ordering does in theories like Stump (2002). But the context sensitivity does additional work, and is therefore additional evidence for it. The restriction of *-t* suffixation to plural stems also accounts for the absence of a *-t* suffix in the 2sg and 3sg feminine forms. This is not a question of rule ordering. Note also that Rule 7 and Rule 5 are not ordered with respect to each other by the PDS, so there is an alternate derivation of *t-wala-m-t*. It is immaterial whether the prefix or suffix is attached first.

The context for Rule 8 was given above in terms of the morphological feature composition of the stem, under the assumption that such morphological features are still visible to the computation after the feature has been realized as an affix and the exponent of the affix has been incorporated in the stem. Considering the process of morpheme realization in (32) makes it clear that there is an asymmetry between the left context, the stem, and the right context, which consists of still unrealized morphological features. It is natural to suppose that this leads to an asymmetry between the characteristics of material in the left context that can enter into realization rules and the characteristics of material in the right context that can enter into these rules. Bobaljik (1999), in fact, has

proposed that left contexts of realization rules (i.e. characteristics of the stem to which the affix is applying) cannot include purely morphological features, so that Rule 8 is not a permissible rule.[13] Note, however, that there is a variant of Rule 8,

$$+Fm \ \rightarrow \ \textit{-t} \ / \ \text{nasal suffix} \ \_\_\_ \ ,$$

which easily meets objections of this kind. It is beyond the scope of this article to explore the question of allowable contexts for morpheme realization.

Noyer's analysis assumes that +Fm is deleted in the 1st person and in the 2nd person plural, and works out a vocabulary on this basis. The analysis above did not assume any impoverishment. I take that to be an advantage. But it should be made clear on what grounds it is an advantage. There is no special disadvantage to the impoverishment rules that Noyer assumes, other than that they increase the learning burden. I assume that impoverishment does follow as a consequence of the vocabulary that is acquired. But it is an automatic consequence of the vocabulary, not an independent acquisition task.

The analysis above is a significant simplification of Noyer's analysis. The simplification is made possible by the bifurcation of person into a pair of features. Noyer's analysis requires two context-sensitive realization rules, as opposed to the single context sensitive rule above; rule ordering imposed by a feature hierarchy, in opposition to rule ordering determined completely by the PDS; two homophonous *t-* prefixes realizing different feature sets, as opposed to the single *t-* prefix above; and relies on the acquistion of an impoverishment rule.

6 A residual question

Zwicky (1977) claims that 2nd and 3rd person, and 1st and 3rd person, are rarely natural classes in morphology. Noyer (1992:181) agrees and goes to some length to develop a theory which makes mention of negative valued features costly. In three-person systems, the 1st/3rd class corresponds to -2 and the 2nd/3rd class corresponds to -1. The analyses presented here are not consistent with Zwicky's claim. The analysis of syncretism in Germanic verbal paradigms gives some evidence that 1st and 3rd do form a natural class in at least some languages. The analysis of Kabyle Berber given above, which I believe to be a significant simplification of Noyer's analysis, uses both -1 and -2 in morpheme realization rules. The question is not whether it is possible to construct an analysis that avoids -1 and -2, but which approach leads to more easily learnable vocabularies. All other things being equal, it might be desirable to bias the learning mechanism against learning vocabulary items that refer to negative person feature values, narrowing the space of possibilities. If the actual learning mechanism is not biased in this way, however, analyses that begin from that point of view make learning more difficult and produce grammars that are more complex. The present

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[13] In other work, Bobaljik moderates this strong position and gives conceptual grounds for supposing that the morphological features of the most recently incorporated morpheme are still visible.

study is too narrowly based to be considered a refutation of Zwicky's claim. But it does call it into question.

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