Yaqui nominal paradigms and the theory of paradigmatic structure[*]

D. Terence Langendoen, University of Arizona

Constantino Martínez Fabian, University of Sonora

The problem

This paper deals with a deceptively simple problem.[1] Yaqui nouns are inflected for Case and Number. The language has the two nominal inflectional paradigms illustrated in (1) and (2). In (1) there are three distinct morphosyntactic forms:

- the nominative singular form, which is unmarked (unsuffixed);
- the accusative singular form, which is suffixed with *–ta*;
- the nominative/accusative plural form, which is suffixed with *–(i)m*.[2]

In (2) there is only one morphosyntactic form:

- the nominative/accusative/singular/plural form, which is suffixed with *–(i)m*.

The question is why the suffix *–(i)m* is used in the paradigm in (2).

(1) Paradigm for *miisi* 'cat'

		Number	
		Singular	**Plural**
Case	**Nominative**	miisi	miisim
	Accusative	miisita	

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[1] We thank Heidi Harley for her enthusiastic reception of the first version of this paper, and particularly for her discretion in pointing out that we had entirely overlooked alternatives to our original Optimality Theoretic analysis. As a result we have been able not only to provide a comparison, but also to improve our original account, which she was able to convince us in about thirty seconds was inferior to an account she formulated within Distributed Morphology.

[2] This is an example of **syncretism** (Williams 1994) in which a single form represents a (partially) neutralized opposition, and is therefore compatible with two or more distinct feature specifications. Traditionally, syncretic forms are repeated in paradigms, with each occurrence representing a distinct specification. However that mode of representation conflates syncretism with homonymy, in which morphosyntactically distinct forms are realized identically. Deciding between neutralization and homonymy in particular cases can be difficult.

(2) Paradigm for *supe* ‘shirt’

		Number	
		Singular	**Plural**
Case	**Nominative**	supem	
	Accusative		

Types of inflectional paradigms

To answer this question, we need to describe in some detail the nature of inflectional paradigms. An inflectional paradigm is a nonempty set of inflections of a linguistic form or class of forms for a nonempty set of inflectional features. Abstracting away from the morphosyntactic and morphophonological realization of these inflections, we obtain the notion of a **schema** for an inflectional paradigm, in which the members of the schema represent the various values of those features. Such a schema may be **complete** or **defective**. It is complete if all possible values for those features are represented by a member of the schema; otherwise it is defective.

Complete schemas for inflectional paradigms

For example, suppose, as in Yaqui, there is a class of forms that is inflected for the features Case and Number, where Case takes the binary values [Nominative] and [Accusative], and Number the binary values [Singular] and [Plural]. Then there are $2^4 - 1 = 15$ schemas of complete inflectional paradigms for those features, depending on whether any of the feature-value distinctions are neutralized, and if so which ones. The 15 schemas are shown in (3) through (17). Yaqui manifests two of these 15 schemas; the paradigm in (1) is an instance of the schema in (4), and the paradigm in (2) is an instance of the schema in (17).

(3) Non-neutralized (full) complete paradigmatic schema for binary Case and Number features

		Number	
		Singular	**Plural**
Case	**Nominative**	[Nominative] & [Singular]	[Nominative] & [Plural]
	Accusative	[Accusative] & [Singular]	[Accusative] & [Plural]

(4) Neutralization of Case with [Plural]

		Number	
		Singular	**Plural**
Case	**Nominative**	[Nominative] & [Singular]	[Plural]
	Accusative	[Accusative] & [Singular]	

(5) Neutralization of Case with [Singular]

		Number	
		Singular	**Plural**
Case	**Nominative**	[Singular]	[Nominative] & [Plural]
	Accusative		[Accusative] & [Plural]

(6) Neutralization of Number with [Accusative]

		Number	
		Singular	**Plural**
Case	**Nominative**	[Nominative] & [Singular]	[Nominative] & [Plural]
	Accusative	[Accusative]	

(7) Neutralization of Number with [Nominative]

		Number	
		Singular	**Plural**
Case	**Nominative**	[Nominative]	
	Accusative	[Accusative] & [Singular]	[Accusative] & [Plural]

(8) Partial neutralization of Case and Number along NW–SE diagonal

		Number	
		Singular	**Plural**
Case	**Nominative**		[Nominative] & [Plural]
		([Nominative] & [Singular]) | ([Accusative] & [Plural])	
	Accusative	[Accusative] & [Singular]	

(9) Partial neutralization of Case and Number along SW–NE diagonal

		Number	
		Singular	**Plural**
Case	**Nominative**	[Nominative] & [Singular]	
		([Accusative] & [Singular]) | ([Nominative] & [Plural])	
	Accusative		[Accusative] & [Plural]

(10) Complete neutralization of Case

		Number	
		Singular	**Plural**
Case	**Nominative**		
		[Singular]	[Plural]
	Accusative		

(11) Complete neutralization of Number

		Number	
		Singular	**Plural**
Case	**Nominative**	[Nominative]	
	Accusative	[Accusative]	

(12) Neutralization through negation of [Nominative] & [Singular]

		Number	
		Singular	**Plural**
Case	**Nominative**	[Nominative]&[Singular]	↑
	Accusative	←	~ ([Nominative]&[Singular])

(13) Neutralization through negation of [Accusative] & [Singular]

		Number	
		Singular	**Plural**
Case	**Nominative**	←	~ ([Accusative]&[Singular]) ↓
	Accusative	[Accusative]&[Singular]	

(14) Neutralization through negation of [Nominative] & [Plural]

		Number	
		Singular	**Plural**
Case	**Nominative**		[Nominative]&[Plural]
		↑	
	Accusative	~ ([Nominative]&[Plural]) →	

(15) Neutralization through negation of [Accusative] & [Plural]

		Number	
		Singular	**Plural**
Case	**Nominative**	~ ([Accusative]&[Plural]) →	
		↓	
	Accusative		[Accusative]&[Plural]

(16) Neutralization along both diagonals

		Number	
		Singular	**Plural**
Case	**Nominative**	([Accusative] & [Singular]) | ([Nominative] & [Plural])	
	Accusative	([Nominative] & [Singular]) | ([Accusative] & [Plural])	

(17) Full neutralization of Case and Number

		Number	
		Singular	**Plural**
Case	**Nominative**	[ ]	
	Accusative		

Defective schemas for inflectional paradigms

A defective schema for inflectional paradigms, on the other hand, is one whose members do not cover the space of all possible values for the features involved, i.e. one that leaves a "gap". For example, corresponding to the full complete schema in (3), there is the defective schema in (18) that has no provision for the [Accusative] & [Plural] combination of values. In general there are many more defective schemas for inflectional paradigms than complete ones; for example, there are 36 defective schemas for two binary features compared to 15 complete ones, but the occurrence of defective paradigms in natural language descriptions is comparatively rare. We leave the explanation for this fact for another occasion; for now we simply declare that grammars abhor defective paradigms.

(18) Defective schema for an inflectional paradigm, lacking [Accusative] & [Plural]

		Number	
		Singular	**Plural**
Case	**Nominative**	[Nominative] & [Singular]	[Nominative] & [Plural]
	Accusative	[Accusative] & [Singular]	––

The realization of complete paradigm schemas

Different languages manifest different paradigm schemas for given sets of features, but certain preferences are clear. For example, we are aware of no cases in which the schemas involving the "diagonal" neutralizations such as (8), (9) and (16) are realized. In addition, schemas involving the negation of a particular combination of features such as (12)–(15) are unusual, an example is the Person and Number paradigm for the present tense of verbs (other than *be*) in standard English. On the other hand, schemas involving the neutralization of one or more features such as (4)–(7), (10) and (11) are quite commonly manifested, with preferences for which feature(s) to neutralize being dictated by markedness considerations. Finally, full complete schemas such as (3) are also very common, at least when the number of feature-value combinations is relatively small, as are fully neutralized complete schemas such as (17).

Accounting for the Yaqui nominal paradigms

There are two classes of morphological theories that account for paradigmatic patterns such as observed in Yaqui nominal inflection, those that are **paradigm-based** and those that are **vocabulary-based** (Bobaljik 2001: 53-54).[3] An example of a vocabulary-based morphological theory is Distributed Morphology (DM) (Halle & Marantz 1993), which Bobaljik also espouses. An example of a paradigm-based theory is one developed by Edwin Williams, according to which a paradigm is "a real object, and not the epiphenomenal product of various rules" (Williams 1994: 22).

A Distributed Morphology account

An elegant DM account of the Yaqui nominal paradigms in (1) and (2) was suggested to us by Heidi Harley (see fn. 1). It goes as follows. Assume as we have already done that Yaqui nouns are inflected for Case and Number, that the values for Case are [Nominative] and [Accusative] and that the values for Number are [Singular] and [Plural]. Assume also that there are two classes of nouns, Class1 the *miisi* class and Class2 the *supe* class. Then the ordered list of morpheme realization rules in (19) derives the paradigms in (1) and (2), i.e. treats them precisely as epiphenomenal products.

(19) Morpheme realization rules that derive the Yaqui nominal paradigms

-ta ⇔ [Accusative] & [Singular] / Class1 ___

-∅ ⇔ [Singular] / Class1 ___

-(i)m ⇔ elsewhere

There are two noteworthy properties of this account. First, a zero affix must be postulated, since the rule for its insertion is ordered after that of *-ta* insertion and before the default insertion of -(*i*)*m*. Second, -(*i*)*m* has no inherent features; in particular it is not specified [Plural].

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[3] Bobaljik (2001: 78, fn. 1) points out that certain morphological theories, such as that of Wunderlich (1995) and Stump (2001), may not be easily placed within one or the other of these classes.

An Optimality Theory account

DM is a theory that ranks rules. On the other hand, Optimality Theory (OT), which ranks constraints rather than rules, can be used within the paradigm-based framework to account for the forms that appear in the paradigms in (1) and (2), but without the use of zero affixes or default (elsewhere) conditions. The suffix -(*i*)*m* may be assumed to be specified [Plural] and the suffix -*ta* specified as [Accusative]. Then, assuming that the entries in the paradigm schema in (4) appear in inputs together with a Class 1 noun such as *miisi*, we correctly account for the choice of affix in accordance with a faithfulness constraint we call FAITHFS (FS for "feature specifications"), as shown in the tableaux in (20)-(22).

(20) Choice of *miisi* to represent *miisi* [Nominative] & [Singular]

miisi [Nominative] & [Singular]		FAITHFS
⇒	miisi	**
	miisi-ta [Accusative]	***!
	miisi-m [Plural]	***!

(21) Choice of *miisi-ta* to represent *miisi* [Accusative] & [Singular]

miisi [Accusative] & [Singular]		FAITHFS
	miisi	**!
⇒	miisi-ta [Accusative]	*
	miisi-m [Plural]	**!*

(22) Choice of *miisi-m* to represent *miisi* [Plural]

miisi [Plural]		FAITHFS
	miisi	*!
	miisi-ta [Accusative]	*!*
⇒	miisi-m [Plural]	

However, FAITHFS by itself does not predict that the affix -(*i*)*m* appears in instances of the paradigm schema (17). Instead, as shows, it predicts that no affix appears.

(23) False prediction that *supe* represents *supe* [ ]

supe [ ]		FAITHFS
☹⇒	supe	
	supe-ta [Accusative]	*!
	supe-m [Plural]	*!

To force the choice of *supem*, several additional constraints are required. First, we need a constraint that prefers outputs of inflected forms that have affixes. Call that constraint HAVEAFF.

Clearly FAITHFS >> HAVEAFF, since otherwise the choice of *miisi* as the expression of *miisi* [Nominative] & [Accusative] would be prevented. However, for Class2 nouns, we require in effect that HAVEAFF outrank FAITHFS. Whether this is a case of local reranking or an additional constraint expressed as a conditional is not our concern here. We assume the latter, calling the constraint HAVEAFF2, and proposing the ranking HAVEAFF2 >> FAITHFS >> HAVEAFF. Now, *supe* is not winning candidate for expressing *supe* [ ], but as (24) shows, we are still left with no basis for choosing between *supe-ta* and *supe-m*.

(24) Failure to choose between *supe-ta* and *supe-m* as representing *supe* [ ]

supe [ ]		HAVEAFF2	FAITHFS	HAVEAFF
	supe	*!		*
☹⇒	supe-ta [Accusative]		*	
⇒	supe-m [Plural]		*	

To account for the choice of *supe-m*, we propose two additional markedness filters: *CASE, which indicates an aversion to marking Case, and *NUMBER, which indicates an aversion to marking Number, and the ranking FAITHFS >> *CASE >> *NUMBER. Then, as (25) shows, we obtain the result that *supem* instantiates paradigm schema (17) in Yaqui.

(25) Choice of *supe-m* to represent *supe* [ ]

supe [ ]		HAVEAFF2	FAITHFS	*CASE	*NUMBER	HAVEAFF
	supe	*!				*
	supe-ta [Accusative]		*	*!		
⇒	supe-m [Plural]		*		*	

Comparison of DM and OT accounts of Yaqui nominal paradigmatic structure

From our presentation so far of the DM and OT accounts of the paradigmatic structure of Yaqui nominals, one might conclude that the DM account is to be preferred on grounds of simplicity. As Bobaljik (2001) points out, a vocabulary-based account such as DM is conceptually simpler than paradigm-based accounts of morphological structure, so is to be preferred for that reason, all things being equal. Since we are interested not so much in the comparison between vocabulary-based and paradigm-based accounts as in the comparison of DM and OT accounts of paradigmatic structure, we now convert the paradigm-based OT account given above to a vocabulary-based one, so as to level the playing field for evaluating those two theories in this arena. To effect this conversion, we replace the inputs with elements that represent all possible combinations of the case and number feature values that Yaqui nouns can express and determine the constraint rankings that yield the correct outputs. For example, we consider an input such as *miisi* [Nominative] & [Plural] and determine what constraint ranking yields the desired *miisi-m* as output. For Class1 nouns, we determine immediately that the ranking FAITHFS >> *CASE >> *NUMBER yields the desired outputs for all combinations of feature values. In (26) and (27), we give two illustrative tableaux.

(26) Choice of *miisi* to express *miisi* [Nominative] & [Singular]

miisi [Nominative] & [Singular]		FAITHFS	*CASE	*NUMBER
⇒	miisi	**		
	miisi-ta [Accusative]	***!	*	
	miisi-m [Plural]	***!		*

(27) Choice of *miisi-m* to express *miisi* [Accusative] & [Plural]

miisi [Accusative] & [Plural]		FAITHFS	*CASE	*NUMBER
	miisi	**!		
	miisi-ta [Accusative]	*	*!	
⇒	miisi-m [Plural]	*		*

However, this ranking gives the same results for Class2 nouns as for Class1 nouns. In order that *supe-m* is always selected as output, no matter what feature value combinations are associated with the input stem *supe*, we require a version of the *CASE constraint, call it *CASE2, that is specific to Class2 nouns, with the ranking *CASE2 >> FAITHFS; (28) shows that it does not matter how *CASE2 is ranked with respect to HAVEAFF2.

(28) Choice of *supe-m* to express *supe* [Accusative] & [Singular]

supe [Accusative] & [Singular]		HAVEAFF2	*CASE2	FAITHFS	*CASE	*NUMBER
	supe	*!				
	supe-ta [Accusative]		*!	*	*	
⇒	supe-m [Plural]			***		*

The OT analysis presented in this section, like the DM analysis in the preceding section, is vocabulary-based, and derives the two Yaqui nominal paradigm schemas in (4) and (17). However, unlike the DM analysis, it assigns feature content to the suffix -(*i*)*m*, namely [Plural]; assigns only one feature value to *-ta* instead of two and does not explicitly restrict its occurrence to Class1 nouns; and does not posit a zero-affix, much less assign feature content to it. Moreover the association of features with Yaqui affixes is **lexical**, as proposed in Lieber (1982) and DiSciullo & Williams (1987), as opposed to **realizational** as in DM theories generally, and also in Williams (1994); see Bobaljik (2001: 56) for discussion. In all these respects, we believe that the OT analysis is closer to the 'truth' regarding Yaqui (and universal) grammar than the DM analysis. On the other hand, the DM analysis is simpler, inasmuch as it posits only three rules as opposed to the five constraints in the OT analysis. However, the DM theory suffers from the fact that there is an equally simple analysis in which the first two rules are reordered, given in (29), and there is no basis for choosing between them.

(29) Another list of morpheme realization rules that derives the Yaqui nominal paradigms

-∅ ⇔ [Nominative] & [Singular] / Class1 ___

-ta ⇔ [Singular] / Class1 ___

-(i)m ⇔ elsewhere

Finally, another advantage we see to the OT analysis is that it provides the beginning of a basis for the analysis of the class of possible paradigms within the enormous space of paradigm schemas provided by the free combination of morphosyntactic feature values. Paradigm schema (4) is derived, as we have already seen, from the ranking FAITHFS >> *CASE >> *NUMBER. Paradigm schema (17) with the [Plural] affix used throughout is derived from the ranking HAVEAFF >> *CASE >> FAITHFS >> *NUMBER. The need to double the *CASE and HAVEAFF constraints in the analysis of Yaqui results from having two coexisting nominal paradigms in the language.

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