

Paradigm Uniformity: Evidence for Inflectional Bases

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1. Introduction

Paradigms of forms sharing a common root tend to be phonologically similar, sometimes in unexpected ways (Jakobson 1939; Greenberg 1969; Burzio 1996; Kraska-Szlenk 1995; Steriade 2000; Kiparsky 2002; Kenstowicz to appear). To explain this observation, researchers have noted that derivationally less complex as well as morpho-syntactically unmarked forms in a paradigm tend to influence the phonological shape of more marked members (Mańczak 1958; Bybee and Brewer 1980; Benua 1997; among others). Underapplication effects within the Czech masculine nominal paradigm support the claim that reference to a privileged base is necessary within inflectional, as well as derivational paradigms. This contradicts the generalization of McCarthy (2002) that inflectional paradigms differ from derivational paradigms in that they are evaluated as a whole and lack a privileged 'base.'

2. The puzzle: Czech nominal paradigms

Two Czech nominal paradigms exhibit unexpected patterns of stem uniformity. Although three pairs of alveolar/palatal stops, [t/c, d/ʃ, n/ɲ], alternate within the language, neither the masculine nor the feminine paradigm exhibit alternations of this type, though they would be expected to, given certain phonotactic restrictions.

Czech has a standard five vowel system with phonemic length distinctions, [i/i:, e/e:, a/a:, u/u:, o], and while alveolars do not have restrictions on their distribution, palatal stops are disallowed before back vowels (Townsend 1981; Janda and Townsend 1996).

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Surprisingly, however, palatal-back vowel sequences are maintained at the stem-suffix boundary in some oblique masculine nominal cases. Uniformity is also found within paradigms of feminine nominals; no feminine noun stems end in a palatal segment. Given Richness of the Base, this, too, requires an explanation.

(1) Masculine and Feminine Nominal Paradigms¹

Case	<i>Masculine, Palatal stem</i>	<i>Masculine, Alveolar stem</i>	<i>*Feminine, Palatal stem</i>	<i>Feminine, Alveolar stem</i>
nom, sg.	a. [oheɲ] ² 'fire'	[student] 'student'	*[strɔp-a]->	[stran-a] 'side'
nom, pl.	b. [ohɲ-e]	[studenc-i] ³	--	[stran-i]
acc, sg.	c. [oheɲ]	[student]	--	[stran-u]
acc, pl.	d. [ohɲ-e]	[student-i]	--	[stran-i]
gen, sg.	e. [oheɲ]	[student-a]	--	[stran-i]
gen, pl.	f. [ohɲ-u:]	[student-u:]	--	[stran-Ø]
dat, sg.	g. [ohɲ-i]	[student-ovi]	--	[strɔp-e] ³
dat, pl.	h. [ohɲ-u:m]	[student-u:m]	--	[stran-a:m]

In principle, alternations between alveolar and palatal stops would be expected within both paradigms as suffixes begin with both front *and* back vowels, but no such alternations are found. These facts can be partially explained by the phonotactic restriction in Czech against palatal-back vowel sequences. As the masculine nominative marker is null, stem-final palatals are allowed to surface on that form; these stem final segments are then maintained throughout the rest of the paradigm, though a violation of an otherwise active phonotactic restriction is incurred. Within the feminine paradigm, however, the nominative marker is a back vowel, [-a]; this prohibits stem-final palatals from surfacing in the nominative. This restriction is then propagated throughout the paradigm. Note, in particular, that the genitive plural marker is null; an underlying stem-final palatal would, theoretically, be expected to surface faithfully in this position.

Supporting evidence is found in pairs of masculine and feminine nouns which, arguably, share a stem.

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1. Czech has seven nominal cases; a representative sample has been given.
 2. *Jer* alternations are ignored.
 3. These stem changes (from alveolar to palatal stop) are conditioned by the suffix. For further discussion, see Appendix.

- (2) a. [za:j] ‘stern (of a boat), masc.’ [za:d-a] ‘back, fem.’
 b. [stra:n] ‘hillside, masc.’ [stran-a] ‘side, fem.’

The stem-final palatal surfaces faithfully in the masculine, but the corresponding alveolar segment surfaces in the feminine due to the nominative suffix.

An analysis which accounts for the unexpected uniformity within the masculine and feminine paradigms is presented in the next section with the introduction of Output-Output Correspondence Theory.

3. 'Output-Output' Correspondence in inflectional paradigms

Transderivational Correspondence Theory accounts for paradigm uniformity effects primarily within derivational morphology (Benua 1997). Benua argues that, within paradigms of morphologically related words containing the same stem, morphologically complex forms are in correspondence relationships with related forms of less complexity. Within inflectional paradigms, as all forms are, generally, of equal morphological complexity, the base form is not immediately apparent. Benua considers several cases of paradigm uniformity within inflectional paradigms and assumes that the base is a morpho-syntactically unmarked form which is, crucially, another *output*, not a stem (Portugese (Ranier 1995), Cibemba (Hyman 1994), Polish (Kraska-Szlenk 1995)). Within the paradigms discussed above, it appears that segments allowed in the nominative form (masculine), as well as segments disallowed there (feminine), are imported into the rest of the paradigm.

An account of the distribution of palatal segments, crucial to the analysis of paradigm uniformity, is presented in the next section, followed by an Output-Output Correspondence analysis.

3.1. Palatal stop distribution

To predict that palatal segments do not occur before back vowels but surface faithfully in other environments, both a markedness and a faithfulness constraint are necessary. Root-internally, as well as at the nominative suffix boundary, palatal-back vowel sequences are prohibited.⁴

I assume these featural compositions for alveolar and palatal stops.

4. This restriction holds in the standard, native vocabulary. Exceptions include: [cuk] ‘tap, rap, onomatopoeia’; [capka] ‘paw, colloquialism’; [jabel] ‘devil, borrowing.’ One exception is [ʃcastna:] ‘happy’; palatalization assimilation may provide an explanation for this example (Palková 1997).

- (3) a. [t, d, n]: [+cor, +ant, -dors]
 b. [c, j, ɲ]: [+cor, -ant, +dors, -back]

Palatal segments are found before front, but not back, vowels because they share the feature [-back] with front vowels.

- (4) $*C_{-bk}V_{+bk}$: A [-bk] consonant cannot be followed by a [+bk] vowel.

- (5) $I\text{-OIdent}_{[dors]}$: Corresponding segments have identical values for [dors].

$I\text{-OIdent}_{[dors]}$ requires that segments maintain their value for *dorsal*, prohibiting alveolars and palatals from being in correspondence.

Assuming Richness of the Base, I consider inputs (feminine nominative nouns) with both palatal and alveolar stem-final segments. Under a ranking of Markedness >> Faithfulness, both input alveolars and input palatals surface as alveolar.

(6) Input Alveolar

/za:d-a/	$*C_{-bk}V_{+bk}$	$I\text{-OIdent}_{[dors]}$
a. za:ja	*!	
b. [ɲ] za:da		

(7) Input Palatal

/za:j-a/	$*C_{-bk}V_{+bk}$	$I\text{-OIdent}_{[dors]}$
a. za:ja	*!	
b. [ɲ] za:da		*

The unmarked candidate, [za:da], wins in both tableaux. The faithful candidate in (7), (7a), loses, due to the high ranking markedness constraint, and the unmarked (and unfaithful) candidate, (7b), wins. Stem final palatals within the masculine paradigm, however, *are* expected to surface faithfully in the nominative case as this case marker is null; no markedness violation would prohibit palatals in this position.

3.2. The analysis: Underapplication in the masculine paradigm

Returning to the problem outlined in Section 2, a morphological difference between the nominative forms within the masculine and feminine paradigms provides an explanation for the observed uniformity. Stem-final palatal consonants in the masculine nominative forms surface faithfully as the nominative marker is null. If it is assumed that the base in inflectional

paradigms is the nominative form, the palatal stem is then imported from the nominative into the rest of the paradigm under Output-Output Correspondence. Similarly, as stem-final palatals are prohibited in the feminine nominative form, this prohibition is propagated throughout the paradigm, extending to forms which would not violate any phonotactic restrictions.

Researchers have suggested that there is a morpho-syntactically unmarked 'base' within inflectional paradigms. For Lahiri and Drescher (1984) the base is the nominative and for Bybee (1985), either nominative or accusative, depending on animacy. I follow Lahiri and Drescher and assume that the inflectional base for Czech is the nominative form (both accusative and nominative produce the same results for the Czech data).

Turning first to underapplication of depalatalization in the masculine paradigm, relevant examples are presented in the table in (8). Note the ungrammatical, 'depalatalized,' forms in (8c-d).

(8) Masculine Nouns with Palatal Stems⁵

nom, sg	a. [suc] 'quarry'	[loj] 'boat'	[oheɲ] 'fire'
nom, pl	b. [suc-i]	[loj-i]	[ohɲ-i]
gen, pl	c. [suc-u:m] *[sut-u:m]	[loj-u:] *[lod-u:]	[ohɲ-u:] *[ohn-u:]
dat, pl	d. [suc-u:m] *[sut-u:m]	[loj-u:m] *[lod-u:m]	[ohɲ-u:m] *[ohn-u:m]

An Output-Output Correspondence constraint prohibiting a change in palatalization is posited.

(9) *O-Ident*_[dors]: Corresponding output segments have identical values for [dors].

Following Benua (1997), recursions of optimizations are presented. First, the nominative form, which has no corresponding base, is evaluated, and the winner from that tableau then serves as the base for the evaluation of other cases.

5. Currently, for many speakers, the genitive and dative plural endings are: [-i/-i:m] to avoid a markedness violation. In either case, the stem final consonant remains constant throughout the paradigm. For all speakers, words ending with a palatal nasal that have a *jer* in the final syllable retain the [-u/-u:m] endings in the genitive and dative plurals [oheɲ] (masc, nom, sing), [ohɲ-u:] (masc, gen, pl). Also, given nonce forms with a palatal nasal, the [u:/u:m] endings are used.

(10) Underapplication in the Masculine Paradigm⁶

/oheɲ-ø/ (nom)	O-OIdent _[dors]	*C _{-bk} V _{+bk}	I-OIdent _[dors]
(a) [☞] oheɲ			
(b) ohen			*!

/oheɲ-u:/(gen pl)	O-OIdent _[dors]	*C _{-bk} V _{+bk}	I-OIdent _[dors]
(a') [☞] ohɲu:		*	
(b') ohnu:	*!		*

The winner in the first evaluation is (10a), the faithful candidate. As the nominative marker is null, the stem-final palatal is allowed to surface faithfully. With O-OIdent ranked high, the unmarked candidate in the second evaluation, (10b'), loses as its value for *dorsal* is not identical to the palatal in the base (the nominative form). The correct winner, the faithful (10a'), is predicted; this candidate only incurs a violation of the lower ranked markedness. Through correspondence with the nominative base, a palatal segment in an oblique case is maintained despite markedness violations.

3.3. Overapplication in the feminine paradigm

In the feminine paradigm, there is a parallel case of overapplication of depalatalization. Alveolar segments are retained, even in cases in which there would be no markedness violations if an underlying palatal surfaced faithfully.

(11) Overapplication in the Feminine Paradigm

nom, sg.	[stran-a] 'side'
nom, pl.	[stran-i]
gen, pl.	[stran-Ø]
dat, pl.	[stran-a:m]

The genitive plural form is surprising. Since the genitive plural marker is null, an underlying palatal (given Richness of the Base) would be expected to surface faithfully; this does not happen. The constraint ranking given above predicts that an alveolar segment in the nominative form will be imported into the rest of the paradigm.

6. A *jer* which is present in the output correspondent does not surface in the winning candidate. I assume that there are higher ranking constraints governing *jer* deletion in these cases.

(12) Overapplication in the Feminine Paradigm

/straj-a/ (nom)	O-OIdent _[dors]	*C _{-bk} V _{+bk}	I-OIdent _[dors]
(a) strajna		*!	
(b) ^{ESP} strana			*

/straj- Ø/ (gen pl)	O-OIdent _[dors]	*C _{-bk} V _{+bk}	I-OIdent _[dors]
(a') straj	*!		
(b') ^{ESP} stran			*

In contrast with masculines, in the first evaluation, the unmarked candidate wins. The faithful candidate, (12a), violates the highly ranked markedness (due to the [-a] suffix), while (12b) violates only the lower ranked I-OIdent. This candidate then serves as the base for further evaluations. In the second evaluation, the O-O faithful candidate, (12b'), wins. This candidate violates the low ranking I-OIdent but satisfies O-OIdent. (12a'), though faithful to the input, is not faithful to the output base and loses.

Though the genitive plural form has a null suffix, an underlying palatal segment fails to surface faithfully due to Output-Output Correspondence. Unlike in the masculine paradigm in which faithfulness to the input palatal segment is maintained, in this paradigm, the unmarked nominative output restricts the inventory of stem-final coronal segments to alveolars (excluding palatals).

(13) Summary of Predictions

	Base:	Suffix on Base:	Predictions:
Masculine Nominals	nom, sg	null Stems end in palatal or alveolar	oblique forms exhibit marked CV clusters: <i>palatals retained</i>
Feminine Nominals		[-a] No stems end in a palatal	no forms exhibit marked CV clusters: <i>only alveolars allowed</i>

Through this constraint ranking, stems in both the feminine and masculine paradigms are predicted to level: masculines through underapplication and feminines through overapplication. Output-Output Correspondence Theory provides an accurate account of the facts and captures the intuition that phonotactic differences in the nominative forms are responsible for differences between these two paradigms.

4. Inflectional bases?: Optimal Paradigms (McCarthy 2002)

McCarthy (2002) contrasts derivational paradigms with their inflectional counterparts. While derivational paradigms reference a less complex base form, he argues that inflectional paradigms are evaluated as a whole without reference to a privileged base. Each member of the paradigm is in a correspondence relationship with all other members. Through this analysis, correct results are predicted for difficult cases of paradigm uniformity in Classical Arabic. One strong prediction of Optimal Paradigms is that underapplication does not occur; inflectional paradigms generally level to the unmarked. The masculine nominal paradigm in Czech contradicts this.⁷

An Optimal Paradigms (OP) constraint which prohibits a change in palatalization is posited.

(14) *OP-Ident*_[dors]: A [dors] feature in one member of the paradigm must have a correspondent with the same value in another.

(15) The Wrong Winner Emerges under OP.

/oheɲ, -i, -u:/	OP-Ident _[dors]	*C _{-bk} V _{+bk}	I-OIdent _[dors]
a. ⊗ <oheɲ, ohɲi, ohɲu:>		*!	
b. ●* <ohen, ohni, ohnu:>			***
c. <oheɲ, ohɲi, ohnu:>	*!*		*

The alternating paradigm, (15c), loses due to violations of the OP constraint; two violations are incurred because there are two pairs of candidates, <oheɲ, ohnu:> and <ohɲi, ohnu:>, which do not share the same value for *dorsal*. The unmarked paradigm, (15b), is incorrectly predicted to be the winner; this candidate set only violates the low ranking I-OIdent constraint.

The paradigm which is found in Czech, (15a), levels to the more marked palatal segment, incurring a violation of the markedness constraint. The wrong winner is chosen; it is not the least marked paradigm, (15b), that surfaces, but the paradigm that contains the marked CV sequence. In order to predict the correct winner, the ranking of the markedness and faithfulness

7. Ko (2002) also cites cases of underapplication within nominal paradigms in Korean. Certain processes of vowel reduction which normally occur within the language are blocked in nominals. She analyzes this through Output-Output Correspondence.

constraints must be reversed; this would create a ranking paradox because this ranking is shown to be necessary for the normal phonology of Czech in (6-7). This type of underapplication is not predicted under Optimal Paradigms.

There is, however, a case of underapplication cited in McCarthy (2002): Tiberian Hebrew. Under his account, though, underapplication can only occur when a highly ranked markedness constraint forces it. In Tiberian Hebrew, it is a syllable well-formedness constraint that outranks the Optimal Paradigms constraint and forces underapplication. No such constraint which would rule out the candidate set in (15b) appears to be relevant for the Czech data. As opposed to Semitic languages, Czech has few syllable well-formedness conditions and is a quantity insensitive language with invariant word-initial stress.

This account is problematic in predicting underapplication within the Czech masculine nominal paradigm. Forms within this inflectional paradigm do level, but not in the way in which the Optimal Paradigms approach predicts.

5. Conclusion

In order to predict surprising leveling facts within Czech nominal paradigms (through underapplication in masculines and overapplication in feminines) reference to a privileged base (the nominative form) has been shown to be necessary. This contradicts the claim in McCarthy (2002) that, in contrast to derivational paradigms, inflectional paradigms lack a privileged 'base' and are evaluated as a whole. An Optimal Paradigms approach is not adequate to account for the Czech data.

I conclude that reference to privileged bases within Czech inflectional paradigms is necessary, and Ko (2002) suggests that the same is true for Korean as well. Ruling out bases within all inflectional paradigms is a problematic result of Optimal Paradigms.

Appendix: Morphologically conditioned stem changes

Morphologically conditioned stem changes within the nominal paradigms, (1) and footnote 2, present a challenge to the high ranking of O-Ident. Within Czech, and related Slavic languages such as Polish, stem changes due to suffixal material are common; generally, affixes surface faithfully, at the expense of stems (see also Ussishkin and Wedel 2002; Sanders 2003).

As the constraint rankings stand, no stem changes of any kind are permitted in oblique cases. This is not a correct result. Certain (non-


nominative) suffixes obligatorily palatalize the preceding segment which I assume is the result of a floating palatalization feature.⁸



(16) Suffix-conditioned stem changes

Case	<i>Masculine</i>	<i>Feminine</i>
nom, sg.	a. [student] 'student'	[stran-a] 'side'
nom, pl.	b. [studenc-i]	[stran-i]
acc, pl.	c. [student-i]	[stran-i]
dat, sg.	d. [student-ovi]	[stran-e]

These stem changes are present in the feminine dative singular and in the masculine nominative plural. Note that in the masculine paradigm, the accusative plural ending, also [-i], does not palatalize the preceding stem segment. This suggests that this is indeed a morphological palatalization process and not the result of a general phonological palatalization of obstruents before front vowels.

(17) Incorrect predictions for stem palatalization

/student-ø/ (nom)	O-Oident _[dors]	*C _{-bk} V _{+bk}	I-Oident _[dors]
(a) studenc			*!
(b)  student			

/student- ^j i/ (nom pl)	O-Oident _[dors]	*C _{-bk} V _{+bk}	I-Oident _[dors]
(a')  studenti			*!
(b')  studenci	*!		

The wrong winner, (17a'), emerges from the second evaluation because the floating palatalization feature, having no correspondent in the output base, *student*, is not required to surface in the output. The correct winner, (17b'), in which palatalization conditioned by the suffix emerges, loses due to a violation of O-Oident.

To account for these facts, I-Oident is split into I-Oident-Root and I-Oident-Affix. Contrary to the 'Root-Affix Faithfulness Metaconstraint' ranking of Faith-Root >> Faith-Affix (McCarthy and Prince 1995), I posit a constraint ranking of Faith-Affix >> Faith-Root. Ussishkin and Wedel (2002) argue against the fixed ranking of McCarthy and Prince and cite evidence against the claim that faithfulness to roots always is greater than

8. Note that this palatalization is not, then, imported into the rest of the paradigm as this type of morphological palatalization occurs only in oblique cases.

faithfulness to affixes. Counterexamples include ATR harmony in Turkana (Noske 2000) and the Hebrew verbal paradigm (Ussishkin 2000).

In Czech, faithfulness to affixes is always upheld, so I-OIdent-Affix is highly ranked, outranking O-OIdent. With the division of I-OIdent into I-OIdent-Affix and I-OIdent-Root, the correct predictions are made for cases of morphologically conditioned stem changes.

(18) I-OIdentAffix_[dors] >> I-OIdentRoot_[dors]

/student-ø/ (nom)	I-OIdent Affix _[dors]	O-O Ident _[dors]	*C _{-bk} V _{+bk}	I-OIdent Root _[dors]
(a) studenc				*!
(b) ☞ student				

/student-i/ (nom pl)	I-OIdent Affix _[dors]	O-O Ident _[dors]	*C _{-bk} V _{+bk}	I-OIdent Root _[dors]
(a') studenti	*!			
(b') ☞ studenci		*		*

The same predictions are made for the first evaluation. In the second evaluation, I assume that the floating palatalization feature coalesces with the stem-final segment of the noun.⁹ Under that assumption, the unfaithful candidate, (18a'), loses due to a violation of the highly ranked I-OIdent-Affix. The palatalization feature in the affix, [j], [+dors], does not match the [-dors] value of the stem final segment, [-t]. The candidate with a stem-change, (18b'), wins because it satisfies the higher ranked I-OIdent-Affix, but violates both lower ranking faithfulness constraints, O-OIdent and I-OIdent-Root. Assuming the ranking I-OIdent-Affix >> I-OIdent-Root, the correct predictions are made for morphologically conditioned palatalization effects. This splitting of I-OIdent does not affect the results shown in the body of the paper for phonological depalatalization processes.

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9. I assume that coalescence of the stem-final consonant with the floating palatalization feature is required in Czech. This is achieved through a ranking of Max >> Uniformity (prohibiting the deletion of the floating palatalization feature in favor of a violation of Uniformity). In addition, there is evidence in Czech for a high ranking *SecondaryArticulation constraint (NíChosáin and Padgett 2001) which penalizes the appearance of floating palatalization as a secondary articulation.

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