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How to derive allomorphy: a case study from Czech

Abstract: The paper discusses a three-way allomorphic pattern of neuter-gender stems in Czech. We argue that there are two surface alternations involved in the three-stem pattern, i.e. *a-e* and *t*-zero, and that the two alternations are driven by two distinct mechanisms, i.e. suppletion and regular phonological computation respectively. We postulate two suppletive stem-building suffixes that are lexically connected via the Nanosyntactic tool of pointers. We argue that the default *a*-initial suffix spells out the neuter gender and its suppletive *e*-initial variant is a portmanteau morpheme of the (neuter) gender and (singular) number. We further propose that the suppletive suffix is stored with a floating consonant that does not surface word-finally due to regular phonological computation.

Keywords: ABA; age projection; Czech; gender; Nanosyntax; number; phrasal spellout; three-stem pattern

1 Introduction

This paper deals with contextual allomorphy, a phenomenon extensively studied in realizational theories of morphology (e.g. Bonet and Harbour 2012). In particular, we focus on the allomorphic variation of one type of nominal stems in Czech and argue that it can be accounted for by the tools used in Nanosyntax, namely Phrasal Spellout, the Superset Principle, and lexical pointers (Starke 2009, 2018).

The allomorphic pattern that we are going to explain is illustrated in Table 1. The first row of the table shows four inflectional forms of the noun 'chicken'. These forms contain three phonologically different stems: (i) the *e*-stem *kuře* (in the zero-marked nominative singular), (ii) the *et*-stem *kuřet*, which is found before the genitive singular marker *-e*, and (iii) the *at*-stem *kuřat*, shared by the plural forms. A comparison with (1b) and (1c) shows that the three-stem variation is not

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automatic: the corresponding inflectional forms of the nouns 'ridge' and 'tray' contain invariant stems that always end in *et* and *at* respectively.[1]

Table 1: A fragment of Czech nominal declension.

		NOM SG	GEN SG	NOM PL	GEN PL
a.	'chicken'	kuř**e**	kuř**et**-e	kuř**at**-a	kuř**at**
b.	'ridge'	hř**bet**	hř**bet**-u	hř**bet**-y	hř**bet**-ů
c.	'tray'	pl**at**-o	pl**at**-a	pl**at**-a	pl**at**

The three-stem pattern, which we call the *chicken* paradigm throughout this paper, can be broken down into two surface alternations: (i) the *a*-stem alternates with the *e*-stem (cf. *kuř*at vs. *kuř*e/*kuř*et), and (ii) the C(onsonant)-final stem alternates with the V(vowel)-final stem (cf. *kuř*at/*kuř*et vs. *kuř*e). To account for the distribution of these stems, we propose that the alternations are driven by two distinct mechanisms. First, we take the *a-e* alternation to be an instance of contextual allomorphy. According to this analysis, both stem alternants are stored as separate lexical entries: the *a*-stem is the default realization, and the *e*-stem is a suppletive form conditioned for insertion by singular number. As for the second surface alternation, i.e. *t*-zero, we argue that it arises from regular phonological computation over the suppletive *e*-stem allomorph.

2 The *chicken* paradigm

The stem alternations in the *chicken* paradigm always target the final part of the stem, which is preceded by an invariant part. In what follows, we shall segment the variable part as an independent morpheme and call it a stem-building affix. The invariable part corresponds to the root. In other words, we postulate a suffixal position with three complementary surface forms, i.e. /-e/, /-et/, and /-at/. The stem-building suffix -*{e/et/at}* may be further followed by another suffix, as in the genitive singular and the nominative plural forms in Table 2. Here the stem is followed by the inflectional endings -*e* and -*a* respectively. The stem-building suffix may also appear word-finally, as in the nominative singular and the genitive plural forms, which lack overt case markers.

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1 Throughout this paper, we present examples in their orthographic form; we use IPA transcription only if the need arises. Note that Czech orthography marks vowel length either by an acute accent (e.g. *á* corresponds to [a:]) or a superscript circle (*ů* marks [u:]).

Table 2: The chicken paradigm: three stem-building suffixes.

NOM SG	GEN SG	NOM PL	GEN PL
[kuř-**e**$_{stem}$]	[kuř-**et**$_{stem}$]-e	[kuř-**at**$_{stem}$]-a	[kuř-**at**$_{stem}$]
root-SUFFIX	root-SUFFIX-ending	root-SUFFIX-ending	root-SUFFIX

The segmentation depicted in the table above is further supported by the fact that the roots of such stems often (though not always) exist without the stem marker -*{e/et/at}*, a fact that we discuss in more detail in the next section.

2.1 The (neuter) gender marker

Having attributed the stem alternation to an independent suffix, namely -*{e/et/at}*, let us now focus on its syntactic features. Traditionally, the suffix -*{e/et/at}* is taken to be a derivational affix producing terms referring to youngsters (see Petr [1986]). The age-marking function of -*{e/et/at}* can be illustrated by examples like those in Table 3. The left part of the table shows nouns which denote both the kind of the animal and the individual representing the kind; e.g. *pštros* refers either to the kind *ostrich* or to an individual ostrich. On the right, there are the corresponding youngster terms that include the suffix - *{e/et/at}*. (Note that the root-final velar [k] changes to the affricate [ʧ] before the suffix in (3b), which is a regular phonological process in Czech.)

Table 3: Age-marked nouns of the chicken paradigm.

	animal kind		animal youngster	
a.	*pštros*	'ostrich'	*pštros-{e/et/at}*	'ostrich youngster'
b.	*pták*	'bird'	*ptáč-{e/et/at}*	'bird youngster'
c.	*sokol*	'falcon'	*sokol-{e/et/at}*	'falcon youngster'
d.	*mrož*	'walrus'	*mrož-{e/et/at}*	'walrus youngster'

The three-stem pattern is not, however, restricted to youngster terms. Animate nouns like 'animal' and 'twin' in (4a,b) or inanimate nouns like 'broom' and

'rosebud' in (4c,d) display the same stem alternations, but none of them denotes a youngster of any kind.[2]

Table 4: Age-unmarked nouns of the chicken paradigm.

		NOM SG	GEN SG	NOM PL	GEN PL
a.	'animal'	zvíř**e**	zvíř**et**-e	zvíř**at**-a	zvíř**at**
b.	'twin'	dvojč**e**	dvojč**et**-e	dvojč**at**-a	dvojč**at**
c.	'broom'	košt**ě**	košt**ět**-e	košť**at**-a	košť**at**
d.	'rosebud'	poup**ě**	poup**ět**-e	poup**at**-a	poup**at**

Since the stem alternations are regular, we assume that the suffix -*{e/et/at}* is included in all nouns of the *chicken* paradigm, regardless of their meaning. In other words, we claim that the nouns unmarked for age, like those in Table 4 above, involve -*{e/et/at}* as well. Because of this fact, we propose that the suffix -*{e/et/at}* is not an age marker, as is traditionally assumed, but a (neuter) gender marker. The new proposal is formalized in the lexical entry in (1).

(1)   </-{e/et/at}/, [NEUTER]>

The lexical entry postulates a direct link between the three-stem variation and the neuter gender. To see the reason for this proposal, consider the examples in Table 5. Here, we show four pairs of words where each pair has the same base. The identical bases are either merged with the suffix -*{e/et/at}* or with a different suffix, i.e. -*ec* (5a) and (5b), -*ek* (5c), and -*ík* (5d). The result are synonymous words that, however, differ in gender features. For example, *novorozeň-{e/et/at}* and *novorozen-ec* in (5a) both mean 'newborn (of either sex),' but they each have a different grammatical gender: *novorozeň-{e/et/at}* is neuter, *novorozen-ec* masculine. The rest of the table replicates the pattern with additional bases. In sum, the examples below clearly show that the suffix -*{e/et/at}* is associated

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2 Note that the examples in (4c,d) involve a regular orthographic alternation between *ě* and *e*, seen in the *e*-stem forms: *košt\<ě\>, košt\<ě\>t-e* vs. *poup\<ě\>, poup\<ě\>t-e* vs. *zvíř\<e\>, zvíř\<e\>t-e*. Generally, the grapheme *ě* appears only in two contexts: (i) after *d, t, n* which correspond to palatal sounds [ɟ c ɲ], i.e. *koš\<tě\>* [ce], or (ii) after labials, which are then pronounced with a palatal glide, i.e. *pou\<pě\>* [pje]. Furthermore, the noun 'broom' illustrates yet another orthographic rule according to which palatals [ɟ c ɲ] are written as *d, t, n* before *ě* (and *i*) and as *ď, ť, ň* elsewhere. In this particular case, a palatal [c] is marked graphically as *t* in the *e*-stem forms *koš\<t\>ě, koš\<t\>ět-e* and as *ť* in *a*-stem forms *koš\<ť\>at-a, koš\<ť\>at*.

with the neuter gender, with the result that the *chicken* paradigm contains neuter-gender nouns.[3]

Table 5: A comparison of neuter and masculine nouns of the same root.

	three-stem noun: neuter	single-stem noun: masculine	
a.	*novorozeň-{e/et/at}*	*novorozen-ec*	'newborn'
b.	*kojeň-{e/et/at}*	*kojen-ec*	'nursling'
c.	*klouč-{e/et/at}*	*klouč-ek*	'small boy'
d.	*šupl-{e/et/at}*	*šupl-ík*	'drawer'

If we adopt the conclusion that the suffix *-{e/et/at}* is indeed stored as in (1), it follows that it fails to realize the age meaning both in the case of the age-unmarked nouns such as *zvíře* 'animal' or *koště* 'broom,' but crucially also in the case of the youngster terms like *pštrose* 'ostrich youngster.' Since this is a departure from the standard view, we are going to examine this claim in more detail in the next section.

2.2 Synthetic vs. analytic forms

Youngster terms of the *chicken* paradigm fall into two morphological types illustrated in Table 6. The first type is represented by nouns like *pštros-{e/et/at}* in (6a), in which the suffix *-{e/et/at}* is attached directly to a noun that denotes a particular animal kind. The second type involves multiword expressions. For instance, the noun *hroznýš* 'boa' refuses the youngster affix *-{e/et/at}*. Instead, we get an analytic form *mláď-{e/et/at} hroznýše* in (6b), literally 'youngster of boa.' Importantly, the first noun 'youngster' features the suffix *-{e/et/at}* on the adjectival base *mláď* 'young.' The animal-kind noun 'boa' appears as the second noun, and it is only marked for the genitive case, lacking any age-specific suffix. The suffix *-{e/et/at}* is

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3 While there is an implication that three-stem nouns are neuters (with the exception of four nouns denoting members of the high nobility, i.e. *hrabě* 'Earl', *kníže* 'Fürst', *lankrabě* 'Landgrave', and *markrabě* 'Margrave', which alternate between neuter gender [in the plural] and masculine gender [in the singular]), the reverse is not true. There exist dozens of nouns that are neuters (i.e. trigger neuter agreement on adjectives and verbal participles), but do not show the three-stem variation. The morphological variety of neuter nouns can be explained under the assumption that morphemes realize syntactic phrases (and not their heads). There exist root morphemes that can lexicalize phrases including the neuter-gender projection with monomorphemic neuter stems like e.g. *neb* 'sky' as the result. Or the gender is lexicalized separately from the root as in nouns of the *chicken* paradigm.

still present in the analytic construction, but its host is the first noun, i.e. *mláď-{e/et/at}*.

Table 6: Two types of age-marking in Czech.

	age-unmarked kind term	age-marked term	
a.	*pštros*	*pštros-{e/et/at}*	'ostrich youngster, ostrich'
b.	*hroznýš*	*mláď-{e/et/at} hroznýš-e*	'boa youngster, boa'

As pointed out to us by Pavel Caha (p.c.), this analytic/synthetic alternation of youngster terms can be analysed as analogous to English comparatives, which also come in two morphological types (analytic and synthetic). To bring out the parallel between these two constructions, let us turn to Table 7. In (7a), both youngster terms and comparatives involve the affixation of the relevant morpheme to the root. The analytic pattern in (7b) consists of a combination of affixation and a multiword expression. Another parallel is that in both constructions the affix used in the synthetic form is affixed to the first word of the analytic form.

Table 7: Synthetic and analytic forms: English comparatives and Czech youngster terms.

a.	*pštros-{e/et/at}*	*pštros*	synthetic expression
	smart -er	*smart*	
b.	*mláď-{e/et/at} hroznýš(-e)*	*hroznýš*	analytic expression
	mo -re intelligent	*intelligent*	

Of course, both categories are structurally parallel only under the assumption that the free-standing comparative *more* contains a suffix identical to the suffix found in single-word comparatives like *smarter*. This is what is proposed for instance by Corver (1997), who argues that the comparative *more* and the superlative *most* both share the root *mo*.

We will adopt here a Nanosyntactic approach to such alternations. More specifically, we will follow the proposal put forth in Caha et al. (2019), who derive the two-way typology of English comparatives in terms of Phrasal Spellout (Starke 2009, 2018). The main idea of their approach is that the absence of the root *mo* in synthetic forms is due to the fact that the position where *mo* would normally appear is spelled out by the root of the synthetic construction. Analytic constructions arise when the root cannot spell out this projection. The variation between synthetic comparatives created by affixation to adjectival roots and analytic comparatives thus arises as a consequence of the lexical size of particular

adjectival roots. The term *lexical size* then refers to a maximal portion of the syntactic structure which a given morpheme can spell out. In this approach, roots combining with *more*, like e.g. *intelligent*, are lexically smaller than roots like *smart* which combine with a morphologically reduced version of the comparative, i.e. the suffix *-er*. The gist of Caha's et al. analysis is depicted graphically in Figure 1.

a.

$mo \leftrightarrow B \quad C \leftrightarrow -er \quad A \leftrightarrow intelligent$
$= more$

b.

$smart \leftrightarrow \boxed{B \quad A} \quad C \leftrightarrow -er$

Figure 1: Synthetic and analytic comparatives in English: a nanosyntactic account (Caha et al. 2019).

Both the *more*-comparative in Figure 1a and the *er*-comparative in Figure 1b contain the same syntactic ingredients, which we label simply as A, B, and C for ease of exposition. The only difference is in how these ingredients are spelled out, where the crucial factor governing spellout is the size of the lexical items for particular roots. If an adjectival root is lexically specified only for A, then the rest of the projections, i.e. B and C, are pronounced by a morphologically complex comparative marker, made up from the root *mo* and the comparative suffix; see Figure 1a. The spellout of the *er*-comparative in Figure 1b, on the other hand, involves only two lexical items: the comparative suffix, which realizes C as in the previous case, and the adjectival root *smart* that lexicalizes both A and B. We must note that the spellout of the structures in Figure 1 involves movement, which is motivated by the fact that only constituents can be lexicalized (Starke 2018). The movement places the root in front of the comparative affix in both cases: the degree root is fronted in Figure 1a, the adjectival root in Figure 1b. We only show the surface structures in Figure 1 to illustrate the main point of Caha's et al. (2019) approach. We will come back to this spellout-driven movement later in Section 3.1.

In sum, Caha et al. (2019) assume that the comparative is encoded syntactically in two projections, labelled B and C in Figure 1 above. The highest projection, C, is pronounced invariably as the comparative suffix *-er*. The spell out of the lower projection, B, on the other hand, involves variation: it can be lexicalized either by the adjectival root or by *mo*, the root of the analytic comparative marker *more*. What is crucial here is the lexical size of particular adjectival roots.

Along similar lines, we propose that the variation between synthetic and analytic youngster terms stems from the lexical properties of particular roots. That is: lexically small roots like *hroznýš* 'boa' produce analytic expressions (i.e. *mláď-{e/et/at} hroznýš(-e)*), while lexically large roots like *pštros* 'ostrich' derive synthetic expressions (i.e. *pštros-{e/et/at}*). This proposal is schematized in Figure 2 below.

a.

b.

$mlád' ↔ B \quad C ↔ -\{e/et/at\} \quad A ↔ hroznýš \qquad pštros ↔ \boxed{B \quad A} \quad C ↔ -\{e/et/at\}$
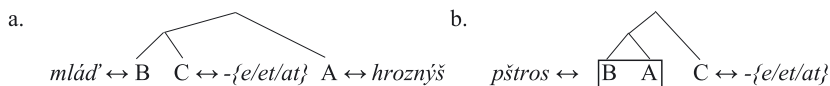
Figure 2: Synthetic and analytic youngster terms in Czech: a nanosyntactic account.

A comparison between youngster terms in Figure 2 and comparatives in Figure 1 shows that it is the B projection that is lexicalized in two different ways in synthetic and analytic expressions. In Figures 1b and 2b, B is lexicalized together with A, i.e. by the lexically large roots *smart* and *pštros* 'ostrich' respectively. The multiword expressions in Figures 1a and 2a, on the other hand, involve lexically small roots (i.e. *intelligent* and *hroznýš* 'boa'), which lexicalize only the A projection. Another lexical item is thus needed to spell out the B projection in the context of such small roots, which is either the root *mo* in the English comparative or the root *mlád* 'young' in the Czech youngster construction. Finally, the last syntactic ingredient of the structures in Figures 1 and 2, i.e. the C projection, is invariably lexicalized by the suffix, i.e. *-er* in comparatives or *-{e/et/at}* in youngster terms.

2.3 The ᴀɢᴇ head

So far, we have used three diacritics (A, B, C) to express the structural parallel between comparatives and youngster terms. Now let us focus on their syntactic content. Previously, we established that the suffix *-{e/et/at}* lexicalizes neuter gender; this is therfore the content of the C projection in the structures in Figure 2. The A projection is spelled out by the roots *hroznýš* 'boa' and *pštros* 'ostrich' in Figure 2, which, on their own, denote particular animal kinds. It is therefore reasonable to conclude that A stands for ᴋɪɴᴅ. Since the structures in Figure 2 underlie age-marked nouns, it follows that the B projection is related to the meaning ᴀɢᴇ. In sum, Figure 3a and b repeat the structures from Figure 2 above with the diacritics A, B, and C replaced with the syntactic features ᴋɪɴᴅ, ᴀɢᴇ, and ɢᴇɴᴅᴇʀ respectively.

a.

b.

AGE   GENDER   KIND   AGE KIND   GENDER
mlád' -{e/et/at} hroznýš   *pštros   -{e/et/at}*

Figure 3: The age head and its spellout.

In sum, we propose that the AGE projection can be lexicalized in two different ways. In synthetic expressions like *pštros-{e/et/at}* in Figure 3b, AGE is lexicalized together with KIND by a particular animal-denoting root. In analytic expressions, on the other hand, both AGE and KIND are spelled out separately by two lexical items which involve a root *mlád* 'young' and a root denoting particular animal kind.

It is not a new idea that AGE is encoded syntactically. For example, Scott (2002) proposes a fine-grained hierarchy of attributive adjectives which involves the AGE head. Scott's hierarchy contains also a SIZE head, which, according to Cinque (2015), can be expressed as an affix on a noun. In particular, the size-encoding head is present in the *f*-seq of diminutives. We generalize this idea to youngster terms and propose that the AGE head also has an affixal counterpart: it is involved in the *f*-seq of nouns that denote animal or human youngsters.

The proposed analysis, in which the suffix *-{e/et/at}* does not lexicalize AGE (contra what is traditionally assumed), but rather the gender head, correctly predicts two things. First, it accounts for nouns like *zvíře* 'animal' that belong to the *chicken* paradigm. These nouns follow the three-stem pattern, but do not carry the age meaning. We simply claim that they lack the AGE projection: GENDER is merged directly to KIND, as in Figure 4 below.

zvíř ↔ KIND   GENDER ↔ *-{e/et/at}*

Figure 4: The age-unmarked noun *zvíře* 'animal'.

The second prediction concerns suppletive youngster terms, which never appear in multiword expressions. Table 8 lists a couple of single-word age-marked nouns, in which the suffix *-{e/et/at}* is attached to roots that differ phonologically (in an unpredictable way) from the roots denoting the corresponding kind terms (in the right part of the table). In the first row, for example, a noun 'cattle' suppletes for AGE: the kind term *tur* and the youngster term *tel-{e/et/at}* contain phonologically unrelated roots.[4]

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[4] Note that the age-unmarked terms in Table 8 refer also to whole biological families, i.e. they serve as cover terms for biologically related kinds of animals. For example, the root *pes* in (8b) refers either to a single kind of carnivorous mammals, i.e. domestic dogs, or to a group of dog-like animals, e.g. coyotes, jackals or dingoes. And the same semantic ambiguity is involved in suppletive terms. The age term *štěň-{e/et/at}* thus suppletes for either the single kind (i.e. domestic dog) or the kind group involving any dog-like animal.

Table 8: Suppletive age-marked nouns.

	suppletive youngster term		kind term	
a.	*tel-{e/et/at}*	'calf'	*tur*	'cattle'
b.	*štěň-{e/et/at}*	'puppy'	*pes*	'dog'
c.	*jehň-{e/et/at}*	'lamb'	*ovc(-e)*	'sheep'
d.	*koť-{e/et/at}*	'kitten'	*kočk(-a)*	'cat'

The Phrasal Spellout of youngster terms, in which root suppletion is combined with affixation, is depicted in Figure 5. The diagram reads as follows: the root *tel* spells out the same portion of the syntactic structure as the root *tur* extended by the AGE projection.
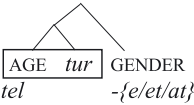
Figure 5: The suppletive noun tele 'calf'.

In sum, suppletive roots lexicalize AGE and point to another specific (kind-denoting) root, i.e. *tel* points to *tur* in this particular case. Under this scenario, it follows that suppletive multiword expressions like **mládě telete*, literally 'youngster of calf', do not exist, because a single projection, i.e. AGE, would be simultaneously lexicalized by two roots in these structures.

Moreover, the analysis proposed in Figure 5 above accounts also for cases where suppletive roots appear without the suffix *-{e/et/at}*. An example is provided by the verb *otelit* in Figure 6. Here the suppletive root *tel* is merged with a causative verbal affix *-i*. (An (aspectual) prefix *o-* and an (infinitival) suffix *-t* are omitted in the tree below.) The verb literally means 'to conceive a calf', which supports our claim that it is the root *tel* alone what realizes the age meaning, not the suffix *-{e/et/at}* (as traditionally claimed).
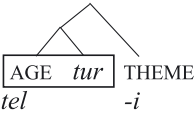
Figure 6: The verb otelit 'to conceive a calf'.

To summarize this section, we have proposed that all nouns of the *chicken* paradigm share a single suffix which has three surface allomorphs, producing a specific three-stem pattern. We have analyzed the suffix as a neuter-gender marker, which attaches to roots of different syntactic sizes yielding three-stem neuters of various semantic types. In the next section, we examine the distribution of its various allomorphs.

3 Allomorph distribution

The suffix allomorphy involves two alternations that produce the three-way surface contrast: (i) the vocalic alternation distinguishes between *e*-forms of the suffix, i.e. *kuř-e* and *kuř-et*, and an *a*-form, i.e. *kuř-at*, (ii) the consonantal alternation yields contrast between consonant-final forms of the suffix ending in a dental [t], i.e. *kuř-et* and *kuř-at*, and a vowel-final form, i.e. *kuř-e*. The alternant distribution is summarized in first two columns of Table 9. We can see that the suffix surfaces as /-e/ in two zero-marked inflectional forms, i.e. the nominative singular and the accusative singular. In the rest of the inflectional paradigm, the suffix is consonant-final, with the final [t] preceded by a mid vowel [e] in the singular and by a low vowel [a] in the plural.

Table 9: The chicken paradigm: two surface alternations of the stem.

|	'chicken' SG	'chicken' PL	'ridge' SG	'ridge' PL	'wage' SG	'wage' PL
NOMINATIVE	*kuř-e*	*kuř-at-a*	*hřbet*	*hřbet-y*	*plat*	*plat-y*
ACCUSATIVE	*kuř-e*	*kuř-at-a*	*hřbet*	*hřbet-y*	*plat*	*plat-y*
GENITIVE	*kuř-et-e*	*kuř-at*	*hřbet-u*	*hřbet-ů*	*plat-u*	*plat-ů*
DATIVE	*kuř-et-i*	*kuř-at-ům*	*hřbet-u*	*hřbet-ům*	*plat-u*	*plat-ům*
LOCATIVE	*kuř-et-i*	*kuř-at-ech*	*hřbet-u*	*hřbet-ech*	*plat-u*	*plat-ech*
INSTRUMENTAL	*kuř-et-em*	*kuř-at-y*	*hřbet-em*	*hřbet-y*	*plat-em*	*plat-y*

The two other inflectional paradigms that were introduced in Table 1 in Section 1 are shown in the right part of the table to illustrate that the three-way allomorphy is item-specific, i.e. it affects only the gender-marking suffix (as we propose). There are two masculine nouns ('ridge' and 'wage'), which do not contain the gender-marking suffix, and hence do not display the three-stem variation: their stems end in [et] or [at], respectively, across all paradigm cells.

There are two main approaches to item-specific allomorphy, differing in whether they encode the form variation in the lexicon, i.e. in the lexical representations of particular lexical items, or in the phonology, i.e. via item-specific

phonological rules; see e.g. Bonet and Harbour (2012). In this paper we argue for the first, i.e. representational option, since it uses tools motivated independently of the empirical pattern considered in this article.

## 3.1 The vowel alternation: an ABA pattern

Let us first focus on the vocalic alternation which involves [e] in the singular and [a] in the plural. We account for it by Cyclic Phrasal Spellout and pointers, two tools used previously in the analysis of suppletive youngster terms. Our analysis of age suppletion is repeated in Figure 7. In a cyclic model of spellout, spellout always targets lower nodes before higher nodes. Lexicalization, which occurs here at every node, therefore targets KIND before AGE. In this model, the lexical entry of the suppletive root *tel* 'calf' lexicalizes the AGE projection and points to a different root, i.e. *tur* 'cattle.' This ensures that *tel* 'calf' will only be able to lexicalize the KIND projection if at an earlier cycle, *tur* 'cattle' has spelled out KIND. In other words, the lexical form /tel/ is associated with the same portion of the syntactic structure as the form /tur/ extended by an additional syntactic layer, i.e. AGEP.

< /tel/, AGEP >

     ⌒

AGE /tur/
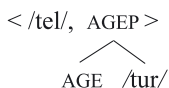
Figure 7: The lexical entry of the suppletive root tel.

We argue that the [e]-[a] alternation can be treated analogously. In particular, we propose that the vocalic alternants are lexically stored in two separate lexical entries which involve structural containment and pointers. The question then of course becomes whether the *e*-alternant points to the *a*-alternant or the other way around.

As has been illustrated in Table 9 above, the vocalic alternation is number-sensitive: the *e*-alternant appears in the singular part of the inflectional paradigm, and the *a*-alternant appears in the plural. The correspondence between the vowel and number is schematized in Figure 8. (The dental is enclosed in brackets to indicate that it alternates with zero in the *e*-variant of the suffix.)

-at ↔ PLURAL
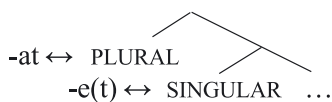
     -e(t) ↔ SINGULAR …

Figure 8: A correspondence between the stem-vowel and number.

The tree above assumes a decomposition of number into two hierarchically ordered projections, where SINGULAR is a proper structural part of PLURAL; see Vanden Wyngaerd (2018) or Smith et al. (2018) for arguments supporting this decomposition. Given the PLURAL > SINGULAR hierarchy, one might be tempted to conclude that the *a*-alternant of the suffix must point to the *e*-alternant, not the other way around. In other words, the *e*-initial suffix suppletes for plural number with an *a*-initial form. However, this scenario, reasonable at first sight, does not account for our previous finding that the alternating suffix is a gender (and not a number) marker.

We identified a correspondence between the vowel and number, as revealed in the inflectional paradigm. But what is the relationship between the vowel and gender? The scenario under which the *a*-alternant is a suppletive (i.e. plural) version of the *e*-alternant predicts that gender is lexicalized by the *e*-form. This prediction follows from combination of two hierarchies: the number hierarchy proposed in Figure 8 above and the NUMBER > GENDER hierarchy, which is widely accepted to be universal. Put together, the two hierarchies give the following structure: PLURAL > SINGULAR > GENDER. According to this hierarchy, if the *a*-alternant were to lexicalize PLURAL and point to the *e*-alternant, then the *e*-form should lexicalize not only SINGULAR but GENDER as well. This scenario is formalized by lexical entries in Figure 9.

a. < /-e(t)/, SGP >
          SINGULAR   GENP
                        |
                     GENDER

b. < /-at/,   PLP >
          PLURAL   /-e(t)/

Figure 9: Lexical entries of the stem suffixes: scenario 1.

The entry in Figure 9a associates the *e*-alternant with two syntactic projections, i.e. SGP and GENP, which, however, does not mean that the suffix /-e(t)/ always pronounces both of them. Realizational theories of morphology generally employ mechanisms allowing lexical items to appear in syntactic structures other than those exactly matching the structures specified in the lexical entries. In particular, Nanosyntax uses the Superset Principle in (2).

(2)   The Superset Principle (Starke 2009)
       A lexically stored tree L matches a syntactic node S iff L contains the syntactic tree dominated by S as a subtree.

Thus, according to the Superset Principle, the entry for the *e*-alternant in Figure 9a can pronounce either both SINGULAR and GENDER or only GENDER. To see how GENDER is

spelled out (in the absence of number) we must look at forms where gender is not merged with number. Recall that the suppletive scenario outlined in Figure 9 predicts that such "numberless" stems should contain the *e*-initial suffix. However, diminutives and relational adjectives in Table 10, which are regularly derived from numberless stems, show that this prediction is wrong. Both the diminutive suffix *-k* (in the first row) and the adjectival suffix *-ov* (in the bottom row) are attached to the *a*-initial, rather than the *e*-intital, suffix. (Note that the vowel [a] undergoes lengthening, which is a regular process triggered in diminutives, see Ziková [2018].)
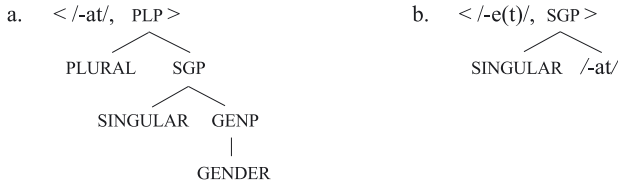
Table 10: The distribution of the a-initial suffix.

	'broom'	**'tomato'**	**'drawer'**
DIMINUTIVE	*košť-**át**-k(-o)*	*rajč-**át**-k(-o)*	*šupl-**át**-k(-o)*
RELATIONAL ADJ.	*košť-**at**-ov(-ý)*	*rajč-**at**-ov(-ý)*	*šupl-**at**-ov(-ý)*

The distribution of the suffix alternants across the PLURAL > SINGULAR > GENDER hierarchy is summarized in Figure 10. Here, the tree involves the non-contiguous ABA pattern in which two non-adjacent projections are syncretic: GENDER and PLURAL, i.e. the bottom and the top projections, are spelled out by the *a*-alternant of the suffix, the mid projection, i.e. SINGULAR, by the *e*-alternant.

PLURAL
/-at /

SINGULAR　GENDER
/-e(t)/　　/-at/
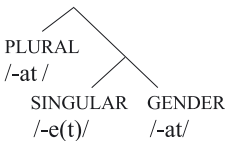
**Figure 10:** The ABA pattern: plural > singular > gender.

Non-contiguous syncretisms are generally rare, but not unattested. Vanden Wyngaerd (2018) shows that they can be derived by either pointers or by revising the Superset Principle. We argue for the first option, since pointers are motivated independently to express lexical relatedness among suppletive forms. In Figure 9 above, we proposed lexical entries in which the entry for the *a*-alternant contains a pointer to the entry for the *e*-alternant. Since this scenario does not bring us the correct results, we propose the opposite analysis, seen in Figure 11 below, according to which the *e*-alternant points to the *a*-alternant.

a.   < /-at/,   PLP >

```
              PLURAL     SGP
                      SINGULAR   GENP
                                    |
                                 GENDER
```

b.   < /-e(t)/,   SGP >

```
              SINGULAR   /-at/
```

Figure 11: Lexical entries of the stem suffixes: scenario 2.

Before showing how the lexical entries derive the distributional pattern depicted in Figure 10, we must explain three specific assumptions about the Spellout mechanism, as it is used in Nanosyntax. First, "Spellout" is not a synonym for "PF-activation" in Nanosyntax: it covers a complex of interface procedures, PF-activation being only one of them. In other words, even when we say that lexical forms are inserted into the syntactic structure, this does not mean that they are automatically shipped to PF to be computed phonologically. Furthermore, since lexical entries contain pointers to other entries, it follows that the spell out procedure must be able to track previously inserted lexical items. Finally, Spellout proceeds cyclically bottom-up, which means here that lexical insertion, regulated by the Superset Principle in (2), takes place after each application of the operation Merge (Starke 2018).
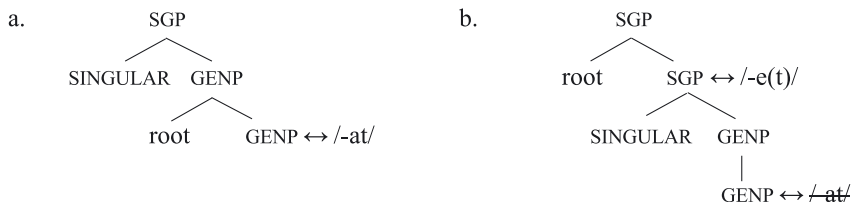
Having introduced the main principles of Phrasal Spellout, let us proceed to the derivation of the ABA pattern as shown in Figure 10. After the bottom projection of the PLURAL > SINGULAR > GENDER hierarchy (i.e. GENDER) is merged to the syntactic structure that is lexicalized by a particular root, the root moves to the Spec of GENP, as in in Figure 12. This allows GENP to be lexicalized by the suffix /-at/, whose entry in Figure 11a contains GENP as a proper part.

```
        GENP
      root     GENP ↔ /-at/
                  |
               GENDER
```
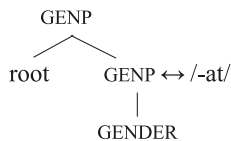
Figure 12: The spellout of the gender.
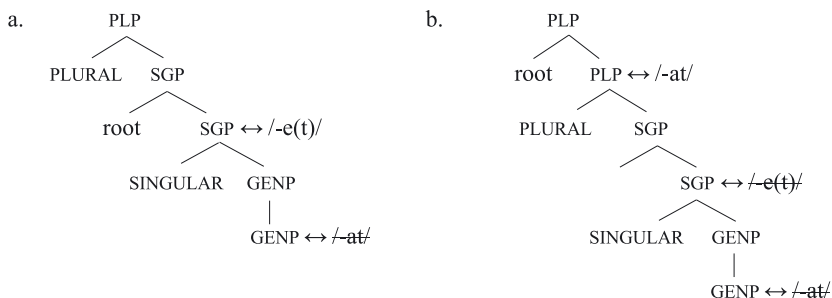
In the next step, the syntax merges SINGULAR. Since there is no lexical entry that would match the tree shown in Figure 13a, the root moves to the Spec of SGP in the tree in Figure 13b and the constituent containing only SINGULAR and GENDER is created.

This subtree exactly matches the entry in Figure 11b, which says "insert the form /-e(t)/ to SGP iff the previous spellout step used the form /-at/." In other words, the *e*-alternant overrides the *a*-alternant at SGP (which is indicated by a strikethrough).

a.

```
         SGP
        /    \
 SINGULAR   GENP
            /    \
         root   GENP ↔ /-at/
```

b.

```
         SGP
        /    \
     root   SGP ↔ /-e(t)/
            /    \
      SINGULAR  GENP
                  |
               GENP ↔ /-at/
```

Figure 13: The spellout of the singular number.

After the merger of the topmost feature of the hierarchy, i.e. PLURAL, the root again moves up in the tree in Figure 14a to the Spec of PLP in 14b. The constituent comprising both number features and gender perfectly matches the lexical tree of the suffix /-at/ already introduced in Figure 11a, and this suffix thus overrides the /-e(t)/ previously inserted at SGP, as is shown in Figure 14b.

a.

```
         PLP
        /    \
  PLURAL   SGP
           /    \
        root   SGP ↔ /-e(t)/
               /    \
         SINGULAR  GENP
                     |
                  GENP ↔ /-at/
```

b.

```
         PLP
        /    \
     root   PLP ↔ /-at/
            /    \
       PLURAL   SGP
                /    \
              SGP ↔ /-e(t)/
              /    \
        SINGULAR  GENP
                    |
                 GENP ↔ /-at/
```

Figure 14: The spellout of the plural number.

To conclude, the contextual allomorphy that accounts for the [e]-[a] alternation follows from the lexical storage of the variants of the stem-building suffix. We propose that the alternants are stored in separate lexical entries, related through a pointer. In particular, the entry of the *e*-alternant contains a pointer to the entry of the *a*-alternant, which, expressed in traditional terms, means that the suffix /-e(t)/ is a suppletive form of /-at/. This enables us to derive the ABA pattern in which /-at/ is distributed across two non-adjacent syntactic projections interrupted by /-e(t)/.

3.2 Consonant alternation: lexically floating segment

The second alternation found in the *chicken* paradigm involves a dental *t* that alternates with zero in the singular. The *t*-zero alternation pattern is shown in the first column in Table 11: the stem is *e*-final in the nominative and accusative and *t*-final elsewhere.

Table 11: A comparison of singular paradigms: the t-zero alternation is not automatic.

	'chicken' SG	'ridge' SG
NOMINATIVE	*kuř-e*	*hřbet*
ACCUSATIVE	*kuř-e*	*hřbet*
GENITIVE	*kuř-et-e*	*hřbet-u*
DATIVE	*kuř-et-i*	*hřbet-u*
LOCATIVE	*kuř-et-i*	*hřbet-u*
INSTRUMENTAL	*kuř-et-em*	*hřbet-em*

A comparison of the two singular paradigms in the table demonstrates that the *t*-zero alternation in the *chicken* paradigm is item-specific: it is not the case that any [t] alternates with zero in the nominative and accusative forms. Being item-specific, the *t*-zero alternation must be encoded lexically, just like the *a-e* alternation. However, we argue that these are encoded by different means: the *a-e* alternation is encoded suppletively in two separate lexical forms, the *t*-zero alternation, on the other hand, arises from regular phonological computation applied to a single lexical form. In other words, we propose that there is a single suppletive suffix /-e(t)/ which surfaces as [e] or [et] depending on its phonological context.

Above, we have described the distributional pattern in morphosyntactic terms: the suppletive suffix ends in [e] in the nominative and accusative case and in [t] in the rest of the cases. However, there is an obvious correlation between the surface form of the suffix and how the case features are marked phonologically. The correlation is as follows: the suffix surfaces as *e*-final in the zero-marked nominative and accusative and as *t*-final before overt case endings that include the genitive *-e*, the dative/locative *-i* and the instrumental *-em*. To capture the fact that the *t*-zero alternation is not entirely arbitrary with respect to the phonological context, we will assume that it is encoded phonologically, i.e. in the lexical phonological structure of the suppletive suffix.

Consonant-zero alternations like the one observed for the suffix /-e(t)/ are well documented cross-linguistically. A classic example is liaison consonants in

French, which are not realized word-finally unless they are followed by a vowel-initial word. For example, a quantifier 'every' surfaces as *t*-final before a vowel-initial *ami*, i.e. *tout ami* [tutami] 'every friend,' but not before a consonant-initial *garçon*, i.e. *tout garçon* [tugaʁsɔ] 'every boy.' An additional parallel is that in both languages, the alternation is item-specific. This means that only some morphemes alternate in this way. In French, *tout* 'every' alternates between vowel-final and consonant-final, but e.g. *cher* 'dear' surfaces as consonant-final in both contexts, i.e. *cher ami* [ʃeʁami] and *cher garçon* [ʃeʁgaʁsɔ]. An analogous bifurcation in Czech has been shown in Table 11.

There is a well-established tradition in autosegmental phonology of marking liaison consonants lexically as floating segments which are realized only when the phonology associates them with prosodic structure; see e.g. Tranel (1995). Following this tradition, we propose that the suppletive suffix /-e(t)/ is stored with a floating dental. The dental is not realized in the zero-marked nominative/accusative forms, because there is no empty C-slot available to which the lexically floating *t* could dock. The structure of the zero-marked case forms is depicted in Figure 15a. In the rest of the singular cases, the suffix /-e(t)/ is followed by vowel-initial endings, i.e. -*e* (genitive), -*i* (dative/locative), and -*em* (instrumental). Since prosodic structure is made up from strictly alternating C-slots and V-slots (Scheer 2004), there is therefore an empty C-slot in the overtly-marked singular forms, which intervenes between the V-slot occupied by a case-marking vowel and the V-slot hosting the mid-vowel of the suppletive suffix. This empty C-slot (in the box in Figure 15b) thus provides a room for the linking of the floating *t*.

Figure 15: The floating consonant of the stem-building suffix.

In sum, the proposed analysis of the *e-et* variation involves the notion of floating melodic structure. Although whether a consonant is floating is lexically encoded, it is not a diacritic. It exploits both autosegmental representations and regular phonological computation. This approach allows for a uniform handling of other instances of consonant-zero alternations in nominal paradigms, that are traditionally considered irregular. What we have in mind are nouns of Greek origin like *drama* 'drama', *téma* 'theme' or *sperma* 'sperm' in Table 12. We can see that these nouns show a similar stem allomorphy as nouns of the *chicken* paradigm: the stem appears as consonant-final before overt case markers and vowel-final in the zero-marked nominative and accusative singular forms. If these nouns are stored

Table 12: Three singular paradigms involving the t-zero alternation.

	'drama' SG	'theme' SG	'sperm' SG
NOMINATIVE	*drama*	*téma*	*sperma*
ACCUSATIVE	*drama*	*téma*	*sperma*
GENITIVE	*dramat-u*	*témat-u*	*spermat-u*
DATIVE	*dramat-u*	*témat-u*	*spermat-u*
LOCATIVE	*dramat-u*	*témat-u*	*spermat-u*
INSTRUMENTAL	*dramat-em*	*témat-em*	*spermat-em*

with floating consonants, the distributional pattern arises automatically: the regular phonology associates the floating consonant word-internally, but not word-finally.

4 Conclusions

In this paper, we have investigated allomorphic variation of three-stemmed nouns in Czech. We have argued that the three-stem pattern arises via a suffix which is a portmanteau of gender and number. The suffix has two allomorphs, /-at/ and /-e(t)/, that are stored as separate lexical entries. We have accounted for their distribution in terms of Nanosyntax (Starke 2009). In particular, we have proposed that the default allomorph /-at/ lexicalizes a syntactic phrase consisting of a neuter gender and two number features; singular and plural. In the singular, the default allomorph is overwritten by the suppletive allomorph /-e(t)/, that is specified for spelling out singular number. This suppletive allomorph is stored with a floating consonant that surfaces word-internally, but not word-finally due to regular phonological computation.

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