Modeling declensions without declension features. The case of Russian

Pavel Caha
Masarykova univerzita

Abstract

This paper presents an analysis of the Russian declension in Nanosyntax (Starke 2009, 2018). The analysis has two theoretically important features. First, it makes no reference to language-particular declension features. This allows one to maintain the idea that morphosyntactic features are drawn from a set provided by the UG, i.e., language invariant. The analysis also does not use contextual rules. In order to correctly pair the right ending with a particular root, the analysis only relies on specifying each marker for the features it spells out. The correct pairing of roots and affixes falls out from such a specification and the Nanosyntax model of spellout.

Keywords: Nanosyntax; declension; Russian; morphology; syntax

1 The arbitrary nature of declensions

Let me start by introducing two Russian nouns, namely 'snowstorm' and 'week.' Their roots are given in (1).

(1) Russian
   a. *metel'*- 'snowstorm'
   b. *nedel'*- 'week'

What is interesting about the two nouns is that "both of these are feminine, and both have a stem ending in a soft consonant, but they decline differently" Corbett (1982). Their differing declensions are illustrated in (2) and (3), where I list the nominative and the instumental singular respectively.

(2) The nominative

a. metel'-**Ø** (snowstorm)
b. nedel'-**a** (week)

(3) The instrumental

a. metel'-**ju** (snowstorm)
b. nedel'-**ej** (week)

The issue is that there is nothing in the two nouns (be it their phonology, morphology or semantics) that would allow us to understand why the root *nedel'-* takes one ending in INS, while *metel'-* takes a different one. The difference in the endings is therefore arbitrary, and has to be somehow stated on top of the information that the roots have a certain phonology, belong to a certain gender and refer to a particular thing.

The way this is usually stated is by assigning roots into declensions with arbitrary labels I-IV, though the labels differ in different accounts. In the numbering I adopt (Corbett 1982), the noun *nedel'-* belongs in Declension II, while the noun *metel-'* belongs in Declension III. The singular paradigms of the two declensions are depicted side by side in (4), using the nouns *gub-a* 'lip' and *tetraď* as the representatives of each declension.

(4) The singular of declensions II and III (Timberlake 2004)

	lip II (FEM)	notebook, III (FEM)
NOM	**gub-a**	**tetraď-Ø**
ACC	gub-u	tetraď-Ø
GEN	gub-y	tetraď-i
LOC	gub-e	tetraď-i
DAT	gub-e	tetraď-i
INS	**gub-oj**	**tetraď-ju**

The point of the table is to show that the difference in the nominative and in the instrumental (which are in bold) is not an isolated fact; it is a pervasive property of the paradigm that the two classes of nouns combine with different endings throughout the declension.[1]

Russian has in total four declensions. The remaining two are given below in (5). These show a difference in the nominative and in the ac-

[1] The INS ending *-ej* in (3b) is a phonologically conditioned allomorph of *-oj* in (5), where *-ej* appears after soft consonants, *-oj* after hard consonants. Since the alternation between *o/e* is phonologically conditioned and regular across multiple environments, I treat this as a regular phonological process (orthogonal to the issue of declension).

cusative, but the oblique cases are the same, as the shading indicates. This is interesting in that this seems to suggest that declension class differences may be present in some cases, but obliterated in others, and any account of declension classes should take this into account.

(5) Declensions I and IV (Timberlake 2004)

	factory I (MASC)	place IV (NEUT)
NOM	zavod-Ø	mest-o
ACC	zavod-Ø	mest-o
GEN	zavod-a	mest-a
LOC	zavod-e	mest-e
DAT	zavod-u	mest-u
INS	zavod-om	mest-om

For completeness, I also list the plural forms in (6), although the analysis of the plural will remain outside of the scope of this article. The plural declension (on the whole) reinforces the need to allow individual endings to appear in multiple declensions, since the endings in the LOC, DAT, INS are the same for all nouns.

(6) Declensions I-IV, plural (Timberlake 2004)

	factory I (MASC)	place IV (NEUT)	lip II (FEM)	notebook, III (FEM)
NOM	zavod-y	mest-a	gub-y	tetraď-i
ACC	zavod-y	mest-a	gub-y	tetraď-i
GEN	zavod-ov	mést-Ø	gub-Ø	tetraď-ej
LOC	zavod-ax	mest-ax	gub-ax	tetraď-ax
DAT	zavod-am	mest-am	gub-am	tetraď-am
INS	zavod-ami	mest-ami	gub-ami	tetraď-ami

1.1 Declension features

Let me now turn to the issue how differences in declension class are encoded theoretically. To have a concrete example to work with, let me come back to the instrumental. The specific question to be addressed is what forces the grammar to generate the words in (7), rather than the

hypothetical words in (8), where the endings are swapped.

(7) The correct instrumental
- a. metel'-**ju** (snowstorm)
- b. nedel'-**ej** (week)

(8) The wrong instrumental[2]
- a. *metel'-**ej** (snowstorm)
- b. *nedel'-**ju** (week)

The standard approach to this issue is to assign an arbitrary index II and III to the roots, see (9).

(9) Roots carry declension features
- a. metel' $\Leftrightarrow$ [FEM, II]
- b. nedel' $\Leftrightarrow$ [FEM, III]

The endings are then specified for the case they pronounce (the instrumental), and they contain (in addition) a contextual restriction. The contextual restriction says that the relevant endings can only be used in the context of a Class II noun (*-ej* in (10a)) or a Class III noun (*-ju* in (10b)).

(10) Endings are specified for the context of insertion
- a. **ej** $\Leftrightarrow$ INS / _ [III]
- b. **ju** $\Leftrightarrow$ INS / _ [II]

The (arbitrary) features on the roots and the contextual restriction of the endings are the two tools that current theories use to generate the correct pairings of roots and affixes in (7), and, at the same time, rule out the incorrect pairings in (8) (see, e.g., Halle 1997, Halle & Vaux 1998).

An analysis along these lines has been applied to Russian by Müller (2004) (cf. Alexiadou & Müller 2008). What Müller proposes in addition is that declension classes on nouns are not primitive entities, but decompose into two equipolent features, namely [+/-α] and [+/-β], see (11).

(11) Müller (2004)
- a. I: [+α, −β]
- b. II: [−α, +β]
- c. III: [−α, −β]
- d. IV: [+α, +β]

The reason why Müller proposes to decompose the Class features I-IV is

[2]The form *nedel'-ju* would be acceptable as an accusative, but not as an instrumental.

that this allows him to capture syncretism in between classes; recall, for instance, table (5) showing that declensions I and IV have the same endings in most cases. The decomposition in (11) is intended to capture this by proposing that the two declensions share the feature $[+\alpha]$. An ending specified for this feature as its contextual restriction will naturally appear in both classes that have this feature.

The important point for now is that underlying the proposal is the very same logic as described at the beginning: tag the roots with arbitrary class features and make the endings sensitive to those features. According to Müller, "[i]nflection class features are arbitrary and irreducible by definition; this is reflected in the labels. Still, it is worth emphasizing that the features $[+/-\alpha]$, $[+/-\beta]$ are no more arbitrary than standardly adopted features like [class I], [class II]."

1.2 Arbitrary features vs. UG

Arbitrary class features are theoretically interesting entities, because they have implications for the architecture of grammar. Taking first a narrowly morphological perspective, a traditional architectural question in morphology is which words should be decomposed into component parts, which should not be, and how we can tell. For instance, should the past tense of *go* – namely *went* – be decomposed into an irregular root *wen-* and a non-productive past tense *-t*? Should the plural *children* be decomposed into an irregular root *child(r)-* and an irregular plural *-(r)en*?

Some approaches argue for full decomposition in such cases (see, e.g., Stockall & Marantz 2006). Others propose that morphological decomposition is justified only when we can productively combine the pieces together. Blevins (2016:69-73) mentions specifically Russian declension as a case where it is impossible to combine roots/stems productively with the correct ending. According to Blevins, the need to introduce arbitrary declension features is nothing but a blatant admission of this fact. According to him, such diacritic features cannot be treated like regular properties of lexical items analogous to 'plural.' Rather, they are "assembly instructions" in disguise, masquerading as properties of lexical items.

An even broader issue can be linked to the ontological status of such features. For example, as Chomsky (2001) observes, the faculty of language "FL appears to be a species property, close to uniform across a broad

range. It has a genetically-determined initial state S_0, which determines the possible states it can assume. [...] S_0 determines the set {F} of properties ("features") available for languages."

Clearly, arbitrary declension features like [I, II] or [+/-α] are not among those. So the need to postulate such features significantly weakens our theory of grammar: by postulating declension features, we implicitly claim that grammars do not rely only on the set of features determined by UG, but also on language-specific features. This in turn weakens the degree to which the "genetically-determined initial state S_0" actually restricts the shape of surface grammars.

The idea that UG relies on a language-invariant feature set has been recently advocated also in Cinque (2013). Specifically, Cinque stresses "the observation that of all the concepts and distinctions that populate our system of thought only a fragment receives a grammatical encoding in the languages of the world, arguably the same in all languages. [...] Most cognitive concepts and distinctions do not find any such encoding. [...] Verbal projections in clauses grammatically encode (through affixes, particles, auxiliaries, etc.) distinctions relating to the external and internal temporal constituency of events (tense and aspect) and the speaker's attitude toward the truth of the proposition (mood), but they are never found to grammatically encode such human cognitive universals as "shame", "mourning", "sexual taboos", etc." Such facts make declension features even more remarkable: why is it that grammars do not allow for features related to cognitive universals, while allowing for a feature like [+/-α]?

The positions entertained by Chomsky and Cinque are, of course, controversial, and some of that controversy relates precisely to language-particular categories like the Russian declension class. For example, Haspelmath (2007) says: "descriptive linguists still have no choice but to adopt the Boasian approach of positing special language-particular categories for each language. Theorists often resist it, but the crosslinguistic evidence is not converging on a smallish set of possibly innate categories" (p. 119). Arbitrary declension classes I, II, etc. are clearly an instance of language particular categories that need to be posited in our descriptions. They are therefore a relevant piece in the puzzle that we must consider in order to be able to address the larger question: what is the relationship between language particular classes and the invariant set of features? Is the existence of declensions compatible with a universal set of features at all?

In this article, I put forth one specific proposal as to how we can elim-

inate declension features while still accounting for the existence of declension classes. If this attempt turns out to be successful, it represents a small (but meaningful) step on the path towards a restrictive (or even contentful) theory of UG.

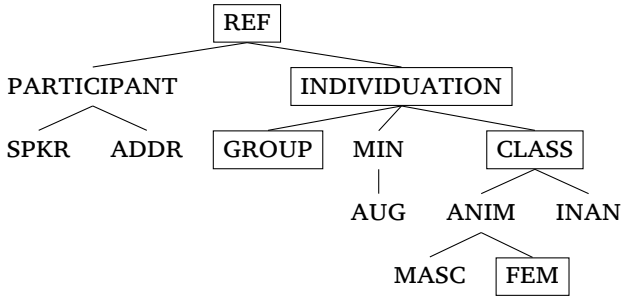
2 An alternative to declension features

The model I shall explore here has two major components. The first component is the morphosyntactic structure underlying nouns. What features are present? How are they arranged? I tackle this in Section 2.1. The second component concerns spellout. How do the underlying feature structures map onto specific exponents? This issue will be picked up in 2.2.

2.1 Features and hierarchies

The features I adopt in my analysis come from the cross-linguistic study of pronominal systems by Harley & Ritter (2002). The paper studied the formal distinctions expressed by pronouns in 110 languages. The study finds that the distinctions between various persons, numbers and genders are expressible in terms of the feature hierarchy depicted in (12).

(12)



In my proposal, I am going to rely on a subset of these features to model the Russian declension. The specific features I shall use are placed in rectangles. The main reason for using these features (and only these features) is to make sure that I avoid using features that are language specific. This is important in order to reach the desideratum, which is showing that it is possible to rely on universal features only and still account for (language-specific) declension classes.

The second reason for using the features in (12) is that nouns often mirror the grammatical categories of 3rd person pronouns (and *vice versa*). For instance, looking at Russian 3rd person pronouns, we see that they show very much the same distinctions as nouns: they fall into three genders (like nouns), they have a singular and plural (like nouns) and they exhibit the same set of case distinctions. Under the approach I adopt here, nouns and pronouns thus have the same grammatical features and differ mainly in that nouns have an encyclopedic content (concept) associated to them, while pronouns lack it.

The features used by Harley and Ritter are privative. Their presence indicates the presence of a particular grammatical meaning, the absence of the feature indicates the absence of that meaning.

The top-most node of the tree is labelled REF. This feature encodes the fact that pronouns are referential expressions: they always include this feature. I will assume that this feature is present also in nouns, and it is what distinguishes nouns from other lexical categories. This idea is reminiscent of Baker (2003), who proposes that nouns are distinguished by bearing a referential index.

The features below REF are organized into two branches. On the left branch, there are person/number features. When present, they distinguish various types of first and second persons from each other. Their absence is characteristic for 3rd person pronouns. Since I am not interested here in 1st/2nd person expressions, these features are irrelevant for my analysis and I will not use them.

Moving on to the right branch of the tree (12), we find here information related to number and gender. Let me begin by number. The INDIVIDUATION node (IND) is a default number node. On its own, it yields singular interpretation. When further number features are present (these are below IND on the left branch), they influence the number interpretation. For example, when the feature GROUP is present, this yields plural interpretation. The features AUGmented and MINimal are used for special numbers (dual, paucal). These two are not relevant for my analysis and I will not use them.

The right-hand branch under the INDIVIDUATION node encodes gender. Russian has three genders (neuter, feminine, masculine) and it has an animate/inanimate distinction for masculine nouns. I will set animate nouns aside in my analysis and focus only on inanimate nouns.

It turns out that in order to account for inanimate declension classes

in Russian, it is enough to distinguish only two genders, where feminine nouns form one class, and the neuter and masculine nouns belong to a second class. This is not to say that the Russian grammar does not distinguish between masculine nouns and neuter nouns in terms of features, but it is to say that the declension endings are oblivious to this distinction (as we shall see in the course of the discussion). In order to use as few features as possible, I will only use two of the gender features proposed by Harley and Ritter. Specifically, nouns of all genders will be given the feature CLASS, while feminine nouns add the feature FEM.[3]

In (13) and (14), I summarize the relevant features. In (13), I give my assumptions about number, in (14), I list the minimal amount of gender features that are necessary for my analysis.

(13) Number
   a. [IND] = singular
   b. [IND + GROUP] = plural

(14) Gender
   a. [CLASS] = masculine and neuter
   b. [CLASS + FEM] = feminine

In addition, I will need to rely on a number of case features. For the time being, I will use a single case feature K as a stand in for the nominative case, see (15a). I shall introduce additional case features in section 3.2.

(15) Case
   a. [K] = nominative
   b. [K + ???] = other cases, to be determined

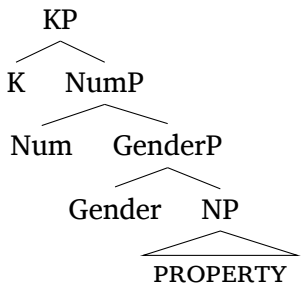
Following Harley & Ritter (2002), I shall be further assuming that the features laid out in (13) to (15) are structured. As for the specifics of such a structure, I am going to diverge from their proposal in several ways. Before I highlight the differences, let me say the following: the main reason why I am going to use a different structure is that this alternative structure will allow me to explain how declension classes work, while at the same time using an independently proposed theory of spellout. It is, however, possible that declension classes can also be understood without altering

[3]The analysis will be compatible with Russian having three genders. I return to this in 4.4.

the structure. As to whether that is possible or not remains to be seen: the point I want to make is that there is a way of structuring these features such that an account of declension emerges without the need to introduce declension features.

Another general point is that while the structures I propose are motivated by the desire to provide a coherent proposal for declension classes, the structures are not *ad hoc*. They have both an internal logic and a relationship to the existing literature on the topic. The essence of my proposal is depicted in the structure in (16). At the bottom of this structure, we have the NP node that traditionally hosts the noun root. The NP node denotes a property that the referent of the noun has. Above the noun, we have the projections of gender, number and case respectively.

(16)



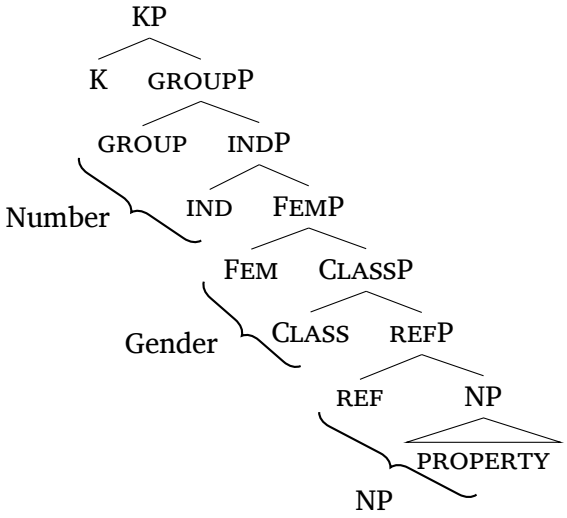
The lower part of the structure – with number and gender above the NP – can be traced back at least to work by Picallo (1991), and a version of it is also used more recently in Kramer (2015:43). Although the proposals differ in detail, both Picallo and Kramer converge on the idea that gender corresponds to a head that is syntactically independent of the noun root. Both approaches also consider gender to be a separate head from number, and both approaches place the number head higher than gender.

Similarly, whenever K is proposed to exist as an independent head, there is agreement that this head is high up in the noun phrase, definitely above number and quite likely also above D (which itself is higher than Num, see, e.g., Bittner & Hale 1996, Bayer et al. 2001, Kloudová 2020).

Now a specific property of my proposal is going to be that rather than locating gender/number features *inside* the heads in (16), I am going to rely on an approach where each such feature is an independent head. This leads me to adopt the tree in (17) as a 'split-XP' version of (16). The features that we see in (17) are exactly the same features as used by Harley and Ritter, and they are abstractly grouped into sets that represent the

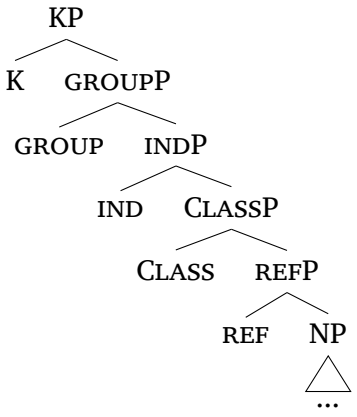
traditional division of the NP into its 'lexical' part (at the bottom), and then gender, number and case on top.

(17) The full structure (FEM.PL)

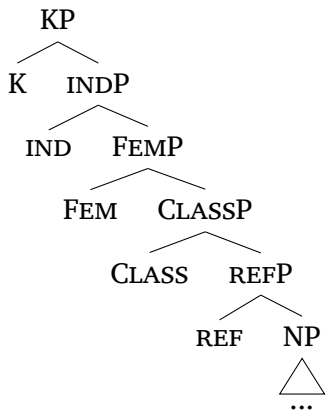


As in the original proposal by Harley & Ritter (2002), the features are privative. This means that they can be present or absent. The tree in (17) contains the maximal number of features, and corresponds therefore to the feminine plural. However, some of the features may be missing. For example, if the FEM head is missing, we get a non-feminine noun, i.e., either a masculine noun or a neuter plural, see (18). If the GROUP feature is missing, we get a feminine singular structure, as in (19).

(18) A masculine/neuter noun



(19) A feminine singular noun

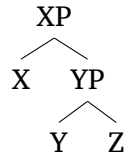


2.2 Phrasal spellout

In addition to the structures explored above, I will rely on phrasal spellout as the second ingredient that allows for the elimination of declension features. The specific approach to phrasal spellout I adopt has been developed within the Nanosyntax framework (Starke 2009, 2018, cf. Baunaz & Lander 2018, Taraldsen 2019, Caha 2020). This section describes my assumptions about spellout in detail. Since I motivate the spellout principles independently of the empirical topic of declension, the section is a digression on the path. Therefore, readers who are familiar with the Nanosyntax should proceed directly to Section 3.

I start by introducing the basic concepts. Phrasal spellout refers to a situation where a full syntactic phrase containing multiple terminals – such as the one in (20) – is pronounced by a single lexical item. This can be depicted as in (21). The circle indicates that the relevant phrase (containing the features X, Y and Z) has been pronounced by a single marker inserted at the top node. The phonology of the marker is placed below the circle.

(20)



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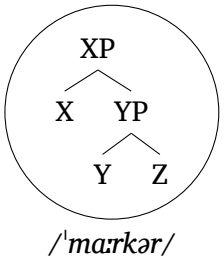


Let me now describe in more detail how phrasal spellout works. To have a concrete case to work with, I shall look at the three singular-plural pairs given in (22). Accounting for these three pairs will allow me to showcase most of the tools we shall need for the analysis of the Russian declension.

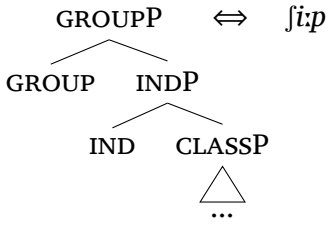
(22) English plural

a. sheep — sheep (syncretism)
b. mouse — mice (suppletion)
c. cat — cat-s (affixation)

Each pair features a different type of a morphological relation between the singular and plural. In (22a), we find syncretism. In (22b), we have suppletion. Finally, in (22c), the plural has an extra affix.

Let me now show how the three different cases are treated in Nanosyntax, beginning with (22a) (*sheep*). The starting point of my analysis is the observation that this noun has no ending in the plural. The lexical entry for this item is therefore construed in a way that it pronounces all the features contained inside the plural. What are these features? According to the proposal (17), the plural structure has two number features, IND and GROUP. I am further assuming that the noun *sheep* has a CLASSP below the number features, but no FEM. The lexical entry therefore looks as in (23).

(23)



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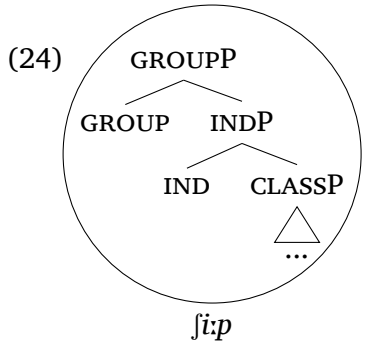
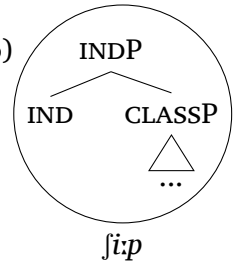


As a result, when syntax builds the relevant constituent corresponding to the plural, as in (24), this constituent can be pronounced using the lexical entry of *sheep*. The specific principle which determines when a lexical item matches a syntactic structure is called the Superset Principle, see (25).

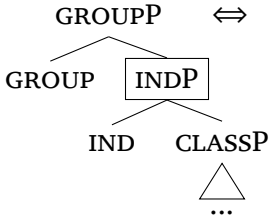
(25) *Superset Principle* (Starke 2009)
A lexically stored tree L matches a syntactic node S iff L contains the syntactic tree dominated by S as a subtree.

The principle says that matching obtains when the tree built by syntax is fully contained inside the tree stored in the lexical item. This is obviously the case in (24). However, matching also obtains when syntax builds only the tree associated to the singular, such as the one in (26).

(26)



(27)



The tree in (26) is also contained in the lexically stored tree for *sheep*. The entry is repeated for convenience in (27), and the relevant constituent is marked by a rectangle in the lexical entry. As a result, the singular structure is also spelled out as *sheep* and we get the same spellout for singular as we did for plural. This is the intended consequence of matching based on the Superset Principle.

In this paper, I shall be using the so-called lexicalization tables to encode the result of spellout. A lexicalization table for the singular and for the plural of *sheep* looks as in (28).

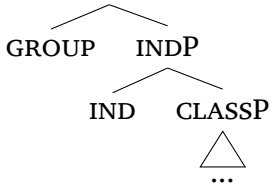
(28)

	CLASSP	IND	GROUP
'sheep,' SG	sheep		
'sheep,' PL	sheep		

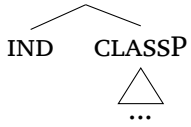
In the header of the table, the grammatical features are given. The rows depict how they are spelled out. The first row of the table depicts the spellout of the singular. The singular has only two components: CLASSP and IND. The shading indicates that both of these are spelled out by *sheep*. The second row depicts the plural, which has three components. All three of them are once again pronounced by *sheep*, as indicated by the shading.

Let me now turn to the pair *mouse* – *mice*. What we need for such cases is to have a pair of lexical entries as in (29) and (30).

(29) GROUPP ⇔ *maɪs*



(30) INDP ⇔ *maʊs*



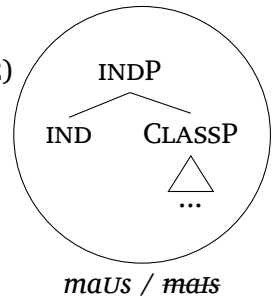
When syntax builds the tree corresponding to the singular, both lexical items match, because they both contain INDP. When two lexical items match, they compete for insertion. The winner of the competition is determined by the Elsewhere condition (going back at least to work by 1973). I give the Elsewhere Condition in (31).

(31) *The Elsewhere Condition*:
When two entries can spell out a given node, the more specific

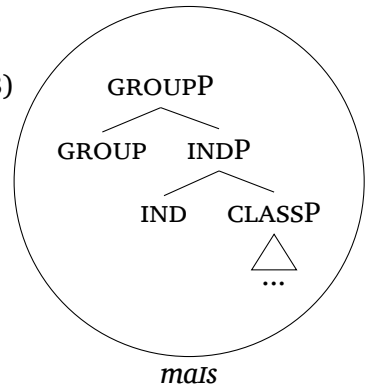
entry wins. The more specific entry is the one which has fewer features.

In the case at hand, this means that *mouse* wins over *mice* in the singular. This is depicted in (32) under the circle, where *mice* (as a losing candidate) is placed under a strike-through. The spellout by *mouse* wins, and the singular therefore comes out correctly as *mouse*.

(32)



(33)



In the plural, see (33), only *mice* is a candidate. *Mouse* does not contain GROUP inside its specification, and it therefore cannot spell out the relevant phrase.The lexicalization table for the pair *mouse* – *mice* looks as in (34). The difference in the shading gradient highlights the fact that the singular and plural are spelled out by different lexical entries.

(34)

	CLASSP	IND	GROUP
'mouse,' SG	mouse		
'mouse,' PL	mice		

When I come back to the Russian declension, I shall be mainly using lexicalization tables like the one in (34). However, I want to make it clear that these tables arise as a result of a spellout algorithm that operates over trees (rather than stretches of cells, like in (34)).

Let me now turn to the regular plural *cat-s*. The new thing here is that the plural is bi-morphemic. To account for this, I need to introduce some more background. The first assumption is the idea that spellout is cyclic. I state this in (35).

(35) *Cyclic phrasal spellout.*

> Spell out must successfully apply to the output of every Merge F operation. After successful spellout, the derivation may terminate, or proceed to another round of Merge F.

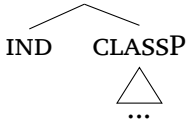
Cyclic spellout entails that as soon as a particular phrase is constructed by syntax (such as the singular structure in (32)), spellout must apply to the top node and find a matching entry for that node. We know that the spellout procedure does indeed find a matching item for (32). In fact, it finds two: both *mouse* and *mice* match. After competition, *mouse* is selected as the winner.

This, however, does not lead to an immediate pronunciation. If we want to add more features, the system does not send the winner to PF as yet, but rather proceeds to further merging. For instance, if we want to derive the plural, the singular structure (32) is subject to further Merge. The GROUP feature is added, and spellout must apply again to the top node, as in (33). As the diagram shows, spellout is again successful in (33), because the lexical item *mice* provides a match. It is important to note at this point that if we find a match for a particular node, this match (*mice*) replaces any items matching lower nodes, specifically the original spellout *mouse* obtained at the INDP mode. This is called Cyclic Override.

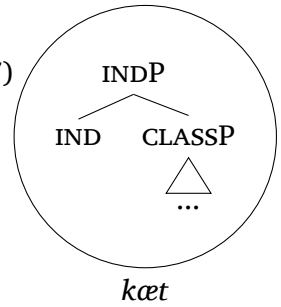
If there are no more features to be added, the derivation terminates and the spellout *mice* is sent to PF (else the derivation continues by adding more features).

Let me now come back to the singular-plural pair *cat* – *cat-s*. The main idea behind its analysis is that the root *cat* cannot spell out the full plural structure and that is why a suffix shows up in the plural. We can encode this by saying that the root is only specified as INDP, see (36). This lexical entry allows the root to spell out the relevant constituent on its own, see (37), but the root won't be able to spell out the plural GROUPP. This is correct, because GROUPP is not pronounced as *cat*; it is pronounced *cat-s*.

(36) INDP ⇔ *kæt*

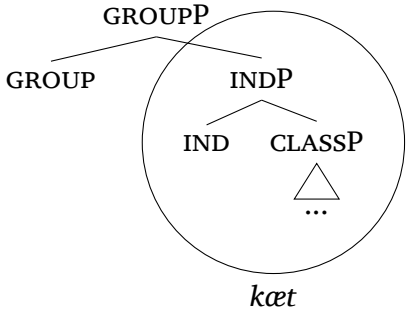


(37)

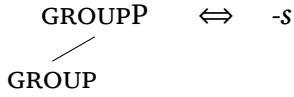


Now recall that the procedure is set up in a way that if no more features are added, the INDP (corresponding to the singular) would be pronounced as *cat*. If plural reading is intended, the GROUP feature must be added. The stage of the derivation where GROUPP is formed by merging GROUP to (37) is shown in (38). The root *cat*, as given in (36), does not contain this structure, and therefore, it cannot spell out the GROUPP in (38). The problem here is that the lexical entry for *cat* does not contain the feature GROUP and its projection GROUPP. These two nodes thus remain without spellout in (38). The plural marker *-s* will thus have to be introduced to spell them out. Its entry is as given in (39).

(38)

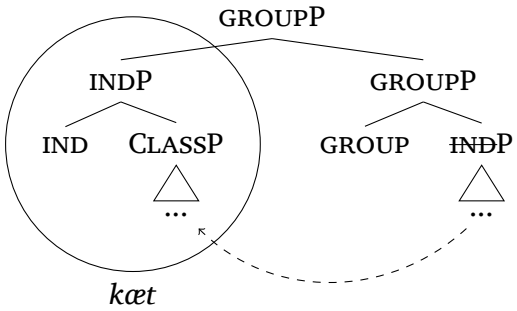


(39)



However, even though the plural marker is specified for exactly those structural components of (38) that the root *cat* cannot spell out, the lexical item also cannot apply to the full phrasal node GROUPP in (38). This is because the entry for *-s* does not contain this node in its entirety (it contains only one of its daughters, namely the feature GROUP). Therefore, in order to achieve successful spellout at GROUPP, INDP has to evacuate, as in (40).

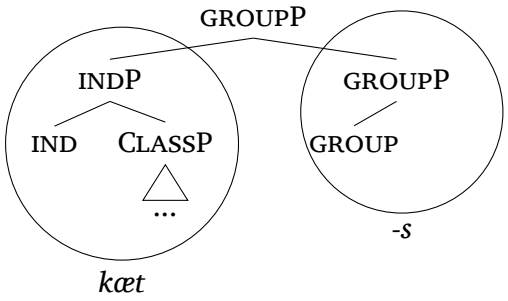
(40)



After this movement, (which renders the extracted INDP irrelevant for

matching) the GROUPP can be spelled out by *-s* without any problems, see (41):

(41)



The final question we must address is why INDP moves. In Nanosyntax, this movement is triggered by the so-called spellout algorithm (see Starke 2018, c.f. De Clercq & Vanden Wyngaerd 2017, Caha et al. 2019, Vanden Wyngaerd et al. 2020). The algorithm is given below.

(42) Spellout Algorithm (based on Starke 2018)

a. Merge F and spell out.
b. If (a) fails, move the Spec of the complement and spell out.
c. If (b) fails, move the complement of F and spell out.

The algorithm at its core implements the idea of cyclic spellout: the initial clause says that we always Merge a feature F and we try to spell out the phrase we have created, see (42a). (42b,c) are new, and they tell us what happens when spellout fails, describing two types of rescue movements: namely Spec movement (42b) and complement movement (42c).

Consider how the algorithm applies to (38). Its first step, namely (42a), tells us that we should try to find a match for this phrase. However, recall that there is no matching item for the full phrase. As a consequence, the option (42b) is considered. The clause says that we should try to move the Spec of the complement. This will be relevant later, but in the case at hand in (38), the complement has no Spec. Therefore, this step is irrelevant and leads to no movement. As a consequence, we proceed to (42c). This clause says that we should try to move the whole complement of the newly added head, which is precisely the tree we saw in the tree (41). In this tree, the spell out of GROUPP succeeds and the derivation either terminates (if there are no more features), or it proceeds to the next cycle of Merge.

The lexicalization table for the pair *cat* – *cat-s* is given in (43). The new

thing is that the spellout of the plural form has two morphemes, where each morpheme is responsible for pronouncing a part of the features.

(43)

	CLASSP	IND	GROUP
'cat,' SG	cat		
'cat,' PL	cat		*s*

To summarize: the model I assume (Nanosyntax) allows that morphemes – including root morphemes – spell out phrasal constituents. Different morphemes may be lexically specified for a different number of features. For example, some roots (like *sheep* or *mice*) spell out the plural feature GROUP. As a result, they need no affix in the plural. Other roots (*cat*) are specified only as INDP and cannot spell out the GROUP feature. These nouns need a special suffix in the plural (*-s*), which spells out GROUP. The division of labor between roots and suffixes is governed by the spellout algorithm, which implements the idea of cyclic spellout and spellout-driven movement. The result of the lexicalization procedure can be depicted as a lexicalization table where individual morphemes are placed under the features they spell out.

3 Declension as a function of root size

Recall now from (2) that one of the basic contrasts we are trying to derive is the one given in (44) and (45). What we see in (44) is that a Declension III noun 'snowstorm' has no audible ending in NOM.SG, while the Declension II noun 'week' has an *-a*. What we see in (45) is that in the instrumental, each noun simply has a different ending.

(44) The nominative

a. metel'-**Ø** (snowstorm)
b. nedel'-**a** (week)

(45) The instrumental

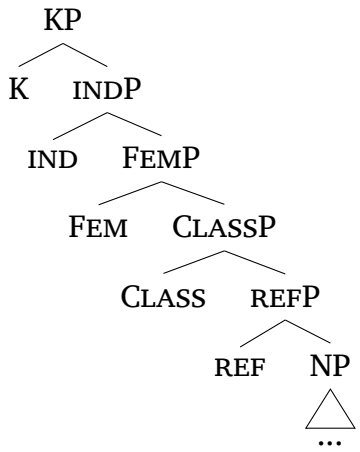
a. metel'-**ju** (snowstorm)
b. nedel'-**ej** (week)

I will now show how we can derive this contrast without any reference to declension features. For clarity, I separate the discussion in two sections. In section 3.1, I show how we can account for the difference in the nominative. In section 3.2, I show how we can extend this to account also for the instrumental.

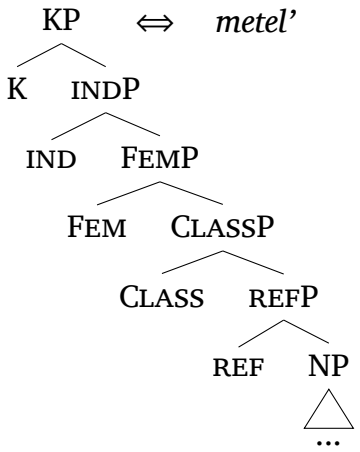
3.1 The nominative

Let me start my analysis of the example in (44) by drawing the structure of the nominative singular feminine, see (46). This structure is relevant for both of the nouns in (44), since both nouns are in the nominative singular, and both are of the feminine gender.

(46)



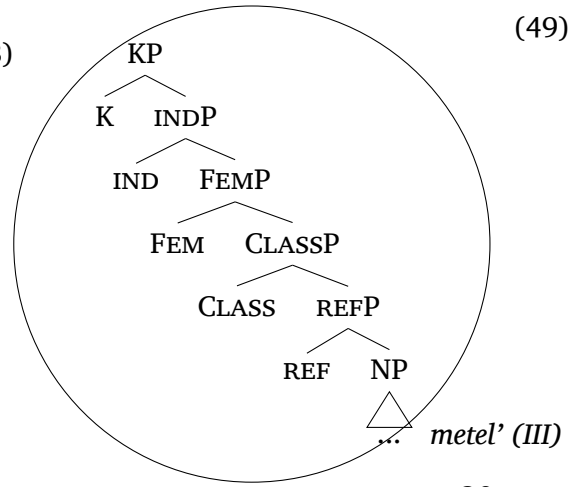
(47)



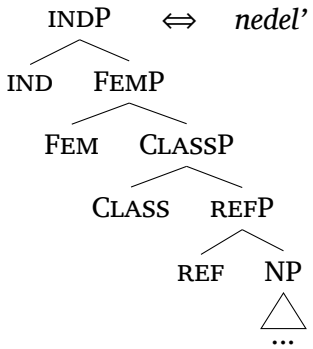
We know that the Declension III noun ‘snowstorm’ has no ending when spelling out a structure like (46). Therefore, I propose that what defines Declension III nouns is the fact that they are able to spell out such a structure in its entirety. This means that they are stored in the lexicon in the form shown in (47).

If that is so, Declension III nouns will be able to spell out all the features of the nominative without the need of any suffix, as in (48).

(48)



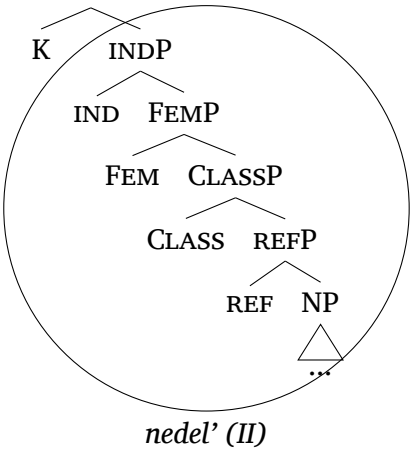
(49)



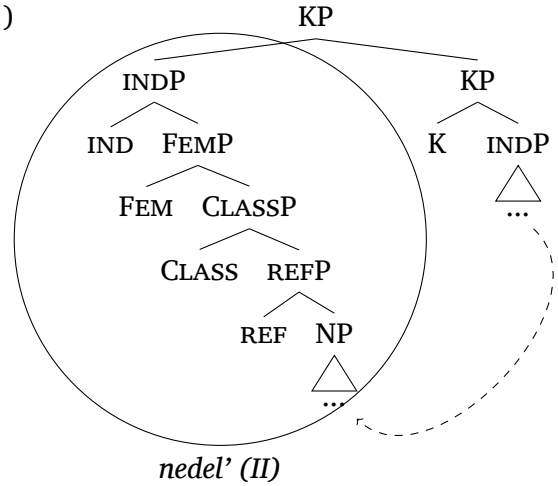
On the other hand, we know that the Declension II noun 'week' needs a suffix in the nominative. We can capture this by saying that the noun is stored in such a way that it does not spell out all the features of the nominative. We do not know exactly how many features the noun spells out, but let me assume for the start that it is lexically specified as spelling out the INDP projection, as in (49). (It could spell out also a lower projection. I will come back to this later and suggest that this is in fact the case.)

The crucial point is that with such an entry, Declension II nouns cannot spell out all the features. Specifically, they leave the K head and its projection without spellout, see (50).

(50)

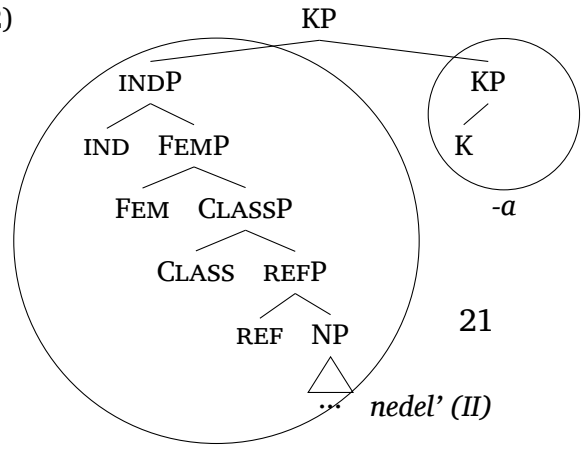


(51)

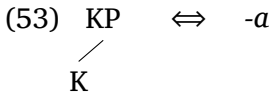


We have seen during our discussion of the English plural that when a root cannot spell out a particular phrasal node, it moves to the left as in (51). This movement makes it possible that the remnant phrase is spelled out by a suffix. The same, I propose, happens in the case of the noun 'week' (*nedel'*-). The lexicalization is shown in (52), and the lexical entry of the suffix is as given in (53).

(52)



(53)



This way, we capture the difference in the nominative case between Declension II and III without using declension-class features. The fact that the nominative of one class has a suffix where the other class has none is captured by associating each root with a structure of a different size. The rest follows from a general theory of spellout introduced in Section 2.2.

3.2 The instrumental

Let me now turn to the question as to whether (and how) we can extend the treatment of the nominative to also encompass the difference in the instrumental, see the basic dataset repeated again in (54) and (55).

(54) The nominative
- a. metel'-**Ø** (snowstorm)
- b. nedel'-**a** (week)

(55) The instrumental
- a. metel'-**ju**
- b. nedel'-**ej**

In order to be able to do so, I now have to say something about the representation of case in the grammar. My starting point is an observation about case syncretism in Russian (due to Chvany 1982, McCreight & Chvany 1991). The observation is that if we order the Russian cases in a particular way, then syncretism in case is restricted to contiguous stretches of paradigms. The particular ordering proposed by Chvany (1982) is NOM — ACC — GEN — LOC — DAT — INS. When cases are ordered in this way, as in the table (56), then all case syncretisms occupy contiguous regions within a paradigm.

(56) *Syncretism in Russian (McCreight & Chvany 1991)*

	window, sg.	teacher, pl.	both, m.i.	book, sg.	100
NOM	OKN-O	učitel-ja	dv-a	knig-a	st-o
ACC	OKN-O	UČITEL-EJ	dv-a	knig-u	st-o
GEN	okn-a	UČITEL-EJ	DV-UX	knig-y	ST-A
LOC	okn-e	učitel-jax	DV-UX	KNIG-E	ST-A
DAT	okn-u	učitel-am	dv-um	KNIG-E	ST-A
INS	okn-om	učitel-ami	dv-umja	knig-oj	ST-A

The columns of the table illustrate various types of syncretism. In the first column, we see the syncretism of NOM – ACC. In order for this syncretism to be adjacent, NOM and ACC must not be separated by any other case. Similarly, the second column shows that some Russian paradigm exhibit

an ACC–GEN syncretism. This requires that ACC – GEN must be next to each other. The same logic can be traced throughout the remaining columns with the result that the order must be as given in the table.

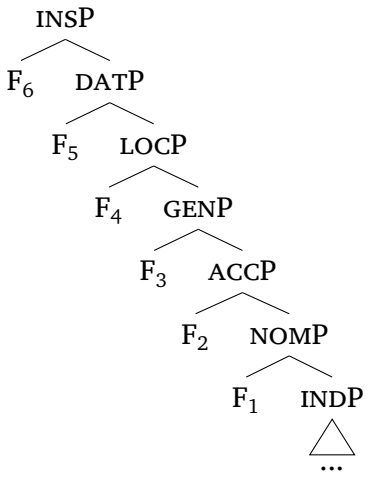
It has been argued in the literature (Caha 2009, Bobaljik 2012, De Clercq 2013) that *ABA constraints point to a type of feature decomposition that can be called 'cumulative.' The idea is that the number of features monotonically grows as we move from the nominative to the accusative and on. This is depicted in Table (57) (see Caha 2009, 2013, Starke 2017, McFadden 2018, Smith et al. 2019, Zompì 2019).

(57) Cumulative feature decomposition

CASE	FEATURES
NOM	F1
ACC	F1, F2
GEN	F1, F2, F3
LOC	F1, F2, F3, F4
DAT	F1, F2, F3, F4, F5
INS	F1, F2, F3, F4, F5, F6

If this type of decomposition is adopted (and regardless of the precise content of the case features), a *ABA pattern cannot be derived (though see Caha 2017, Bobaljik & Sauerland 2018 for other ways of representing the *ABA). In this article (following Caha 2009), I understand each of the case features in (57) as a separate syntactic head. Once this assumption is adopted, the structure of case in Russian looks as in (58).

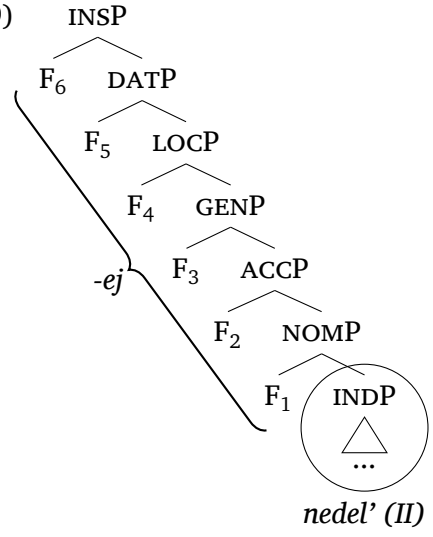
(58)



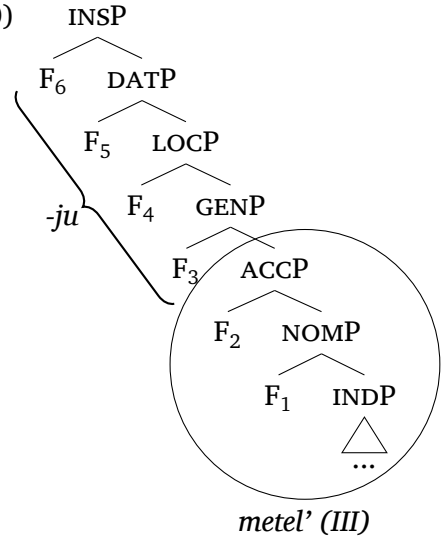
The tree encodes the proposal that when the feature F_1 is added on top of the extended NP (here represented by the singular number, INDP), we get the nominative case. When, in addition, we merge the feature F_2 on top of the nominative, the result is the accusative case, and so on.

This proposal allows us to extend our analysis of the declension differences from the nominative case to all the other cases, including the instrumental. To see how this works, consider the trees in (59) and (60).

(59)



(60)



What we see here are two trees, each of them containing features characteristic for a singular feminine noun in the instrumental case. At the bottom of each tree, we see a different root: we find the Declension II *nedel'*- on the left, and the Declension III *metel'*- on the right. We know from before that the Declension II *nedel'*- spells out a projection that is smaller than the projection of the nominative, because (recall) the noun requires an overt ending in the nominative. For now, the hypothesis is that *nedel'*- spells out INDP.

This contrasts with the situation in Declension III. Here we know from before that the root *metel'*- 'snowstorm' spells out minimally NOMP. In (60), it is depicted as spelling out ACCP. This is thus an update on the previous analysis, which takes into account the fact that *metel'*- has a zero ending also in the accusative, see (61), repeated from (5).[4]

[4]Due to the Superset Principle, the fact that *metel'*- in (60) spells out ACCP is compatible

(61) The singular of declensions II and III (Timberlake 2004)

	lip II (FEM)	notebook, III (FEM)
NOM	**gub-a**	**tetraď-Ø**
ACC	gub-u	tetraď-Ø
GEN	gub-y	tetraď-i
LOC	gub-e	tetraď-i
DAT	gub-e	tetraď-i
INS	**gub-oj**	**tetraď-ju**

Now, the most important point is that due to the fact that the root *metel'*- and *nedel'*- spell out trees of different sizes, they leave different number of case features/projections left for the spellout by the ending. It can be seen from the diagram in (60) that the ending *-ju*, used with Declension III roots, only needs to spell out features F_3 to F_6. This is crucially a different set than the one spelled out by the Declension II ending *-ej*, which needs to spell out all the case features from the nominative F_1 up to the instrumental F_6. In other words, the difference in root size between *nedel'*- and *metel'*- allows us to capture not only the difference in the nominative, but also in the instrumental (and, by extension, in all the cases in between).

As the analysis now stands, the relationship between the two classes can be depicted by the lexicalization table in (62). What we see in the upper part of the table is a Declension III noun. I am using the root *tetraď*- 'notebook' seen in (61). This root (just like all Declension III roots) is specified for all the features up to (and including) F_2. Due to the way the spellout algorithm works, this root always spells out all the features specified in its entry, i.e., up to F_2 (this is because spelling out without movement is always preferred). It is only when the root cannot spell out all the features that a suffix is introduced. The list of suffixes that occur after a Declension III root are given in the table: we see the GEN/LOC/DAT -*i* and the instrumental *-ju*. These endings are lexically specified for spelling out features from F_3 and up to F_5 (*-i*) and from F_3 to F_6 (*-ju*). Note that due to the Superset Principle, the ending *-i* (specified as F_3-F_5) spells out constituents of different sizes (namely the locative F_3-F_4 and the genitive F_3), leading to syncretism. Note that the instrumental *-ju* can also spell

with it spelling out also NOMP, as proposed in Section 3.1. Therefore, this update does not change anything about our previous conclusions.

out DAT/LOC/GEN, but loses to *-i* in competition.

(62)

	xNP	REF	CLASS	FEM	IND	F1	F2	F3	F4	F5	F6
NOM	tetrad'										
ACC	tetrad'										
GEN	tetrad'							i			
LOC	tetrad'								i		
DAT	tetrad'									i	
INS	tetrad'										ju
NOM	gub					a					
ACC	gub						u				
GEN	gub							y			
LOC	gub								e		
DAT	gub									e	
INS	gub										oj

In the bottom part of the table, we see a Declension II root *gub-* 'lip.' This root does not spell out any case features. Therefore, the endings that combine with a Declension II root must actually spell out more features than Declension III endings (they need to spell out F_1 and F_2).

As a result of how the lexical entries are set up, the spellout algorithm does not allow us to generate hypothetical forms where a Declension III ending appears on a Declension II root. The reason is that this would leave the features F_1 and F_2 without spellout. Similarly, we cannot place a Declension II ending on a Declension III root, since that would lead to a double spellout of the very same features. Both of these options are ruled out by the Spellout algorithm (42).

The general conclusion is that if this kind of analysis turns out to be viable in the context of the other two declensions, it shows that an arbitrary lexical difference among roots in terms of 'size' (the number of features associated to the root in its entry) is a tool that is powerful enough to model declension classes. In addition, the analysis has no need for contextual specifications: the correct combination of the roots and the endings falls out from the lexical specifications themselves.

Note again that while we eliminate language-particular declension *features*, we are not eliminating language-particular declension *classes*. Declension classes exist and correspond to a difference in root size. This theoretical possibility relativizes the relationship between the existence of sur-

face 'language-particular categories' and a universal set of features. Specifically, once this proposal is adopted, the existence of language-particular classes is compatible with a universal set of features.

4 The pairing of declensions and genders

In the reminder of this paper, I provide an account of all four declension classes of Russian following the analytical guidelines adopted above. This will require me to change slightly the account of Declension II and III and introduce a new derivational option used in Nanosyntax, namely Backtracking.

4.1 The basic facts

So far, I have focussed on the difference between Declension II and III. The reason is that in these two declensions, it is possible to find minimal pairs of roots that have the same grammatical features and the same type of phonology, but belong to different declensions. Such pairs illustrate the fact that declension classes are (at least in the relevant cases) arbitrary.

However, there is another aspect of declension class membership in Russian, which is that while it is arbitrary to some extent, it is not fully arbitrary. If we focus on inanimate nouns, there is a rather neat implication relation between declensions and genders (Corbett 1982). In (63), I summarize Corbett's observations.

(63) Declensions and gender, inanimates (Corbett 1982:216)

a. I → masculine
b. II → feminine
c. III → feminine (1 exception: *put'* 'journey')
d. IV → neuter

The implicational relations in (63) hold for underived nouns. Some derived nouns (notably augmentatives) lead to minor complications that I come back to. However, in what follows, I will extend my account in a way that it can capture both the arbitrary nature of declension classes, as well as the implicational relations in (63).

4.2 Declension II

Let me start by the observation that so far, the implicational relations noted in (63) do not follow from our system at all. In order to see this, consider the table (64). What I show in the upper part of the table is the current analysis of Declension II, where the root spells out all the features up to IND, and the ending spells out the case features.

(64)

	xNP	REF	CLASS	FEM	IND	F1	F2	F3	F4	F5	F6
NOM			gub			a					
ACC			gub				u				
GEN			gub					y			
LOC			gub						e		
DAT			gub							e	
INS			gub								oj

	xNP	REF	CLASS	IND	F1	F2	F3	F4	F5	F6
NOM			meuter		a					
ACC			meuter			u				
GEN			meuter				y			
LOC			meuter					e		
DAT			meuter						e	
INS			meuter							oj

In the lower part of the table, I show a hypothetical masculine/neuter noun. The hypothetical noun is labelled as *meuter* (a blend of **m**asculine/ n**euter**). Recall that masculine/neuter nouns lack the feature FEM; therefore, the FEM feature is lacking in the row of features to be lexicalized by such a noun, as depicted in the middle row of the table.

The issue with the hypothetical *meuter* noun is that if this noun was also specified for the size INDP in the lexicon as indicated in the table (64), it would be expected to combine with exactly the same endings as found with Declension II nouns. Therefore, the conclusion is that it is so far mysterious as to why there is no such noun as the hypothetical *meuter* in (64).

Can we change something about our analysis of Declension II in a way that we could rule out the hypothetical scenario in (64)? It turns out that this is possible if we adjust the size of the root of Declension II nouns. I have made it clear in Section 3.1 that the only thing we know about

Declension II roots is that they do not spell out all the features of the nominative. However, it is not *a priori* clear where exactly the boundary between the root end the ending actually goes. For example, there is so far nothing that would make us prefer the analysis in (64) to the one depicted in (65), where the declension endings spell out not only case, but also number. If anything, the latter analysis would be preferred on the grounds that Russian endings are portmanteau markers for case and number.

(65)

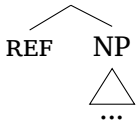
	xNP	REF	CLASS	FEM	IND	F1	F2	F3	F4	F5	F6
NOM	gub					a					
ACC	gub					u					
GEN	gub					y					
LOC	gub					e					
DAT	gub					e					
INS	gub					oj					

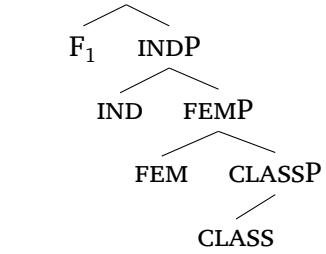
So, the question is where exactly the boundary between the root and the ending goes. It turns out that if we push Declension II roots down to the level of REFP and let the ending spell out the remaining features, we end up with a system that actually derives the generalization that Declension II endings only appear on feminine nouns. The table (66) depicts this option. The Declension II root *gub-* 'lip' spells out REFP, the remaining features are spelled out by the ending. For instance, the ending *-a* spells out the features CLASS, FEM, IND and F_1.

(66)

	xNP	REF	CLASS	FEM	IND	F1	F2	F3	F4	F5	F6
NOM	gub			a							
ACC	gub			u							
GEN	gub			y							
LOC	gub			e							
DAT	gub			e							
INS	gub			oj							

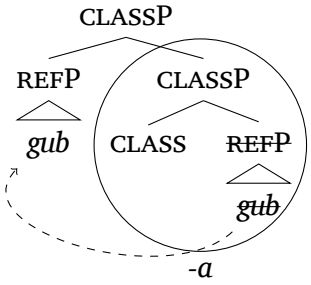
It turns out that such endings are unusable when the feature FEM is lacking in syntax, as is the case (by definition) with masculine and neuter nouns. In order to see that, consider first the lexical entry of the root *gub-* 'lip' and of the ending *-a*, see (67) and (68) respectively.

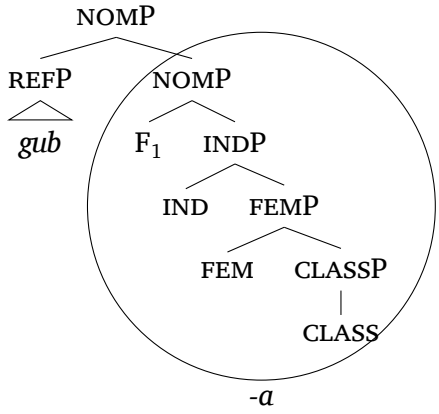
(67) 

(68) 

Let me first show how the root and the ending combine together in an actual derivation guided by the spellout algorithm. Recall that in the course of the derivation, we are cyclically merging features and spelling out the result. The preferred option is to spell out without movement, and we do so as long as the root contains these features. In the case of *gub-*, this works all the way to REFP, see the entry in (67).

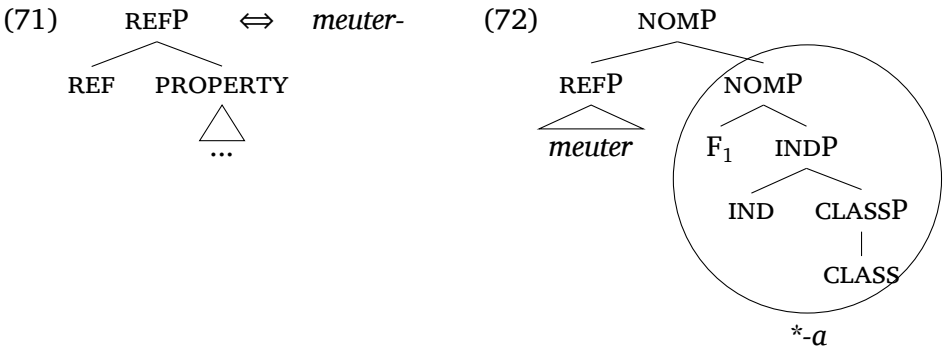
However, once we merge the CLASS feature, the root has to move to the left, and the ending *-a* spells out CLASSP, see (69). When more features are added, the root moves cyclically upwards, so that the nominative looks as in (70). This is nothing but a structural rendering of the top row in the lexicalization table (66).[5]

(69) 

(70) 

[5]It is an interesting question to ask why the FEM feature has to be added. One idea relies on the observation (Harley 2014) that some roots can only be used in a specific syntactic context. As a relevant case, Harley mentions the phrase *kit and caboodle*, where *caboodle* can only be used as a part of this idiom, but not outside of it. On analogy, the idea I pursue here is that some roots (like *gub-*) can only be used in a specific syntactic context, namely one where the feature FEM appears.

Importantly, this derivation is unavailable for masculine/neuter nouns. To see that, let me assume that we have, once again, the hypothetical noun *meuter* with the lexical entry as in (71). This entry is of the same size as the corresponding feminine noun *gub-* 'lip.' If we now try to run the same derivation with this root – but crucially omitting FEM – we end up with the structure (72). This structure is just like (70), but it lacks FEM.



The interesting thing about (72) is that this structure cannot be lexicalized by the Declension II ending *-a*. The reason is that the constituent we are trying to lexicalize in (72) (namely the NOMP) is not a sub-constituent of the lexical entry for *-a*. This bears repeating: despite the fact that the ending *-a* is lexically specified for all the features circled in (72), *-a* does not match here. The reason is that the Superset Principle cares not only about the presence/absence of features, but also about their constituency. As a result, insertion cannot take place when syntax is missing features that are found anywhere but at the top of the lexically stored tree.

To summarize: under the new analysis, the roots of Declension II only spell out REFP. Consequently, the endings of Declension II must be lexically specified in a way that they spell out the rest of the features; in particular, they have the feature FEM in the middle of their lexical tree. As a consequence, they will never be able to lexicalize a constituent that has case features on top, but it is missing if the feature FEM, recall (72). This allows us to derive the implicational relationship between using Declension II endings – and the result being a feminine noun.

4.3 Declension III

Let me now come back to declension III. The analysis we have so far is depicted in (73). This analysis was motivated by the fact that the root needs no ending in NOM/ACC.

(73)

	xNP	REF	CLASS	FEM	IND	F1	F2	F3	F4	F5	F6
NOM			tetrád’								
ACC			tetrád								
GEN			tetrád					i			
LOC			tetrád						i		
DAT			tetrád							i	
INS			tetrád							ju	

Recall now, however, that Declension III nouns are always feminine (with the exception of a single noun, *puť* ‘journey,’ which I am putting aside). The problem is that the particular analysis in (73) does not derive this. To see that, consider the fact that the Declension III endings only spell out case features. The question is: why can’t the same endings pronounce case features also on masculine nouns? One possibility would be that *meuter* nouns never spell out a constituent of the size ACCP, i.e., including all the features up to and including F_2. If that was so, the Declension III endings would be unusable with *meuters*, because their use with a root smaller than ACCP would leave some case features without spellout.

However, it is not very plausible that there are no nouns like that. In fact, there are good candidates among the masculine nouns for spelling out a constituent of the relevant size. To see that, consider the table (74), repeated from (5).

(74) Declensions I and IV (Timberlake 2004)

	factory I (MASC)	place IV (NEUT)
NOM	zavod-Ø	mest-o
ACC	zavod-Ø	mest-o
GEN	zavod-a	mest-a
LOC	zavod-e	mest-e
DAT	zavod-u	mest-u
INS	zavod-om	mest-om

What we see here is that the masculine nouns of Declension I have no overt ending in the nominative and accusative. Therefore, it is not unreasonable to think that they are able to spell out all the features going up to F_2, though they are presumably lacking the FEM feature compared to the nouns belonging to Declension III. But if that is so, then nothing else said, we would expect the masculines of Declension I to combine with the endings of Declension III (contrary to fact).

Therefore, in order to make sure that no masculine or neuter noun combines with Declension III endings, we cannot rely on some special property of masculine/neuter roots. Rather, we have to revise our hypothesis about Declension III endings. This is what I turn to now.

The safest way to prevent Declension III endings from combining with masculine/neuter nouns would be to let them spell out the FEM feature. Recall that if the FEM feature is located low down inside the lexical entry of an ending, the ending cannot spell out case features without simultaneously spelling out the FEM feature. Therefore, such endings can spell out case features only if there is the feature FEM in the actual structure; and this is what Corbett's generalization boils down to in the current system.

The table (75) shows one way how we can set up a system like this. The idea is that the feature FEM is the lowest feature of the endings *-i/-ju* belonging to Declension III. Compared to the table (73), the endings therefore also spell out the IND feature, and the case features F_1 and F_2. This has the desired effect that endings such as *-i* or *-ju* will not combine with masculine nouns.

(75)

	xNP	REF	CLASS	FEM	IND	F1	F2	F3	F4	F5	F6
NOM	tetrad'				Ø						
ACC	tetrad				Ø						
GEN	tetrad					i					
LOC	tetrad						i				
DAT	tetrad							i			
INS	tetrad								ju		
NOM	gub			a							
ACC	gub				u						
GEN	gub					y					
LOC	gub						e				
DAT	gub							e			
INS	gub								oj		

This proposal leads us further to revise the size of Declension III roots: in order to fit under FEM (which is the lowest feature of *-i/-ju*), these nouns are now proposed to be of the size CLASSP. This in turn leads us to the introduction of two silent endings in the nominative and the accusative. For now, I place these in the table, but I will have more to say about this later.

In the lower part of the table, I repeat the analysis of Declension II as proposed above in Section 4.2. The purpose of this is to show that there is still a difference in size between the two roots: the Declension III root *tetraď-* spells out CLASSP, while a Declension II root *gub-* 'lip' spells out only REFP. This is enough to ensure that the two roots combine with different endings.

Let me now come back to the zero ending in the NOM/ACC of Declension III. While this is not necessary for the analysis of the feminine declension, the currently used Nanosyntax theory actually has the tools that allow us to eliminate the zero marker. The updated analysis is depicted in (76). The table features both the idea that the endings of Declension III spell out the FEM feature, while at the same time maintaining the idea that the root of Declension III nouns spells out all the features in NOM/ACC.

(76)

	xNP	REF	CLASS	FEM	IND	F1	F2	F3	F4	F5	F6
NOM	tetraď										
ACC	tetraď										
GEN	tetraď					i					
LOC	tetraď					i					
DAT	tetraď					i					
INS	tetraď					ju					

Combining these two ideas within a single table leads to a phenomenon that we can refer to as root shrinking: a root that spells out quite a lot of features in NOM/ACC 'shrinks' down to the level of CLASSP. The reason why the root has to shrink is because of the endings at our disposal: all the endings that can spell out F_3 contain the FEM feature. Recall that for such endings to actually spell out F_3, they must also spell out FEM. As a result, the only way to spellout of F_3 is to shrink the root below FEM.

Root shrinking is going to be relevant in the analysis of the non-feminine declension, and I will therefore make a small detour here in order to explain how root shrinking is technically implemented. In the recent

Nanosyntax literature, this mechanism is referred to as Backtracking (see Starke 2018, Vanden Wyngaerd et al. 2020). Backtracking is a derivational option that is activated when the spellout algorithm (repeated in (77)) fails to provide a spellout for a particular phrase. When that happens, backtracking brings the derivation one step back and tries some different derivational step at this earlier stage.

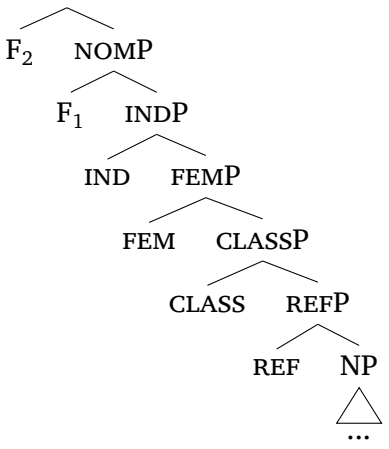
(77) Spellout Algorithm (based on Starke 2018)

a. Merge F and spell out.
b. If (a) fails, move the Spec of the complement and spell out.
c. If (b) fails, move the complement of F and spell out.

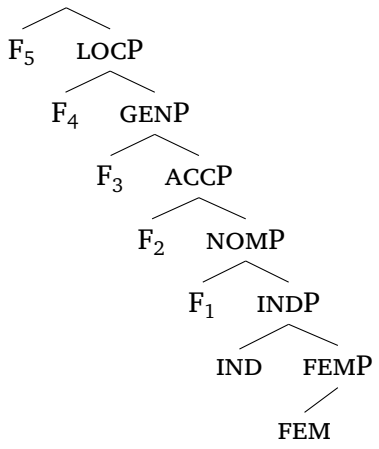
(78) Backtracking (Starke 2018)
When spellout fails, go back to the previous cycle, and try the next option for that cycle.

To see how this works, suppose that we have the lexical entries in (79) (for the root) and (80) (for the ending). These entries reflect the specifications as given in (76).

(79) ACCP ⇔ *tetrad'-*

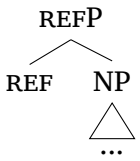


(80) DATP ⇔ *-i*

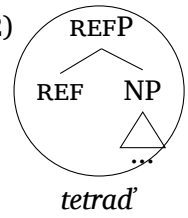


The point is to show how these endings lead to the lexicalization result as depicted in the table, using the algorithm in (79) and (80). Suppose, then, that we are building the genitive singular case of the noun *tetrad'-* (which is *tetrad'-i*). The derivation starts by assembling the REFP, see (81). This structure can be lexicalized without any movement, see (82).

(81)

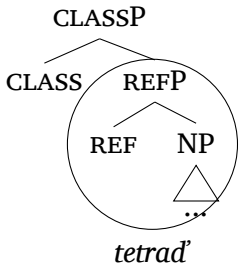


(82)

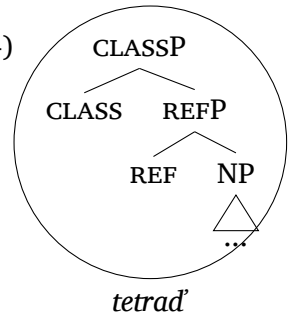


The derivation then continues by adding the CLASS feature, see (83). Spell-out applies without any movement, see (84).

(83)

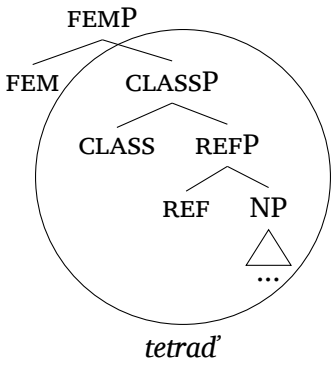


(84)

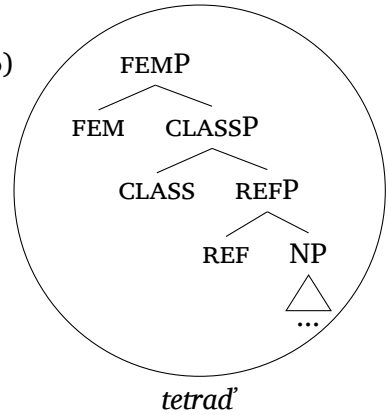


Let me show one more step of the same procedure: the feature FEM is added to (84), yielding (85). Spellout applies, and we get (86).

(85)

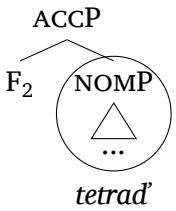


(86)

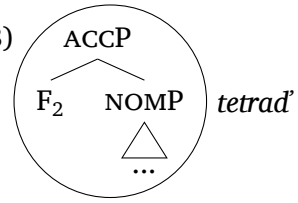


Following a sequence of analogous steps, the derivation ultimately reaches the stage where the accusative case feature is added, see (87), and the whole constituent is spelled out simply by inserting the Declension III root *tetrad'*, see (88).

(87)

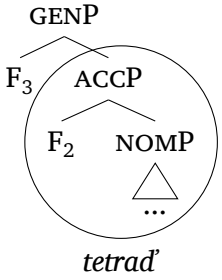


(88)

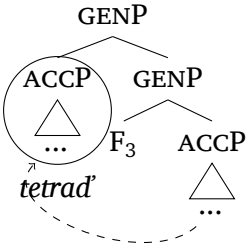


When the genitive feature F_3 is added, we get (89). Spellout without movement is impossible, since the lexical entry for *tetrad'* does not contain F_3. Therefore, spellout movements are activated following the spellout algorithm. This leads to (90).

(89)

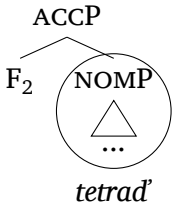


(90)

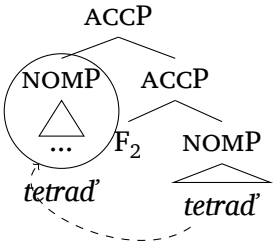


However, the structure in (90) does not lead to a successful spellout: there is no item that matches the remnant GENP (containing just F_3) in (90). Therefore the spellout algorithm fails to produce any output whatsoever. This is when Backtracking is activated. Backtracking says we should go to the previous cycle (which is ACCP). The relevant stage to which we backtrack is given in (91), repeated from (87). Once back at this stage, we should try to spell out ACCP in some other way than before (this is what Backtracking is about). On the first try, we spelled out ACCP without any movement, but that failed later on; so now we must try alternative options of the spellout algorithm. Trying something else means trying first Spec movement, as required by the spellout algorithm. However, there is no Spec, and so we have to try complement movement, as in (92).

(91)

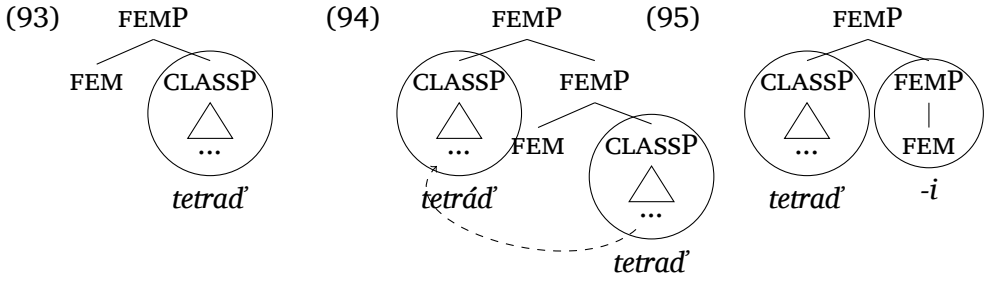


(92)



However, this does not lead to a success either, since there is no lexical item matching the remnant ACCP in (92). Since (92) does not lead to a successful derivation, we will need more backtracking. Note, however, that as a result of backtracking, the root is slowly giving up on the features it had swallowed earlier, and it is releasing them one by one in an attempt to have them spelled out by a suffix, thereby opening some alternative lexicalization path.

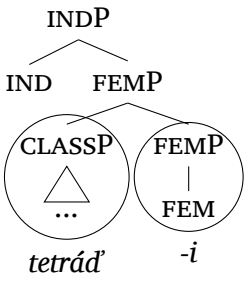
Since (92) failed to find a matching item for ACCP, backtracking is triggered again, then again, until we succeed and open a new derivational option. This happens only once we backtrack all the way back to FEMP. This stage is depicted in (93), repeated from (85). Here we have first spelled out FEMP without any movement, recall (86). However, this ultimately lead nowhere at the genitive level, so we are now trying a different option. Since Spec movement is impossible, complement movement is tried yielding (94).



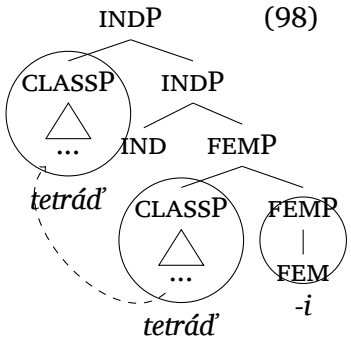
This option is successful, because it yields a structure where the remnant FEMP constituent is matched by the lexical entry for *-i*. This is shown in (95). Notice that by now, the root has given up on quite a lot of features and it has shrunk to the size of CLASSP. This is still a larger size compared to a Declension II root, but nevertheless significantly smaller than ACCP, which is the size for which the root is lexically specified. So this is how backtracking leads to shrinking, as depicted in the table (76).

Once we have opened a new derivational path, the derivation now proceeds as usual. We first add IND on top of (95), yielding (96). This structure cannot be spelled out without movement, so we must move the Spec of the complement, yielding (97).

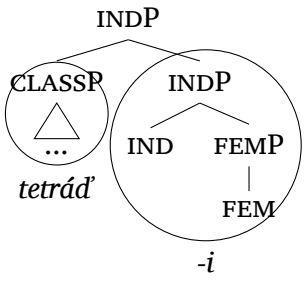
(96)



(97)



(98)



This structure leads to a successful lexicalization of the remnant INDP by *-i*. The derivation then proceeds in an analogous fashion, namely by adding case features on top of the singular number depicted in (98). These features always trigger the Spec-movement option of the algorithm in a fashion analogous to (97). The *-i* always spells out the relevant remnant constituent and ultimately lexicalizes all the relevant case features F_1 to F_3. This is what is depicted in the original table (76).

4.4 Declensions I and IV

Backtracking is important also in the analysis of Declensions I and IV. The phenomenon which backtracking will be needed for is inter-class syncretism as observed in the table (99). What we see here is that the two declensions differ in NOM/ACC, but they have the same endings in the oblique cases.

(99)

	factory I (MASC)	place IV (NEUT)
NOM	zavod-Ø	mest-o
ACC	zavod-Ø	mest-o
GEN	zavod-a	mest-a
LOC	zavod-e	mest-e
DAT	zavod-u	mest-u
INS	zavod-om	mest-om

Recall that this phenomenon has motivated Müller (2004) to propose that declension features should be decomposed. The point I demonstrate in this section is that this effect can also be modeled without declension features.

Let me start first with an analysis of Declension I. The simplest analytical option (which will turn out to be wrong) is sketched in the table (100).[6]

(100)

	xNP	REF	CLASS	IND	F1	F2	F3	F4	F5	F6
NOM	zavod									
ACC	zavod									
GEN	zavod						a			
LOC	zavod							e		
DAT	zavod								u	
INS	zavod									om

The starting point of the analysis depicted in the table is the observation that the root *zavod-* has no ending in NOM/ACC. This is reflected in the table by letting the root spell out all the features of these forms. In the oblique cases, the size of the root is kept constant in (100), and the case endings simply spell out the leftover case features.

However, this analysis has the same problem as the original proposal for Declension III: the endings depicted in (100) are pure case markers, and we would expect them to appear on feminine nouns. However, the don't do this and we meed to capture that somehow.

More specifically, the problem is that we would expect these endings to combine with the feminines of Declension III like *metel'-*. According to the latest (and final) proposal in (76), this noun spells out all the features up to F_2. So if the case endings were as shown in the table (100), we would predict that nouns like *metel'-* will combine with the endings in (100), contrary to fact.

This state of affairs forces us to reconsider the lexical entries of the endings in (100). What we must achieve is tat these endings cannot combine with Declension III nouns. Once again, the strategy is to say that there are many ways in which the features of the oblique cases can be divided between the root and the suffix, and we must look for a way to do this division in a way that leads to the correct distribution.

Given this desideratum, it will not help (for instance) to say that the endings of Declension I spell out all case features and in addition also the

[6]Note that this table differs from the tables used for Declension II and III in that there is no FEM feature to be lexicalized.

IND node, but not the CLASS node. This would still allow them to combine with (feminine) Declension III roots.

The strategy that works is to propose that in addition to case and IND, the endings spell out also CLASS. Once we encode their specification like this, these endings will be inapplicable in any structure that has the feature FEM in between CLASS and IND. The reason is that a specification CLASS + IND + CASE will never match a constituent containing CLASS + FEM + IND + CASE. As a result, such endings will never appear with feminine nouns.

This type of analysis is depicted in the table (101). Note that I am assuming that the root of Declension I has to shrink under the case endings in the oblique cases. When these roots shrink, the spell out the REFP, and the ending pronounces the remaining features.

(101)

	xNP	REF	CLASS	IND	F1	F2	F3	F4	F5	F6
NOM	zavod									
ACC	zavod									
GEN	zavod				a					
LOC	zavod					e				
DAT	zavod						u			
INS	zavod							om		

In principle, we could also analyze Declension I as in (102). This analysis does not rely on backtracking, but it has a zero in NOM/ACC.

(102)

	xNP	REF	CLASS	IND	F1	F2	F3	F4	F5	F6
NOM	zavod			Ø						
ACC	zavod				Ø					
GEN	zavod					a				
LOC	zavod						e			
DAT	zavod							u		
INS	zavod								om	

The two analyses ((101) and (102)) appear on a par (both capture the data), but only one of them is compatible with the fact that the endings of the oblique cases appear also in Declension IV. The most straightforward analysis of this final declension is depicted in (103). Since this declension has the very same endings in GEN, LOC, DAT and INS as Declension I, the

lower part of the table (103) is identical to (101) and (102). The only difference is in the nominative and accusative case.

(103)

	xNP	REF	CLASS	IND	F1	F2	F3	F4	F5	F6
NOM	mest			o						
ACC	mest				o					
GEN	mest					a				
LOC	mest						e			
DAT	mest							u		
INS	mest								om	

Specifically, Declension IV has the ending *-o* here. The simplest analysis would say that the size of the root is invariant throughout the paradigm, and that the ending *-o* therefore spells out the features CLASS + IND + F_1 + F_2. This analysis is, however, incompatible with the analysis in (102), which has exactly the same specification for the (spurious) -Ø marker. Therefore, the two analyses clash, because we have the same specification for two different markers. However, it is not possible to have the same specification for them, because they have a different distribution. Hence, juxtaposing the analyses in (102) and (103) leads to a problem.

On the other hand, the analysis in (101) is directly compatible with the analysis in (103). The reason why there is no problem with (101) is because there is no zero ending; its effect is captured by having the root grow and shrink as allowed by Backtracking.

Backtracking also has an important role to play in interclass syncretism. This is because Backtracking leads to the consequence that a root with a large tree in the lexicon (as large as ACCP) shrinks down to a different size, namely REFP. Once the (formerly large) root shrinks, it attains the same size that the roots of Declension IV have; these are associated to a tree of the size REFP in the lexicon. Once the two different roots attain the same size in a derivation, they combine with the same endings as a function of this. Backtracking (root shrinking) thus allows us to model cross-class syncretism, which arises when a large root shrinks down to the size of a different root class.

This concludes my analysis of the Russian declension. The main point was to show that we can capture all four declension classes of Russian without making use of language specific declension features. This goal has at this point been reached. As always, there remain a number of open

issues.

One open issue that I shall not resolve here relates to the difference between nouns of masculine and neuter gender. Specifically, I have set up my analysis in a way that it does not need to distinguish between masculine and neuter nouns. Still, this property of nouns is clearly accessed by agreement, and so the question arises whether this fact is compatible with my analysis at all. The answer is yes.

The first variable in the answer is which of the two genders (masculine or neuter) is marked. One possible answer is that the neuter is marked, and we then use a special feature for it (e.g., Harley and Ritter's feature INANimate). Alternatively, we can have a special feature for the masculine nouns. Regardless of which feature is assumed, this feature never plays a role in my analysis. We can understand the reasons for this if the feature is found very low in the hierarchy: namely below CLASS. If the feature sits at this low place in the tree, no ending will ever be sensitive to it. This is because none of the endings I have used spells out a feature lower than CLASS; hence, if this feature is lower than CLASS, then feature will always be spelled out by the root and never by the ending.

As a result, we can have a grammar that distinguishes between masculine and neuter nouns for the purpose of agreement, but not for the purpose of declension.

This idea raises in turn the question as to whether the endings really are not sensitive to the masculine/neuter distinction. This may appear problematic in view of the fact that there is an implicational relationship between Declension I/IV and masculine/neuter gender, recall (104).

(104) Declensions and gender, inanimates (Corbett 1982:216)

a. I → masculine
b. II → feminine
c. III → feminine (1 exception: *put'* 'journey')
d. IV → neuter

in my analysis, I have derives the fact that no feminine noun can belong in declension I/IV. However, the fact that there are only masculine nouns (and no neuters) in Declension I comes out as an accidental fact on the current analysis. Similarly, it is an accident that Class IV has no masculine nouns. These two facts appear problematic and they keep me thinking about potential improvements.

Now before I dive deeper into this, let us first remind ourselves of the fact that the endings of Declensions I and IV are largely syncretic (see again the shading in (99)). Therefore, it is not the case that the oblique endings are specific to a particular gender. In fact, the only gender specific ending in the whole Declension I and IV is the neuter *-o* – and potentially the masculine zero, if there is one. Therefore, it is important to keep in mind that what the current analysis fails to derive is just an isolated fact about one ending (*-o*), and this fact may be accidental.

It is further interesting to note that Corbett's implicational relations (given in (104)) are intended to characterize underived nouns, even though as far as I can tell, they hold also for a large majority of derived nouns. However, among the derived nouns where the generalizations fail to hold, are augmentatives such as *dom-išk-o* 'big house.' These have the *-o* ending in the nominative, despite the fact that they exhibit masculine agreement. This fact may then support the decision to treat it as an accident that *-o* does not occur with underived masculine nouns. I leave these questions for future research[7]

5 Conclusions

This article started from the observation that standard accounts of declension classes often rely on postulating arbitrary declension-class features. Such features are problematic for a restrictive theory of UG. Consequently, the goal of this article was to formulate an analysis of Russian declension that removes from the grammar any reference to these language-particular declension features.

In the account I have proposed, I rely on a universal set of features, arranged in a hierarchy. Declensions arise because different roots spell out different number of features. As a result of spelling out a different number of features, each root leaves a different residue, where by residue I mean those features that are present in the structure but not spelled out by the root. The residue is spelled out by the ending. When two roots leave a different residue, they combine with different endings.

[7] Another puzzling fact is that the augmentatives may also take on Declension II endings (instead of the Declension IV endings), i.e., we also find forms such as *dom-išk-a*, which have a Declension II ending despite the fact that they trigger masculine agreement.

In sum, since the residue determines the ending, and the root determines the residue, the root controls which ending it combines with. However, the selection is not encoded by contextual restrictions and/or by declension features; all of this is an automatic consequence of encoding in the lexicon the set of features spelled out by the root. The rest follows from the general theory of spellout.

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