Fusional morphology, metasyncretism, and secondary exponence: A morphemic, realizational approach to Latin declension

Ash Asudeh
University of Rochester

Bronwyn Bjorkman
Queen's University

Frances Dowle
University of Oxford

Neil Myler
Boston University

Daniel Siddiqi
Carleton University

Lisa Sullivan
Oklahoma State University

Proceedings of the LFG'24 Conference

Miriam Butt, Jamie Y. Findlay and Ida Toivonen (Editors)

2024

PubliKon

lfg-proceedings.org

Abstract

Using Latin as a case study, we show that Lexical-Realizational Functional Grammar (a union between a morpheme-based realizational morphology and the non-derivational, constraint-based syntactic framework of Lexical-Functional Grammar) is able to offer insights into two fundamentally important morphological phenomena. The first of these is metasyncretism, which is of particular interest because it is a (putative) paradigmatic effect, yet L_RFG does not have paradigms as theoretical objects. Syncretism is captured via cascading macros (i.e., templates), such that a macro for one case value may also call another macro with a different case value, leading to case containment which models a feature hierarchy. We also use the same approach for gender and number. Metasyncretism is handled through a single vocabulary item mapping to a disjunction of two or more possible exponents. The second phenomenon of interest is secondary exponence (or morphological conditioning). This is handled through the addition of constraints to the (relevant) vocabulary items corresponding to their conditioning environments.

1 Introduction

Morpheme-based realizational models of morphology—those that are *lexical-realizational* according to Stump's (2001) classification—have often assumed interfaces with derivational models of syntax.[†] For example both the morphemic, realizational approaches of Distributed Morphology (Halle & Marantz 1993 et seq., among others) and Nanosyntax (Starke 2009, Caha 2009 et seq., among others) are paired with Minimalist syntax (Chomsky 1995). However, there is nothing about morpheme-based realization that is intrinsically derivational.

Lexical-Realizational Functional Grammar (L_RFG; see Asudeh et al. 2023, Asudeh & Siddiqi 2023 and references therein) is a model of morphology that unites morpheme-based realization with the *non-derivational* constraint-based syntactic framework of Lexical-Functional Grammar (LFG; Kaplan & Bresnan 1982, Dalrymple et al. 2019, Dalrymple 2023, among others). In this paper, we show that this union offers insights into two phenomena that any theory of morphology must account for:

1. *Metasyncretism* (Williams 1994, among others)
   Metasyncretism is the phenomenon whereby the same syncretism patterns arise in different paradigms; for further discussion, see §2.1.

   (1) *do:n-i:s* — gift-CLASS2.MASC.PL.DAT   *do:n-i:s* — gift-CLASS2.MASC.PL.ABL

   (2) *re:g-ibus* — royal-CLASS3.MASC.PL.DAT   *re:g-ibus* — royal-CLASS3.MASC.PL.ABL

   We will demonstrate how L_RFG handles metasyncretism through disjunctive exponence.

[†]We thank Nigel Vincent for initially pushing us along the Latin path. We also thank the audience and participants of LFG 2024 for excellent comments and feedback. We thank the members of the L_RFG Lab for a thriving environment and for their comments and discussion. We also thank our reviewers, who improved the paper with their feedback. Any remaining errors are our own. For more on L_RFG, visit our website: lrfg.online.

2. *Secondary exponence* (Noyer 1997, among others)
Secondary exponence is the mechanism that captures the phenomenon of *morphological conditioning*, such that contextual allomorphy arises; for further discussion, see §2.2.

For example, in all declensions, non-neuter ACCUSATIVE is expressed as a mora (realized as vowel lengthening), but only in the context of plural.[1]

(3) *puell-am* girl.CLASS1.FEM.SG.ACC
ci:v-em citizen.CLASS3.MASC.SG.ACC

(4) *puell-**a:**s* girl.CLASS1.FEM.PL.ACC
*ci:v-**e:**s* citizen.CLASS3.MASC.PL.ACC

We will demonstrate how $\mathrm{L_RFG}$ handles secondary exponence through the addition of constraints to the (relevant) vocabulary items, which capture the vocabulary items' conditioning environments.

Our demonstration focuses on the analysis of the nominal declensions of Latin, a complex fusional system that expresses 5 cases (6 if vocative is counted), 3 genders (masculine, feminine, neuter), 2 numbers, and (a minimum of) 5 distinct declension classes. This is illustrated for two declension classes in Table 1, where a box with rounded corners indicates metasyncretism and a box with square corners indicates secondary exponence. We present the traditional affixes on the left, for comparison's sake. The right represents the decompositional analysis from Myler (2024) that we assume here. The theme vowels are excluded from the right for clarity.[2]

1.1 Why should $\mathrm{L_RFG}$ look at Latin?

First, Latin is standard fare for word-based/paradigm-based morphology (see, e.g., Matthews 1972, Stump 2001, Spencer 2013, Bonami & Stump 2016, Blevins 2018). Latin has long been an exemplar of paradigmatic morphology, even just in the descriptive/pre-theoretical sense. Here are some examples of properties of Latin morphology that seem to support the existence of theoretical objects called *paradigms*:

1. Highly fusional morphology
2. Multiple declension and conjugation classes
3. Intra-paradigmatic syncretism patterns
4. Cross-paradigmatic syncretism patterns

[1] As explained below, we analyze the *s* at the end of the forms in (4) as a plural marker, rather than being part of a fused case/number ending as in more traditional analyses.

[2] The fragment follows Oniga (2014: 81) in taking the first vowel of *-ibus* as being part of the case affix, as opposed to an allomorph of the theme vowel, although we acknowledge that this is potentially controversial. See Myler (2024: 10) for the strategies used to arrive at this presentation. Many important aspects of the surface forms, especially in the third declension (but only there), are accounted for by phonological rules. For the phonology we assume, see the supplemental materials associated with Myler (2024), available at https://tinyurl.com/5bw2tw9c.

	CLASS 2		CLASS 3	
	SG	PL	SG	PL
NOM	-us	-i:	-s	-e:s
ACC	-um	-o:s	-em	-e:s
GEN	-i:	-o:rum	-is	-um
DAT	-o:	-i:s	-i:	-ibus
ABL	-o:	-i:s	-e	-ibus

	CLASS 2		CLASS 3	
	SG	PL	SG	PL
NOM	-s	-i:	-s	-$\boxed{\mu}$-s
ACC	-m	-$\boxed{\mu}$-s	-m	-$\boxed{\mu}$-s
GEN	-i:	-rum	-is	-um
DAT	-μ	-$\boxed{\boxed{\text{i:}}}$-s	-i:	-$\boxed{\boxed{\text{ibu}}}$-s
ABL	-μ	-$\boxed{\boxed{\text{i:}}}$-s	-e	-$\boxed{\boxed{\text{ibu}}}$-s

Table 1: Latin cases in 2$^{\text{nd}}$ and 3$^{\text{rd}}$ declensions (masculine only)
Left-hand side: traditional (see, e.g., Allen & Greenough 1888)
Right-hand side: our revision, adapted from Myler (2024).

Since L$_{\text{R}}$FG does not have paradigms as theoretical objects, there is an onus on L$_{\text{R}}$FG to show that it can capture (putative) paradigmatic effects without such objects. This is why this paper looks at syncretism patterns, especially those that cross class paradigms (*metasyncretism*).

Second, Myler (2024) is an existing Latin declension fragment in Morphology as Syntax (MaS; Collins & Kayne 2023) and Myler (2023) compares this MaS fragment to a 'counter-fragment' in DM (both the MaS and DM fragments were devised by Myler himself). This allows us to compare our L$_{\text{R}}$FG fragment to Myler's explicit MaS fragment and his explicit, alternative DM fragment.[3]

1.2 What is L$_{\text{R}}$FG?

Lexical-Realizational Functional Grammar (L$_{\text{R}}$FG) is a theoretical framework that couples Lexical-Functional Grammar (LFG) with Distributed Morphology (DM). From DM, L$_{\text{R}}$FG inherits a morpheme-based, realizational approach to morphosyntax, one which distributes the putative functions of morphology across four domains: hierarchical syntactic structures, syntactic feature structures, phonological representations, and lexical and compositional semantics. L$_{\text{R}}$FG is thus a version of DM, but one that is "constraints all the way down" (Asudeh, Melchin & Siddiqi 2024), rather than a realizational framework with a derivational underbelly.

From LFG, L$_{\text{R}}$FG inherits a constraint-based syntax split into two modules, one capturing dominance and constituency (c-structure) and the other capturing features and syntactic relations (f-structure). L$_{\text{R}}$FG is thus also a version of LFG, but one that gives up Strong Lexicalism (Chomsky 1970, Lapointe 1980, Bresnan et al. 2016) and an isolated morphological module that feeds syntax.

L$_{\text{R}}$FG was first unveiled at the 2020 conference of the Canadian Linguistic Association (Melchin et al. 2020a) and has been developed further since (Melchin et al. 2020b,

[3] "Alternative" because L$_{\text{R}}$FG *is* a variety of DM, but a variety with a constraint-based, rather than derivational, syntax.

Everdell et al. 2021, Asudeh & Siddiqi 2022, Asudeh et al. 2023, Asudeh & Siddiqi 2023, Asudeh et al. 2024, Everdell & Melchin 2024, Siddiqi 2024). In Melchin et al. (2020a) and Melchin et al. (2020b), we sketched part of the morphology of a *polysynthetic* language, Ojibwe (Nishnaabemwin/Anishinaabemowin). Here we sketch part of the morphology of an inflectional-fusional language, Latin.

2 Phenomena: Metasyncretism and secondary exponence

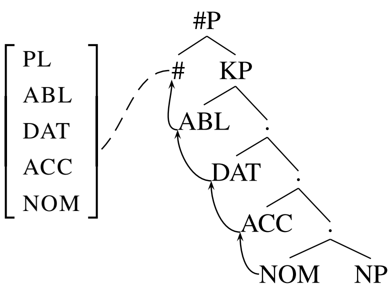
2.1 What is metasyncretism?

Metasyncretism is the phenomenon whereby the same syncretism patterns arise in different paradigms. In other words, while the pattern is consistent, the exponent of the pattern can vary across paradigms (Williams 1994, Bobaljik 2002, Harley 2008, Albright & Fuß 2012). This is the case with the DAT and ABL plurals shown in Table 1. Recall that metasyncretism is indicated by the rounded boxes in Table 1, ▢.

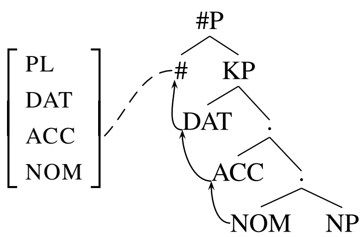
1. In class 2, DAT and ABL plural have the same exponent (*-i:*).
2. In class 3, DAT and ABL plural again have the same exponent (*-ibu*).
3. Thus, this is metasyncretism, because DAT and ABL plural are syncretic across paradigms, but the exponent is not identical.

Alternative contemporary DM analyses of metasyncretism account for the Latin type via a combination of containment among case features[4] (Caha 2009) and *Impoverishment* (Halle & Marantz 1994). For example, DAT/ABL metasyncretism in the plural would work as follows in (5) and (6) below. The first example, (5), is a syntactic representation of the ablative plural, which after head movement results in a complex head containing all the case features and plural. The second example, (6) shows the same for dative plural. The features in the square brackets are the targets for Vocabulary Insertion.

(5)



(6)



This kind of approach would posit an *Impoverishment Rule* which deletes the feature ABL in the context of PL. After this impoverishment rule applies, the targets for insertion in (5) and (6) are identical. Therefore, the same vocabulary item (VI) will be inserted in all instances of DAT PL and ABL PL, as in (5) and (6).

[4]For example, ABL case contains DAT, ACC, and NOM case, meaning ABL is simultaneously specified for all four cases, whereas ACC case contains only NOM, so ACC is encoded as only ACC and NOM. In traditional DM and Nanosyntax analyses, this is because case-marking is underlyingly a complex syntactic structure, with ABL selecting for DAT, DAT selecting for ACC, etc.

2.2 What is secondary exponence?

Secondary exponence is the mechanism that captures the phenomenon of *morphological conditioning*, such that contextual allomorphy arises. Secondary exponence in Latin is indicated by the thin, square-corner boxes in Table 1, $\square$.

The standard DM proposal is that though each feature is only realized once, features can figure in the environment for other realizations. For example, -μ in the ACCUSATIVE PLURAL -μ-*s* in Table 1 is a realization of ACC as a mora (μ), but conditioned by the presence of PL. Contrast this with the realization of ACC in the singular, which is *m*. In DM, secondary exponence occurs when a feature is discharged by one vocabulary item but conditions the realization of other VIs (Noyer 1997). Rules (7a) and (7b) both expone the feature ACC, but (7b) only does so in the context of PL. Therefore, in the context of PL (and only in that context), (7b) is preferred to (7a). However, (7b) does not *discharge* the PL feature (indicated by round brackets). It only discharges the ACC feature (indicated by square brackets).

(7) a. [ACC] $\rightarrow$ *m*

b. [ACC](PL) $\rightarrow$ μ

c. [PL] $\rightarrow$ *s*

The PL feature is then expressed by (7c).

3 Analysis

We now turn to our analysis of metasyncretism and secondary exponence.

3.1 Metasyncretism

In $\mathrm{L_R}$FG, metasyncretism of the Latin type arises from:

1. Case containment
2. Direct disjunction in the exponents of vocabulary items

Let us consider these in turn.

$\mathrm{L_R}$FG captures case containment through the cascading of *macros* (a.k.a. *templates* in the LFG literature; see, e.g., Dalrymple et al. 2004 and Asudeh et al. 2013); we'll call this a *macro cascade*. This is the same method used for capturing person hierarchies in Ojibwe, as in Table 2. For example, HEARER entails PARTICIPANT, because the @HEARER macro calls the @PARTICIPANT macro.

Similarly, we can capture case containment in Latin through a macro cascade, as in Table 3. This captures the following case hierarchy:

(8)

NOMINATIVE
├── VOCATIVE
└── ACCUSATIVE
    ├── GENITIVE
    └── DATIVE
        └── ABLATIVE

Macro	*Description*	*Explanation*
INCLUSIVE(X)	(X PERS SPEAK) = + (X PERS HEAR) = + @PARTICIPANT(X)	1st person inclusive
SPEAKER(X)	(X PERS SPEAK) = + @PARTICIPANT(X)	1st person
HEARER(X)	(X PERS HEAR) = + @PARTICIPANT(X)	2nd person
PARTICIPANT(X)	(X PERS PART) = + @PROXIMATE(X)	1 and/or 2
PROXIMATE(X)	(X PERS PROX) = + @ANIMATE(X)	3 and above
ANIMATE(X)	(X PERS ANIM) = + @ENTITY(X)	$3'$ and above
ENTITY(X)	(X PERS ENTITY) = +	All persons (0 and above)

Table 2: Prominence hierarchy macros (based on Melchin et al. 2020a,b)

This, coupled with the absence of a relevant specifically ablative form, leads to *syncretism* between dative and ablative. For example, if there is no relevant VI for ablative, then the (relevant) dative VI will appear in both dative and ablative environments. We also use the same method for gender, as in Table 4. Note that ‘neuter gender’ is the exponent of the absence of gender features.[5]

Macro	*Description*	*Explanation*
NOM	($\uparrow$ NOMINATIVE) $= +$	Nominative case
ACC	($\uparrow$ ACCUSATIVE) $= +$ @NOM	Accusative case
VOC	($\uparrow$ VOCATIVE) $= +$ @NOM	Vocative case
GEN	($\uparrow$ GENITIVE) $= +$ @ACC	Genitive case
DAT	($\uparrow$ DATIVE) $= +$ @ACC	Dative case
ABL	($\uparrow$ ABLATIVE) $= +$ @DAT	Ablative case

Table 3: Latin case containment

[5]We follow traditional underspecification accounts that use privative features, such as Kramer (2015), whereby singular is the lack of plural (or other more specific number features). The singular feature therefore does not appear—it is unmarked. This also becomes relevant for GENDER below, where MASC is the lack of FEM and NEUT is the lack of gender marking entirely. We acknowledge that, in the context of fusional languages, where both masculine and feminine appear to be equally marked, such a decomposition may be counter-intuitive.

Macro	*Description*	*Explanation*
MASC	$(\uparrow$ GENDER$) = +$	Masculine gender
FEM	$(\uparrow$ FEMININE$) = +$ @MASC	Feminine gender
		Neuter gender

Table 4: Latin gender hierarchy

The second ingredient in the $\mathrm{L_R}$FG account of Latin metasyncretism is direct disjunction in the exponents of vocabulary items. A disjunctive rule of exponence is one in which a single listed exponendum in the Vocabulary maps to more than one possible exponent (although only one can be selected on any given occasion). For example, the metasyncretism of *-i:* and *-ibu* is ensured because they are both exponents of the same exponendum, as demonstrated in (9).

(9)
$$\left\langle \begin{array}{l}[\mathrm{K}], @\textsc{dat}\\ \quad (\uparrow \textsc{plural})\end{array}\right\rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{i{:}}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \textsc{x}{=}1 \vee \textsc{x}{=}2 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{bmatrix} \end{bmatrix} \vee \begin{bmatrix} \textsc{phonrep} & /\mathrm{ibu}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \begin{array}{l}\textsc{x}{=}3 \vee \textsc{x}{=}4 \vee \\ \textsc{x}{=}5\end{array} \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{bmatrix} \end{bmatrix}$$

As shown in (9), *-i:* and *-ibu* must have the same distribution (modulo class), because they are exponents of a single VI. Moreover, the $\mathrm{L_R}$FG analysis encodes the relationship between metasyncretism and simple syncretism directly. The application of the syncretism across multiple classes is expressed in the same rule that would otherwise express a simple syncretism. Note that in the Vocabulary fragment below (§5.4) there is no VI that expones ABLATIVE PLURAL. Note also that (9) contains all five classes. Therefore, The VI in (9) will be used in both dative and ablative plural in all five classes. However, in classes 1 and 2 it will have the form *-i:*, while in classes 3–5 it will have the form *-ibu*. Latin dative-ablative plural metasyncretism thus arises from a single VI being utilized in ten environments. Note also that (9) further demonstrates secondary exponence, since dative case is here conditioned by plural. We turn to secondary exponence next.

3.2 Secondary exponence

Recall that in standard DM, the issue in secondary exponence is that the licensing features 1) are not located in the target node and 2) are not discharged by insertion (the exponence function). This contrasts with the situation in $\mathrm{L_R}$FG. The left-hand sides (exponenda) in vocabulary items contain two kinds of feature specifications (as in standard LFG):

1. *Defining equations* (annotated with plain =) define what features are in the f-structure by stating attributes and their values.

(10) $(\uparrow \text{FEATURE}) = +$ defines an f-structure $\begin{bmatrix}\text{FEATURE} & +\end{bmatrix}$

2. *Constraining equations* (annotated with $=_c$) state what attributes and/or values the f-structure that is defined by the defining equations must or must not contain.

   (a) $(\uparrow \text{FEATURE}) =_c +$ does *not* define an f-structure, but rather constrains the defined f-structure to contain this feature.

   Similarly, existential constraints and negated existential constraints operate on the defined f-structure and do not add information of their own:

   (b) $(\uparrow \text{FEATURE})$ constrains the f-structure to contain the feature FEATURE, but with any value.

   (c) $\neg(\uparrow \text{FEATURE})$ constrains the f-structure to *not* contain the feature FEATURE.

   Existential constraints are the *conditioning environment* of a vocabulary item. Negated existential constraints are the *restricted environment* of a vocabulary item.

For example, consider VI (37) from the fragment in §5.4 below. This morpheme *-m* is prohibited from appearing in f-structures that contain GENDER. The lack of GENDER is how NEUTER is defined. Therefore, NEUTER morphology is explicitly those vocabulary items which express f-structures that don't contain gender.

(37) $$\left\langle \begin{array}{l}[\text{K}], @\text{NOM} \\ \langle\!\langle \neg(\uparrow \text{GENDER}) \rangle\!\rangle\end{array} \right\rangle \xrightarrow{\nu} \begin{bmatrix} \text{PHONREP} & /\text{m}/ \\ \text{DEP} & \text{LT} \\ \text{CLASS} & \text{X}{=}2 \\ \text{HOST} & \begin{bmatrix}\text{IDENT} & + \\ \text{CLASS} & \text{X}\end{bmatrix} \end{bmatrix}$$

Note that we have used an arbitrary double-angle notation $\langle\!\langle\ \rangle\!\rangle$ to highlight constraining equations (including existential and negative existentials). In other words, we use $\langle\!\langle\ \rangle\!\rangle$ to indicate a constraint on the (independently) defined f-structure. VI (37) is an example of *restricting* exponence using a negative existential constraint.

Now let's look at an example of *conditioning* exponence using a positive existential constraint. As we see in (36), again from §5.4 below, the morpheme *-s* is conditioned by f-structures that contain the GENDER feature.

(36) $$\left\langle \begin{array}{l}[\text{K}], @\text{NOM} \\ \langle\!\langle (\uparrow \text{GENDER}) \rangle\!\rangle\end{array} \right\rangle \xrightarrow{\nu} \begin{bmatrix} \text{PHONREP} & /\text{s}/ \\ \text{DEP} & \text{LT} \\ \text{CLASS} & \text{X}{=}2 \vee \text{X}{=}3 \vee \text{X}{=}4 \vee \text{X}{=}5 \\ \text{HOST} & \begin{bmatrix}\text{IDENT} & + \\ \text{CLASS} & \text{X}\end{bmatrix} \end{bmatrix}$$

It will therefore only appear in MASCULINE or FEMININE environments. Note that this is functionally equivalent to DM's use of secondary exponence here, where *-s* would be a secondary exponent of the GENDER feature. However, because this is a constraint on a local f-structure, the phenomenon is captured entirely locally, whereas secondary exponence in standard DM is not inherently local. Additionally, There is no claim of *multiple exponence* here with respect to GENDER. Therefore, feature discharge is not an issue, because GENDER is not exponed twice but rather just conditions the allomorph.

4 Metasyncretism and secondary exponence in action

Let's look at Table 5, which shows the Latin declension paradigms for dative and ablative case; recall that paradigms are not objects in L$_R$FG theory—they are just useful ways to organize data.[6,7] In most declensions, there is a contrast between DATIVE and ABLATIVE in the singular that is always lost in the plural. The PLURAL-conditioned case marker does not span the PLURAL feature, which is realized independently as *-s*. The phenomena that need to be captured here are:

1. The consistent CASE metasyncretism conditioned by PLURAL
2. The secondary exponence of the PLURAL feature on the case marker

	Class 1		2		3		4		5	
	SG	PL	SG	PL	SG	PL	SG	PL	SG	PL
DAT	aqu-*a*-*j*	aqu-*i:*-*s*	do:n-*o*-*µ*	do:n-*i:*-*s*	re:g-*i:*	re:g-*ibu*-*s*	fru:ct-*u*-*i:*	fru:ct-*ibu*-*s*	r-*e:*-*i:*	r-*e:*-*ibu*-*s*
	aquae	*aqui:s*	*do:no:*	*do:ni:s*	*re:gi:*	*re:gibus*	*fru:ctui:*	*fru:ctibus*	*rei:*	*re:bus*
ABL	aqu-*a*-*µ*	aqu-*i:*-*s*	do:n-*o*-*µ*	do:n-*i:*-*s*	re:g-*e*	re:g-*ibu*-*s*	fru:ct-*u*-*µ*	fru:ct-*ibu*-*s*	r-*e:*-*µ*	r-*e:*-*ibu*-*s*
	aqua:	*aqui:s*	*do:no:*	*do:ni:s*	*re:ge*	*re:gibus*	*fru:ctu:*	*fru:ctibus*	*re:*	*re:bus*

Table 5: Latin DATIVE and ABLATIVE (Allen & Greenough 1888, Crowder 2024)[8]

Example (27), from §5.4 below, shows the regular plural marker that appears in all PLURAL environments except genitive plural. This analysis of the regular plural marker comes from Myler (2024).[9]

(27) $$\langle\ [\#],\ @\text{PL}\ \rangle \xrightarrow{\nu} \begin{bmatrix} \text{PHONREP} & /\text{s}/ \\ \text{DEP} & \text{LT} \\ \text{HOST} & \begin{bmatrix} \text{IDENT} & + \end{bmatrix} \end{bmatrix}$$

Example (47), also in §5.4 below and initially presented in (9) above, is where our analysis of secondary exponence and metasyncretism is demonstrated.

[6] Case endings are shown in blue/underlined, number marking in red/double-underlined, and the noun stem and the theme vowel are given in plain black. When the theme vowel is not segmented separately, it has been deleted by the regular phonology. Note that this represents our Mylerian reanalysis; see discussion at Table 1 above.

[7] Astute readers may note that we omitted the possibility of the form *-ubus* as a possible allomorph in fourth declension nouns. In treating these forms as exceptional, we are following Oniga (2014: 82), who states, "An archaic or perhaps analogical ending *-ubus* for the dative and ablative plural is rarely attested. In Classical Latin, the *-ibus* form was generalized."

[8] We are aware that Crowder (2024) is a non-academic source, but it is accurate and easily accessible.

[9] Note that it is not the only vocabulary item that is realized as *s*: not all *s*'s are plural markers.

(47) $$\left\langle \begin{array}{l}\text{[K], @DAT} \\ \quad\langle\!\langle(\uparrow \text{PLURAL})\rangle\!\rangle\end{array} \right\rangle \xrightarrow{\nu} \begin{bmatrix} \text{PHONREP} & \text{/i:/} \\ \text{DEP} & \text{LT} \\ \text{CLASS} & \text{X}=1 \lor \text{X}=2 \\ \text{HOST} & \begin{bmatrix} \text{IDENT} & + \\ \text{CLASS} & \text{X} \end{bmatrix} \end{bmatrix} \lor \begin{bmatrix} \text{PHONREP} & \text{/ibu/} \\ \text{DEP} & \text{LT} \\ \text{CLASS} & \text{X}=3 \lor \text{X}=4 \\ & \lor\, \text{X}=5 \\ \text{HOST} & \begin{bmatrix} \text{IDENT} & + \\ \text{CLASS} & \text{X} \end{bmatrix} \end{bmatrix}$$

With respect to secondary exponence, the VI is conditioned by the feature PLURAL, so it will appear in PLURAL environments, but does not expone PLURAL. With respect to metasyncretism, the right-hand side of the VI is disjunctive—giving one form in first and second declension and another form in the other declensions. This VI will appear in both DATIVE and ABLATIVE, because 1) DATIVE is a subset of ABLATIVE (the latter has one more feature) and 2) there is no competing ABL suffix in the fragment (the only VI specified with ABLATIVE is restricted from PLURAL environments; see (49) below).[10]

5 The Latin declension system: A fragment

This section contains the complete L$_{R}$FG analysis of Latin declension, which we present in the form of a fragment (a sub-grammar and vocabulary for a specific phenomenon). Since L$_{R}$FG fragments are by their nature a list of rules, macros, and vocabulary items, we present some exposition as we go.

5.1 Macros

There are three main kinds of macros in the fragment.[11] The first, which is featured across L$_{R}$FG analyses of all languages, is the *root individuation* macro, which individuates distinct $\sqrt{\ }$ categories by their PRED value.

(11) ROOT(X) := $(\uparrow$ PRED$)$ = 'X'

The macro defines the PRED feature in the standard LFG way; as in LFG, we assume that the PRED value, demarcated by single quotes, is uniquely instantiated. This has the function of making sure that different 'stems' that have the same category in the c-structure ($\sqrt{\ }$) are still morphologically distinguishable from each other; see Siddiqi (2024) for discussion of root individuation in the context of L$_{R}$FG.

The second kind of macro concerns feature selection/association. We designate these with a ! and call them *bang macros*. We refer to them in speech as *number bang*, etc. Since singular is unmarked, there is only one number feature, PLURAL, in our fragment. Therefore, NUM! only calls the feature PLURAL; singular is just the absence of that feature.

(12) NUM! := @PL

[10]We have indicated restrictions with a negation: these preclude insertion in these environments. These are *not* negative features. We have only indicated preclusions when necessary for the fragment. In principle, there could be other (vacuous) preclusions present that we cannot detect in the analysis.

[11]By 'kinds' we do not mean to imply that there is a formal distinction, but rather that they serve different functions in the theory.

Latin has three genders: masculine, feminine, and neuter. Neuter is analyzed as the absence of a gender feature, much like singular modulo number. Therefore, GEND! calls a disjunction between two macros, MASC and FEM, where the latter contains the feature introduced by the former.

(13) GEND! := { @MASC | @FEM }

Latin has six cases, all of which are marked morphologically, so CASE! calls six case macros. These macros, like the ones for GENDER, are in a containment relationship, as described below.

(14) CASE! := { @NOM | @VOC | @ACC | @GEN | @DAT | @ABL }

In sum, bang macros give the possible c-structural exponenda[12] for the features in question by calling any of the specified range of particular macros. In any given c-structure, only one of the disjuncts appears. Thus, CASE!, for example, specifies the range of possible cases, only one of which is chosen on any given occasion. See examples (25) and (26) below. Note that this is distinct information from the category K, which is only responsible for the *distribution* of case (in c-structure) not the featural content/valuation of case in f-structure.

The third kind of macro is macros like PL, which just add a privative feature to the structure.

5.1.1 Feature containment

As mentioned in the previous section, feature macros in L_RFG often call other macros. This naturally gives rise to feature containment in terms of f-structural subsumption. Thus, macro cascades capture feature entailments which define hierarchies (of entailments); these are called *feature geometries* by Harley & Ritter (2002). This is particularly evident in the case of the gender and case macros below.

First, though, we consider the number macro, which defines a trivial/deficient hierarchy, since there is only one marked number feature in our analysis:

(15)

Number	**Hierarchy**
PL := (↑ PLURAL) = +	PLURAL

In short, there is nothing 'below' PLURAL: it entails no further number features and singular is analyzed as the absence of plural.

Since GENDER has two features, it defines a non-deficient hierarchy:

(16)

Gender	**Hierarchy**
MASC := (↑ GENDER) = +	GENDER
FEM := @MASC (↑ FEMININE) = +	FEMININE

[12] Recall that, in L_RFG the source of exponence includes both the c-structure category and the f-structural features associated with the category by c-structure rules. In other words, the terminal nodes in L_RFG for exponence are pairs of categorial/featural information. The terminal node is not the thing sitting under the pre-terminal category, as in standard LFG.

Notice that the MASC macro does not introduce a MASCULINE feature, but rather introduces a GENDER feature. Thus, masculine expresses the GENDER feature, which is also contained by feminine (Kramer 2015).[13]

The case hierarchy is considerably more complex than the gender hierarchy and has been determined by syncretism patterns.[14]

(17) **Case**

NOM := ($\uparrow$ NOMINATIVE) = $+$

ACC := @NOM
($\uparrow$ ACCUSATIVE) = $+$

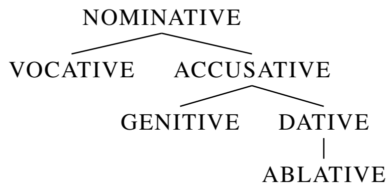
VOC := @NOM
($\uparrow$ VOCATIVE) = $+$

GEN := @ACC
($\uparrow$ GENITIVE) = $+$

DAT := @ACC
($\uparrow$ DATIVE) = $+$

ABL := @DAT
($\uparrow$ ABLATIVE) = $+$

Hierarchy



Note that we have added VOCATIVE mainly because it's straightforward to do so, but we follow the literature in not discussing it.

5.2 Lists

The second major part of our analysis is the LIST macro, which has not featured in previous L_RFG work. In the present paper, it merely captures which PRED FN values each declension class applies to—where the value of PRED FN is the general predicate function without uniqueness (Crouch et al. 2011)—because we assume that declension class is arbitrary and listed. For example, there is nothing about 'water' that puts it in the first declension; it is simply a fact that Latin learners must store. Of special note in the list below is that 'royal' appears in class 3, but also in M_1 and M_2, which is our way of encoding that the PRED FN royal appears in three different declensions with slightly different meanings (*rex* 'king', *regina* 'queen', *regnum* 'rule, authority. kingdom'). We use 'royal' to cover all these cases.[15]

[13] Of course, the GENDER feature could be called MASCULINE, but some might find it confusing in the feminine case, since the forms would be marked as MASCULINE *and* FEMININE.

[14] The analysis of case in terms of a feature breakdown is not new to f-structure; see Dalrymple et al. (2009).

[15] Note that the particular chosen indices are arbitrary up to identity. Since these only roughly correspond to declension class numbers, we have avoided using numerals to forestall confusion.

(18) $$\textsc{list}(\mathrm{X}) := \quad \begin{array}{l} \mathrm{X} = a \Rightarrow (\uparrow \textsc{pred fn}) \in \mathrm{C}_1 \\ \mathrm{X} = b \Rightarrow (\uparrow \textsc{pred fn}) \in \mathrm{C}_2 \\ \mathrm{X} = c \Rightarrow (\uparrow \textsc{pred fn}) \in \mathrm{C}_3 \\ \mathrm{X} = d \Rightarrow (\uparrow \textsc{pred fn}) \in \mathrm{C}_{3m} \\ \mathrm{X} = e \Rightarrow (\uparrow \textsc{pred fn}) \in \mathrm{C}_{3i} \\ \mathrm{X} = f \Rightarrow (\uparrow \textsc{pred fn}) \in \mathrm{C}_4 \\ \mathrm{X} = g \Rightarrow (\uparrow \textsc{pred fn}) \in \mathrm{C}_5 \\ \mathrm{X} = v \Rightarrow (\uparrow \textsc{pred fn}) \in \mathrm{M}_1 \\ \mathrm{X} = w \Rightarrow (\uparrow \textsc{pred fn}) \in \mathrm{M}_2 \\ \vdots \end{array} \quad \& \quad \begin{array}{l} \mathrm{C}_1 = \{\text{ water}, \ldots \} \\ \mathrm{C}_2 = \{\text{ gift}, \ldots \} \\ \mathrm{C}_3 = \{\text{ royal}, \ldots \} \\ \\ \vdots \\ \\ \\ \mathrm{M}_1 = \{\text{ royal}, \ldots \} \\ \mathrm{M}_2 = \{\text{ royal}, \ldots \} \\ \vdots \end{array}$$

The LIST macro can in fact be used for controlling any kind of lexicalized information, including capturing exceptions to general patterns. Thus, we expect the LIST macro to feature prominently in $\mathrm{L_RFG}$ fragments. Note that in each case, a particular clause is triggered conditionally by an index passed through the phrase structure, which brings us to the next section.

5.3 Phrase structure

The third major ingredient of any $\mathrm{L_RFG}$ analysis is a set of annotated phrase structure rules for licensing c-structures, as in LFG.

5.3.1 Metarules

A *metarule* (Gazdar et al. 1985) is a compact specification of multiple phrase structure rules. The numerical annotation on arrows in metarules stands for the number of distinct instantiations of the x c-structure variable, i.e. 9 possible instantiations in rule (19) and 7 in rule (20). We also introduce a new notational convention on our rules (including metarules): annotations that are about the relationship between c-structure and f-structure, i.e. the ϕ-mapping, are written above the category, whereas annotations for exponence, i.e. c-structure exponenda, are written below the category.

(19) $$\mathrm{n}_x\mathrm{P} \quad \xrightarrow{9} \quad \begin{array}{c} \uparrow = \downarrow \\ \sqrt{} \\ @\textsc{root}(\_\_) \end{array} \quad \begin{array}{c} \uparrow = \downarrow \\ \mathrm{n}_{x \in \{a,b,c,d,e,f,g,v,w\}} \\ @\textsc{list}(x) \\ (\ @\textsc{gend}!\ ) \end{array}$$

(20) $$\theta\mathrm{P} \quad \xrightarrow{7} \quad \begin{array}{c} \uparrow = \downarrow \\ \mathrm{n}_x\mathrm{P} \end{array} \quad \begin{array}{c} \uparrow = \downarrow \\ \theta_{x \in \{a,b,c,d,e,f,g\}} \end{array}$$

The combination of (19) and (20) links rules to declension class, via the call to the LIST macro in (19) and the specification of theme vowel in (20). The nominalizer (n) in (20) is never independently exponed. Thus, the reason there are nine nominalizers in (19) but only seven in (20) is because the nominalizers corresponding to n_v and n_w *are* independently exponed, as captured in rules (23) and (24) below. The nominalizer n_v creates first declension nouns and n_w creates second declension nouns.

5.3.2 Rules

The specific rules for Latin declension are reasonably straightforward given the discussion above. The only things to note here are: 1) when number appears, it appears outside the case marker, as captured by (21), and 2) case always appears outside the theme vowel, as captured by (22).

(21) $$\#\mathrm{P} \;\rightarrow\; \begin{array}{c}\uparrow = \downarrow\\ \mathrm{KP}\end{array} \; \left(\begin{array}{c}\uparrow = \downarrow\\ \#\\ @\textsc{num}!\end{array}\right)$$

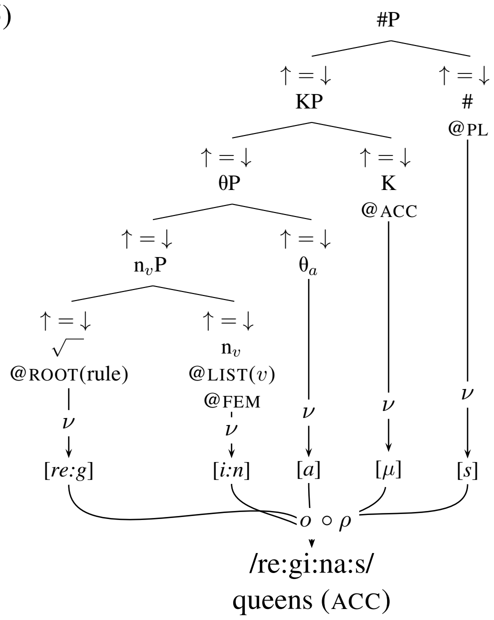
(22) $$\mathrm{KP} \;\rightarrow\; \begin{array}{c}\uparrow = \downarrow\\ \theta\mathrm{P}\end{array} \; \begin{array}{c}\uparrow = \downarrow\\ \mathrm{K}\\ @\textsc{case}!\end{array}$$

(23) $$\theta\mathrm{P} \;\rightarrow\; \begin{array}{c}\uparrow = \downarrow\\ \mathrm{n}_v\mathrm{P}\end{array} \; \begin{array}{c}\uparrow = \downarrow\\ \theta_a\end{array}$$

(24) $$\theta\mathrm{P} \;\rightarrow\; \begin{array}{c}\uparrow = \downarrow\\ \mathrm{n}_w\mathrm{P}\end{array} \; \begin{array}{c}\uparrow = \downarrow\\ \theta_b\end{array}$$

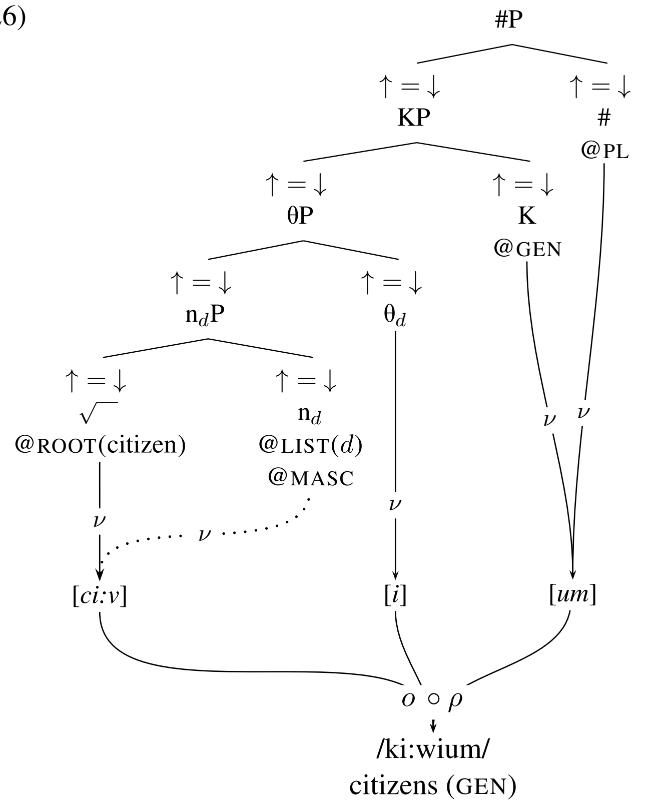
Examples (25) and (26) below show the c-structure and f-structure for two possible instantiations of the rules above. In the case of (25), these lead to the exponents [*re:g*], [*i:n*], [*a*], [μ], and [*s*]; in turn, these are mapped to the realization /re:gi:na:s/ ('queen.ACC-PL'), by the composition of the ρ correspondence function from v-structure to prosodic structure and the o correspondence function from prosody to the phonological string (Asudeh, Bögel & Siddiqi 2023: 39–41). Similarly, (26) leads to the exponents [*ci:v*], [*i*], and [*um*]. There is no exponent for n_d in (26) in the Vocabulary, so this node is *Pac-Man spanned* with the root (Asudeh, Bögel & Siddiqi 2023: 39), which is indicated by a dotted line. In the case of [*um*], this is a portmanteau form that *vocabulary spans* both case and number; see (46) below. These three exponents are mapped by $o \circ \rho$ to the realization /ki:wium/ ('citizen.GEN.PL').

(25)



$$\begin{bmatrix} \textsc{pred} & \text{`royal'} \\ \textsc{gender} & + \\ \textsc{feminine} & + \\ \textsc{nominative} & + \\ \textsc{accusative} & + \\ \textsc{plural} & + \end{bmatrix}$$

(26)



$$\begin{bmatrix} \text{PRED} & \text{`citizen'} \\ \text{GENDER} & + \\ \text{NOMINATIVE} & + \\ \text{ACCUSATIVE} & + \\ \text{GENITIVE} & + \\ \text{PLURAL} & + \end{bmatrix}$$

5.4 Vocabulary

This section contains the vocabulary items in the fragment's Vocabulary. These are listed by the role of the morpheme—whether it is part of number-marking, gender-marking, class-marking, or case-marking. A VI with a list of categories greater than 1, e.g. (46) below, is an instance of *vocabulary spanning*, whereby the VI spans two or more nodes in c-structure. For example, see c-structure (26) above, where K and # are exponed by the second option in the disjunction in (46), [*um*]. Recall that a disjunction on the right-hand side of a VI models metasyncretism. Recall also that the notation $\langle\!\langle\ \rangle\!\rangle$ marks constraining equations (including existentials and negative existentials), which control secondary exponence; i.e., these constraints model morphological conditioning.

5.4.1 Number

(27) $\langle\ [\#], @\text{PL}\ \rangle \xrightarrow{\nu} \begin{bmatrix} \text{PHONREP} & /\text{s}/ \\ \text{DEP} & \text{LT} \\ \text{HOST} & \begin{bmatrix} \text{IDENT} & + \end{bmatrix} \end{bmatrix}$

5.4.2 Nominalizers/gender

(28) $$\langle\ [\mathrm{n}_v],\ @\textsc{fem}\ \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{i{:}n}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{host} & \begin{bmatrix}\textsc{ident} & +\end{bmatrix} \end{bmatrix}$$

(29) $$\langle\ [\mathrm{n}_w],\ \varnothing\ \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{n}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{host} & \begin{bmatrix}\textsc{ident} & +\end{bmatrix} \end{bmatrix}$$

5.4.3 Class

Note that θ_c is missing because it is zero-marked and therefore always spanned (Asudeh & Siddiqi 2023, Asudeh, Bögel & Siddiqi 2023: 39).

(30) $$\langle\ [\theta_a],\ \varnothing\ \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{a}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \mathrm{X}{=}1 \\ \textsc{host} & \begin{bmatrix}\textsc{ident} & + \\ \textsc{class} & \mathrm{X}\end{bmatrix} \end{bmatrix}$$

(31) $$\langle\ [\theta_b],\ \varnothing\ \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{o}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \mathrm{X}{=}2 \\ \textsc{host} & \begin{bmatrix}\textsc{ident} & + \\ \textsc{class} & \mathrm{X}\end{bmatrix} \end{bmatrix}$$

(32) $$\langle\ [\theta_d],\ \langle\!\langle(\uparrow \textsc{pl})\rangle\!\rangle\ \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{i}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \mathrm{X}{=}3 \\ \textsc{host} & \begin{bmatrix}\textsc{ident} & + \\ \textsc{class} & \mathrm{X}\end{bmatrix} \end{bmatrix}$$

(33) $$\langle\ [\theta_e],\ \varnothing\ \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{i}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \mathrm{X}{=}3 \\ \textsc{host} & \begin{bmatrix}\textsc{ident} & + \\ \textsc{class} & \mathrm{X}\end{bmatrix} \end{bmatrix}$$

(34) $\langle\ [\theta_f],\ \varnothing\ \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\text{u}/ \\ \textsc{dep} & \text{LT} \\ \textsc{class} & \text{x}{=}4 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \text{x} \end{bmatrix} \end{bmatrix}$

(35) $\langle\ [\theta_g],\ \varnothing\ \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\text{e:}/ \\ \textsc{dep} & \text{LT} \\ \textsc{class} & \text{x}{=}5 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \text{x} \end{bmatrix} \end{bmatrix}$

5.4.4 Case

(36) $\left\langle\ \begin{array}{l} [\text{K}],\ @\textsc{nom} \\ \langle\!\langle(\uparrow \textsc{gender})\rangle\!\rangle \end{array}\ \right\rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\text{s}/ \\ \textsc{dep} & \text{LT} \\ \textsc{class} & \text{x}{=}2 \ \vee\ \text{x}{=}3 \ \vee\ \text{x}{=}4 \ \vee\ \text{x}{=}5 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \text{x} \end{bmatrix} \end{bmatrix}$

(37) $\left\langle\ \begin{array}{l} [\text{K}],\ @\textsc{nom} \\ \langle\!\langle\neg(\uparrow \textsc{gender})\rangle\!\rangle \end{array}\ \right\rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\text{m}/ \\ \textsc{dep} & \text{LT} \\ \textsc{class} & \text{x}{=}2 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \text{x} \end{bmatrix} \end{bmatrix}$

(38) $\left\langle\ \begin{array}{l} [\text{K}],\ @\textsc{nom} \\ \langle\!\langle\neg(\uparrow \textsc{gender})\rangle\!\rangle \\ \langle\!\langle\neg(\uparrow \textsc{plural})\rangle\!\rangle \end{array}\ \right\rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & \mu \\ \textsc{dep} & \text{LT} \\ \textsc{class} & \text{x}{=}4 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \text{x} \end{bmatrix} \end{bmatrix}$

(39) $\left\langle\ \begin{array}{l} [\text{K}],\ @\textsc{nom} \\ \langle\!\langle(\uparrow \textsc{plural})\rangle\!\rangle \end{array}\ \right\rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & \mu \\ \textsc{dep} & \text{LT} \\ \textsc{class} & \text{x}{=}3 \ \vee\ \text{x}{=}4 \ \vee\ \text{x}{=}5 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \text{x} \end{bmatrix} \end{bmatrix}$

(40)
$$\left\langle [\mathrm{K},\#],\ \begin{array}{l} @\textsc{nom} \\ @\textsc{pl} \\ \langle\!\langle \neg(\uparrow \textsc{accusative})\rangle\!\rangle \end{array} \right\rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{j}/ \\ \textsc{dep} & \mathrm{LT} \\ \textsc{class} & \mathrm{X}{=}1 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \mathrm{X} \end{bmatrix} \end{bmatrix} \vee \begin{bmatrix} \textsc{phonrep} & /\mathrm{i{:}}/ \\ \textsc{dep} & \mathrm{LT} \\ \textsc{class} & \mathrm{X}{=}2 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \mathrm{X} \end{bmatrix} \end{bmatrix}$$

(41)
$$\left\langle [\mathrm{K},\#],\ \begin{array}{l} @\textsc{nom} \\ @\textsc{pl} \\ \langle\!\langle \neg(\uparrow \textsc{gender})\rangle\!\rangle \end{array} \right\rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{a}/ \\ \textsc{dep} & \mathrm{LT} \\ \textsc{class} & \mathrm{X}{=}2 \ \vee\ \mathrm{X}{=}3 \ \vee\ \mathrm{X}{=}4 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \mathrm{X} \end{bmatrix} \end{bmatrix}$$

(42)
$$\left\langle [\mathrm{K}],\ \begin{array}{l} @\textsc{acc} \\ \langle\!\langle (\uparrow \textsc{gender})\rangle\!\rangle \end{array} \right\rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{m}/ \\ \textsc{dep} & \mathrm{LT} \\ \textsc{class} & \begin{array}{l} \mathrm{X}{=}1 \ \vee\ \mathrm{X}{=}2 \ \vee \\ \mathrm{X}{=}3 \ \vee\ \mathrm{X}{=}4 \ \vee \\ \mathrm{X}{=}5 \end{array} \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \mathrm{X} \end{bmatrix} \end{bmatrix}$$

(43)
$$\left\langle [\mathrm{K}],\ \begin{array}{l} @\textsc{acc} \\ \langle\!\langle (\uparrow \textsc{plural})\rangle\!\rangle \\ \langle\!\langle (\uparrow \textsc{gender})\rangle\!\rangle \end{array} \right\rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & \mu \\ \textsc{dep} & \mathrm{LT} \\ \textsc{class} & \mathrm{X}{=}1 \ \vee\ \mathrm{X}{=}2 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \mathrm{X} \end{bmatrix} \end{bmatrix}$$

(44)
$$\langle [\mathrm{K}],\ @\textsc{gen} \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{j}/ \\ \textsc{dep} & \mathrm{LT} \\ \textsc{class} & \mathrm{X}{=}1 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \mathrm{X} \end{bmatrix} \end{bmatrix} \vee \begin{bmatrix} \textsc{phonrep} & /\mathrm{i{:}}/ \\ \textsc{dep} & \mathrm{LT} \\ \textsc{class} & \mathrm{X}{=}5 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \mathrm{X} \end{bmatrix} \end{bmatrix}$$

(45) $$\langle\ [\mathrm{K}],\ @\textsc{gen}\ \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{i{:}}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \textsc{x}{=}2 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{bmatrix} \end{bmatrix} \vee \begin{bmatrix} \textsc{phonrep} & /\mathrm{is}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \textsc{x}{=}3 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{bmatrix} \end{bmatrix} \vee \begin{bmatrix} \textsc{phonrep} & \mu\cdot/\mathrm{s}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \textsc{x}{=}4 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{bmatrix} \end{bmatrix}$$

(46) $$\langle\ [\mathrm{K},\#],\ \begin{matrix} @\textsc{gen} \\ @\textsc{pl} \end{matrix}\ \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{rum}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \textsc{x}{=}1 \ \vee\ \textsc{x}{=}2 \ \vee\ \textsc{x}{=}5 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{bmatrix} \end{bmatrix} \vee \begin{bmatrix} \textsc{phonrep} & /\mathrm{um}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \textsc{x}{=}3 \ \vee\ \textsc{x}{=}4 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{bmatrix} \end{bmatrix}$$

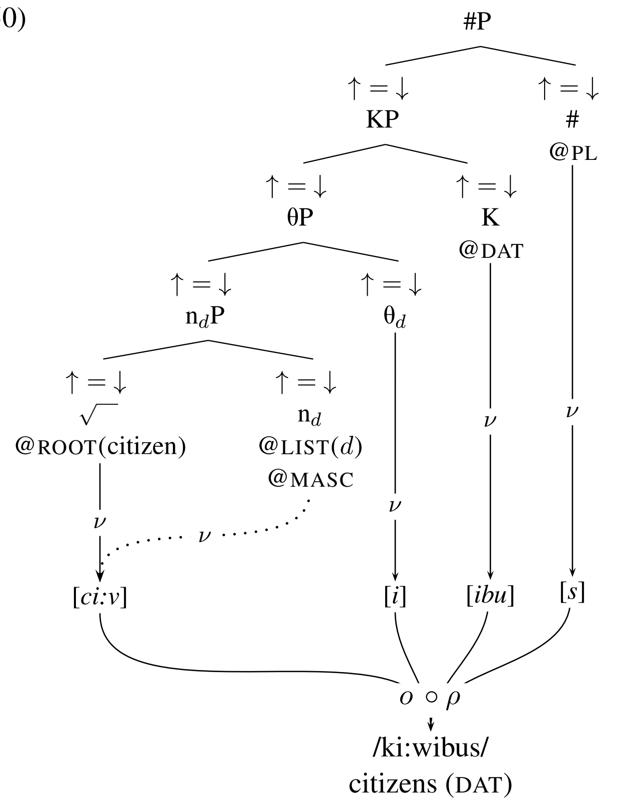
(47) $$\langle\ [\mathrm{K}],\ \begin{matrix} @\textsc{dat} \\ \langle\!\langle(\uparrow \textsc{plural})\rangle\!\rangle \end{matrix}\ \rangle \xrightarrow{\nu} \begin{bmatrix} \textsc{phonrep} & /\mathrm{i{:}}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \textsc{x}{=}1 \ \vee\ \textsc{x}{=}2 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{bmatrix} \end{bmatrix} \vee \begin{bmatrix} \textsc{phonrep} & /\mathrm{ibu}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \textsc{x}{=}3 \ \vee\ \textsc{x}{=}4 \\ & \vee\ \textsc{x}{=}5 \\ \textsc{host} & \begin{bmatrix} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{bmatrix} \end{bmatrix}$$

(48) $\langle\ [\text{K}],\ @\textsc{dat}\ \rangle \xrightarrow{\nu} \left[\begin{array}{ll} \textsc{phonrep} & /\text{i:}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \textsc{x}{=}3\ \vee\ \textsc{x}{=}4 \\ \textsc{host} & \left[\begin{array}{ll} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{array}\right] \end{array}\right]$

(49) $\left\langle\ [\text{K}],\ \begin{array}{l} @\textsc{abl} \\ \langle\!\langle \neg(\uparrow \textsc{plural}) \rangle\!\rangle \end{array}\ \right\rangle \xrightarrow{\nu} \left[\begin{array}{ll} \textsc{phonrep} & \mu \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \textsc{x}{=}1\ \vee\ \textsc{x}{=}4 \\ & \vee\ \textsc{x}{=}5 \\ \textsc{host} & \left[\begin{array}{ll} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{array}\right] \end{array}\right] \vee \left[\begin{array}{ll} \textsc{phonrep} & /\text{e}/ \\ \textsc{dep} & \textsc{lt} \\ \textsc{class} & \textsc{x}{=}3 \\ \textsc{host} & \left[\begin{array}{ll} \textsc{ident} & + \\ \textsc{class} & \textsc{x} \end{array}\right] \end{array}\right]$

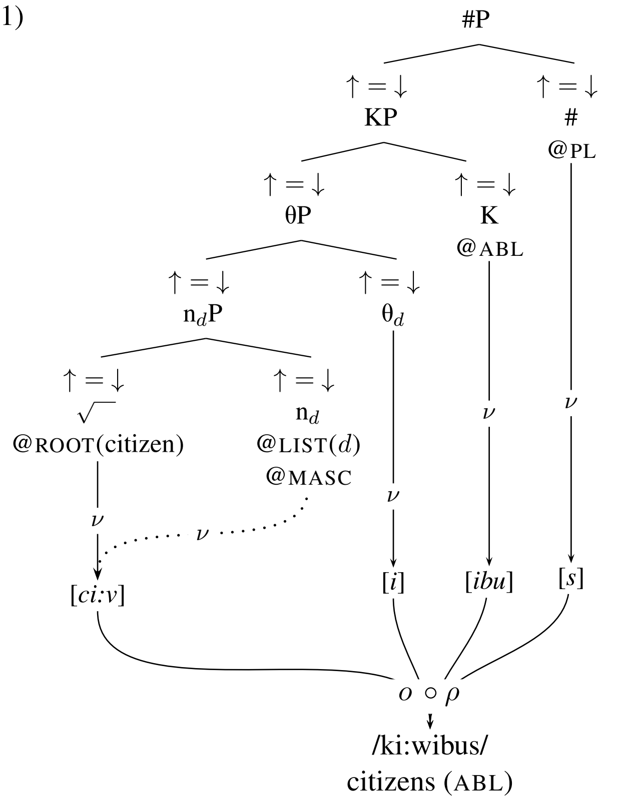
An example of these vocabulary items giving rise to syncretism occurs in the dative plural and ablative plural, as seen in (50) and (51) below.

(50)



$\left[\begin{array}{ll} \textsc{pred} & \text{`citizen'} \\ \textsc{gender} & + \\ \textsc{nominative} & + \\ \textsc{accusative} & + \\ \textsc{dative} & + \\ \textsc{plural} & + \end{array}\right]$

(51)



$$\begin{bmatrix} \text{PRED} & \text{`citizen'} \\ \text{GENDER} & + \\ \text{NOMINATIVE} & + \\ \text{ACCUSATIVE} & + \\ \text{DATIVE} & + \\ \text{ABLATIVE} & + \\ \text{PLURAL} & + \end{bmatrix}$$

Notice that the c-structure and f-structure for (50) and (51) are different: the c-structure for (51) calls the ABL macro and the f-structure for (51) has one additional feature, [ABLATIVE +]. However, both are realized by /ki:wibus/.[16] This is because *-ibu* is the best candidate for ablative plural and it is also the best candidate for dative plural. This happens since ablative case contains dative case—@ABL calls @DAT—and no ablative affix exists for the plural context. Thus, the less specified dative form appears.

6 Conclusion

L$_R$FG is an LFG-like theory that drills down into 'words' and offers a realizational morphology. Thus, L$_R$FG is a *morphemic*, realizational theory. One of the typical strengths of morphemic theories is a deeper analysis of polysynthesis, which seems an unlikely candidate for a paradigmatic approach. One of the typical weaknesses of morphemic theories is trouble with putative paradigmatic effects in fusional languages. Therefore it is incumbent on L$_R$FG to demonstrate that it can indeed provide analyses of fusional languages, of which Latin is a well-studied exemplar. We have delivered on this here.

[16]Note that the theme vowel deletes, which is why we get the realization /ki:wibus/ and not */ki:wi:bus/. The deletion of the theme vowel is due to a phonological rule in Latin that deletes short high vowels when they are preceded by a morpheme boundary and are followed by a morpheme boundary followed by /i/ (see Phonological Rule (27) in the supplemental materials accompanying Myler 2024).

References

Albright, Adam & Eric Fuß. 2012. Syncretism. In Jochen Trommer (ed.), *The morphology and phonology of exponence*, Oxford: Oxford University Press.

Allen, Joseph Henry & James Bradstreet Greenough. 1888. *Allen and Greenough's Latin grammar for schools and colleges*. Boston, MA: Ginn & Co.

Asudeh, Ash, Tina Bögel & Daniel Siddiqi. 2023. Modelling exponents. In Miriam Butt, Jamie Y. Findlay & Ida Toivonen (eds.), *Proceedings of the LFG23 Conference*, 23–44. Konstanz: PubliKon.

Asudeh, Ash, Mary Dalrymple & Ida Toivonen. 2013. Constructions with Lexical Integrity. *Journal of Language Modelling* 1(1). 1–54.

Asudeh, Ash, Paul B. Melchin & Daniel Siddiqi. 2024. Constraints all the way down: DM in a representational model of grammar. In *Proceedings of the 39th West Coast Conference on Formal Linguistics*, Cascadilla Press. Forthcoming.

Asudeh, Ash & Daniel Siddiqi. 2022. Realizational morphosemantics in $\mathrm{L_R FG}$. In Miriam Butt, Jamie Y. Findlay & Ida Toivonen (eds.), *Proceedings of the LFG22 Conference*, 20–40. Stanford, CA: CSLI Publications.

Asudeh, Ash & Daniel Siddiqi. 2023. Morphology in LFG. In Mary Dalrymple (ed.), *Handbook of Lexical Functional Grammar*, 855–901. Berlin: Language Science Press.

Blevins, James P. 2018. *Word and Paradigm Morphology*. Oxford: Oxford University Press.

Bobaljik, Jonathan. 2002. Syncretism without paradigms: Remarks on Williams 1981, 1994. In Geert Booij & Jaap Marle (eds.), *Yearbook of morphology 2001*, 53–85.

Bonami, Olivier & Gregory T. Stump. 2016. Paradigm Function Morphology. In Andrew Hippisley & Gregory T. Stump (eds.), *The cambridge handbook of morphology*, 449–481. Cambridge: Cambridge University Press.

Bresnan, Joan, Ash Asudeh, Ida Toivonen & Stephen Wechsler. 2016. *Lexical-functional syntax* (2nd edn.). Chichester, UK: Wiley-Blackwell.

Caha, Pavel. 2009. *The nanosyntax of case*. Doctoral dissertation, University of Tromsø.

Chomsky, Noam. 1970. Remarks on nominalization. In R. Jacobs & P. Rosenbaum (eds.), *Readings in English transformational grammar*, Waltham, MA: Ginn.

Chomsky, Noam. 1995. *The minimalist program*. Cambridge, MA: MIT Press.

Collins, Chris & Richard S. Kayne. 2023. Towards a theory of morphology as syntax. *Studies in Chinese Linguistics* 44(1). 1–32.

Crouch, Dick, Mary Dalrymple, Ron Kaplan, Tracy King, John Maxwell & Paula Newman. 2011. *XLE documentation*. Palo Alto Research Center Palo Alto, CA. ling.sprachwiss.uni-konstanz.de/pages/xle/doc. ling.sprachwiss.uni-konstanz.de/pages/xle/doc.

Crowder, Ben. 2024. Latin declensions. https://bencrowder.net/latin-declensions/.

Dalrymple, Mary (ed.). 2023. *The handbook of Lexical Functional Grammar*. Language Science Press. Forthcoming.

Dalrymple, Mary, Ronald M. Kaplan & Tracy Holloway King. 2004. Linguistic generalizations over descriptions. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG04 Conference*, 199–208. Stanford, CA: CSLI Publications.

Dalrymple, Mary, Tracy Holloway King & Louisa Sadler. 2009. Indeterminacy by underspecification. *Journal of Linguistics* 45(1). 31–68.

Dalrymple, Mary, John J. Lowe & Louise Mycock. 2019. *The Oxford reference guide to Lexical Functional Grammar*. Oxford: Oxford University Press.

Everdell, Michael & Paul B. Melchin. 2024. Control the sentence, subordinate the pronoun: on the status of controlled versus non-controlled complement clauses in O'dam. In *Proceedings of the 39th West Coast Conference on Formal Linguistics*, Somerville, MA: Cascadilla Press. Forthcoming.

Everdell, Michael, Paul B. Melchin, Ash Asudeh & Daniel Siddiqi. 2021. Beyond c-structure and f-structure: On the argument-adjunct distinction in O'dam. In Miriam Butt, Jamie Y. Findlay & Ida Toivonen (eds.), *Proceedings of the LFG21 Conference*, 125–145. Stanford, CA: CSLI Publications.

Gazdar, Gerald, Ewan Klein, Geoffrey K. Pullum & Ivan A. Sag. 1985. *Generalized phrase structure grammar*. Cambridge, MA: Harvard University Press.

Halle, Morris & Alec Marantz. 1993. Distributed Morphology and the pieces of inflection. In Samuel Jay Keyser & Ken Hale (eds.), *The view from Building 20*, 111–176. Cambridge, MA: MIT Press.

Halle, Morris & Alec Marantz. 1994. Some key features of Distributed Morphology. *MIT Working Papers in Linguistics* 21. 275–288.

Harley, Heidi. 2008. When is a syncretism more than a syncretism? Impoverishment, metasyncretism, and underspecification. In Daniel Harbour, David Adger & Susana Bejar (eds.), *Phi theory: Phi-features across modules and interfaces*, 251–294. Oxford: Oxford University Press.

Harley, Heidi & Elizabeth Ritter. 2002. Person and number in pronouns: A feature-geometric analysis. *Language* 78(3). 482–526.

Kaplan, Ronald M. & Joan Bresnan. 1982. Lexical-Functional Grammar: A formal system for grammatical representation. In Joan Bresnan (ed.), *The mental representation of grammatical information*, 29–130. Cambridge, MA: MIT Press.

Kramer, Ruth. 2015. *The morphosyntax of gender* (Oxford Studies in Theoretical Linguistics). Oxford University Press.

Lapointe, Steven. 1980. *A theory of grammatical agreement*. Ph.D. thesis, University of Massachusetts, Amherst.

Matthews, Peter H. 1972. *Inflectional morphology: A theoretical study based on aspects of Latin verb conjugation*. Cambridge: Cambridge University Press.

Melchin, Paul B., Ash Asudeh & Dan Siddiqi. 2020a. Ojibwe agreement in a representational, morpheme-based framework. In Angelica Hernández & M. Emma Butterworth (eds.), *Proceedings of the 2020 Canadian Linguistic Association*, Canadian Linguistic Association.

Melchin, Paul B., Ash Asudeh & Dan Siddiqi. 2020b. Ojibwe agreement in Lexical-Realizational Functional Grammar. In Miriam Butt & Ida Toivonen (eds.), *Proceedings of the LFG20 Conference*, 268–288. Stanford, CA: CSLI Publications.

Myler, Neil. 2023. MaS versus Metasyncretism: The case of Latin noun declension. Presented at Morphology as Syntax Workshop 3, UQAM, September 23.

Myler, Neil. 2024. Imagining life without Rules of Exponence and the Elsewhere Condition: An evaluation of a Morphology as Syntax approach to Latin noun declension 1(1). 1–40.

Noyer, Rolf. 1997. *Features, positions and affixes in autonomous morphological structure*. New York: Garland Publishing.

Oniga, Renato. 2014. *Latin: A linguistic introduction*. Oxford: Oxford University Press. Edited and translated by Norma Schifano.

Siddiqi, Daniel. 2024. On the taxonomy of root suppletion. In *Proceedings of the 39th West Coast Conference on Formal Linguistics*, Somerville, MA: Cascadilla Press. Forthcoming.

Spencer, Andrew. 2013. *Lexical relatedness: A paradigm-based model*. Oxford: Oxford University Press.

Starke, Michal. 2009. Nanosyntax: A short primer to a new approach to language. *Nordlyd* 36(1). 1–6.

Stump, Gregory T. 2001. *Inflectional morphology: A theory of paradigm structure*. Cambridge: Cambridge University Press.

Williams, Edwin. 1994. Remarks on lexical knowledge. *Lingua* 92(1). 7–34.