Variation and inflectional features in morphological theory

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1 Introduction

Generative morphosyntax (including DM) typically ignores individual variation (saying "the same thing" in "different ways").

In this talk, I'll assume (controversially but, I believe, unavoidably) that our grammars are *variable* (involve some amount of random choice).

Two case studies from Czech show that letting variation in gives us theoretical insights that can be hard to get otherwise – specifically, I will address the question of where a morpheme's *inflectional properties* are stored.

- First: an argument (using variable root suppletion) that inflection class is a property of *phonological exponents*, not the syntactic objects they spell out
- Next: an argument (using semantically conditioned variable allomorphy) that inflection class must be a property of *syntactic objects*, not their phonological exponents (under current DM assumptions)
- I suggest a resolution for this tension: inflection class is phonological and polysemy in roots is instantiated through *different categorizing heads* in the syntax

2 The architecture of DM

Architectural properties of Distributed Morphology:

- *Syntax all the way down*: Both sentences and words are comprised of smaller syntactic pieces
- *Late insertion*: Syntactic structures contain abstract, syntactic objects that are *spelled out* (mapped) to phonological units (these mappings are called Vocabulary Items)
- *Underspecification*: Vocabulary Items do not need to match all of an object's features in order to spell it out; by the *Subset Principle*, when two rules both satisfy the conditions, the more specific one wins

2.1 Roots in the syntax: a historical note

In early versions of DM, roots were not individuated in the syntax – "root" ($\sqrt{}$) was a single syntactic object.

- Benefit: any free choice, including whether to spell out a given syntactic root as /kəm/ or /gow/, could be associated with meaning (semantics can see PF)
- Consequence: root suppletion is impossible, as there is no way for e.g. /gow/ and /wɛn/ to compete only with each other
  - (1-a) and (1-b) are structurally identical, so the choice between them is free and thus meaningful
  - (1-c) is more specific than (1-a) and (1-b), so by the Subset Principle, it wins out over *both* of them – will be inserted for *every* verb in the past tense

(1) *Vocabulary Items for root insertion (early DM)*

a. $\sqrt{} \leftrightarrow$ kəm
b. $\sqrt{} \leftrightarrow$ gow
c. $\sqrt{} \leftrightarrow$ wɛn / ___ [+past]

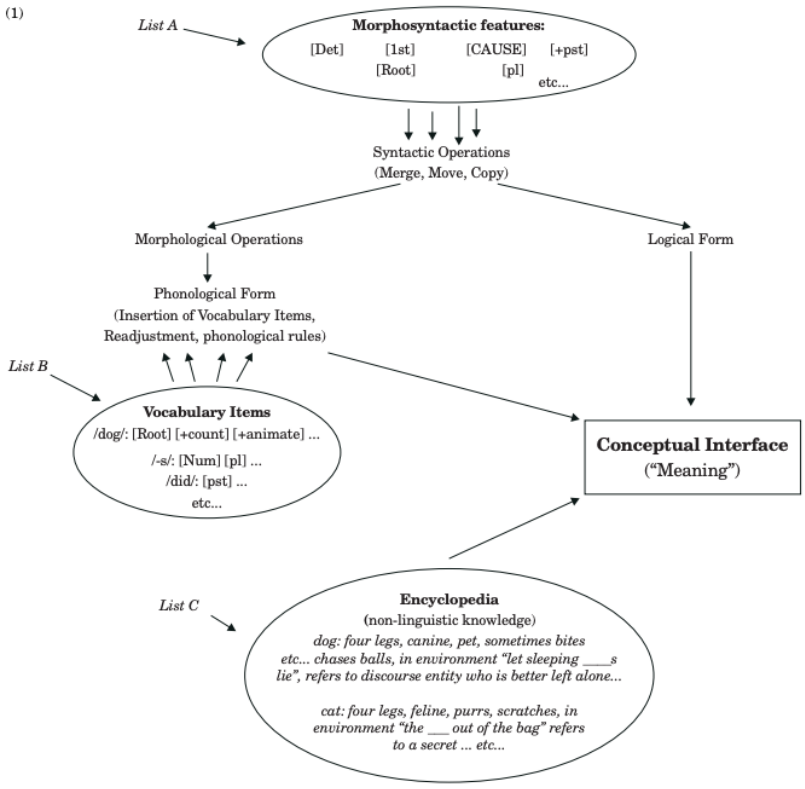

Figure 1: Architecture of early Distributed Morphology (Harley & Noyer 1999)

One solution: cross-linguistically common suppletive roots (*person*, *go*, *be*, etc.) look like functional morphemes, so maybe they don't contain roots at all (and are thus individuated in the syntax)!

Harley (2014): in Hiaki, verb roots like *run*, *kill*, *lie* supplete for number of the internal argument – these are not plausibly comprised entirely of syntactic features, thus true root suppletion exists.

Solution: Roots are distinguished in the syntax (typically, with indices).

- Benefit: Suppletive allomorphs of roots only compete with each other: (2-b) and (2-c) target the same syntactic object, (2-a) targets a different one
- Consequence: There is no longer any free choice in spell-out, only syntax – so the direct link between meaning and PF is severed and rerouted through syntax

(2) *Vocabulary Items for root insertion (contemporary DM)*

a. $\sqrt{}_{35} \leftrightarrow$ kəm
b. $\sqrt{}_{146} \leftrightarrow$ gow
c. $\sqrt{}_{146} \leftrightarrow$ wɛn / ___ [+past]

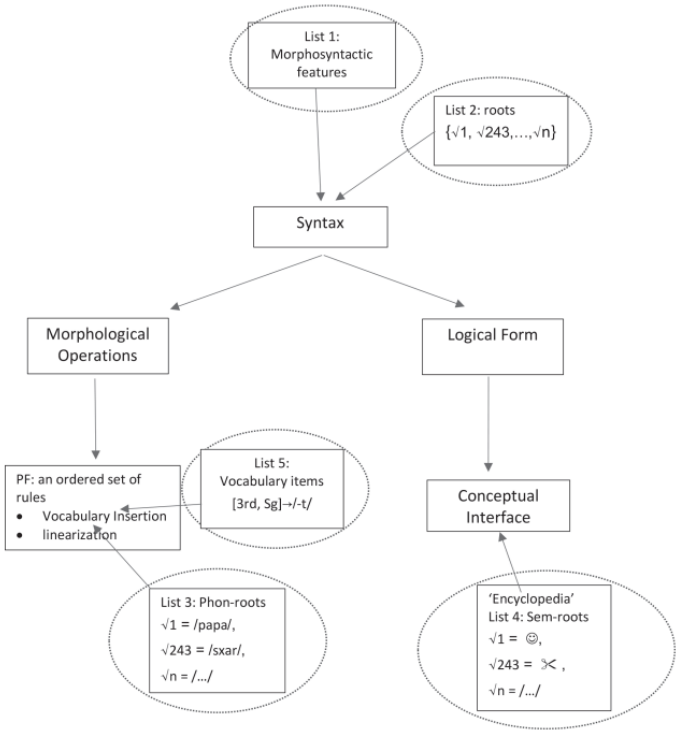

Figure 2: Architecture of contemporary Distributed Morphology (De Belder & Don 2022)

3 Inflection class diacritics

3.1 Encoding arbitrary morphological properties

It is an unavoidable conclusion that some words' inflectional properties are not fully predictable from their phonological or syntactic (e.g. gender) properties and must thus be specially memorized and encoded.

(3) *Inflectional "microclasses" in Czech*

	'north'	'time'	'evening'	'forest'
NOM	sɛvɛr	tʃas	vɛtʃɛr	lɛs
GEN	sɛvɛru	tʃasu	vɛtʃɛra	lɛsa
LOC	sɛvɛru	tʃasɛ	vɛtʃɛru	lɛsɛ

Easiest way to handle these: *diacritic features* that index inflectional behavior, [le] and [ga]

- [tʃas] has [le]
- [vɛtʃɛr] has [ga]
- [lɛs] has both
- [sɛvɛr] has neither

(4) *Vocabulary Items for Czech genitive and locative*

a. LOC ↔ ɛ / [le] ___
b. GEN ↔ a / [ga] ___
c. [−direct] ↔ u

Many linguists (e.g. Bermúdez-Otero 2013, Caha 2021) consider diacritic features empirically and theoretically unrestricted, and have proposed various alternatives:

- Full storage of unpredictable forms (e.g. Bermúdez-Otero 2012, 2013)
- Abstract phonological structure in underlying forms (e.g. Trommer 2021, Lampitelli & Ulfsbjorninn 2023)
- Use or appropriation of existing morphosyntactic features (e.g. Privizentseva 2023)
- Spell-out targeting syntactic structures of different shapes and sizes (e.g. Caha 2021, Janků 2022)

Even those who use them typically do not make an affirmative defence of their role (but see Pater 2006, Gouskova 2012) – they are often simply used when nothing better can be found.

My personal opinion: none of these are really satisfying alternatives for cases like the Czech above.

3.2 Where are diacritics?

If you believe (as I do) that diacritics are unavoidable, the question arises: are they phonological or syntactic?

- Most authors (e.g. Müller 2004, Embick & Halle 2005, Kramer 2015, Privizentseva 2023) assume that they are tied to *syntactic* roots alongside other morphosyntactically active (depending on the language) features like gender, animacy, count/mass
- Harley & Tubino Blanco (2013) and Gouskova & Bobaljik (2022) argue that they are instead properties of *phonological* exponents using suppletion: suppletive allomorphs belong to different inflectional classes (see also Acquaviva 2009)
- In my first case study, I will go through their arguments – which do not entirely convince me – and provide a new argument from *variable* root suppletion
- If this argument doesn't hold, seemingly nothing will

4 Case study 1: Variable root suppletion

I will use *variable root suppletion* in Czech to argue that diacritic features are parts of *phonological* underlying forms associated with *exponents* that spell out syntactic roots, not the roots themselves.

First: two previous arguments for the same point.

4.1 Harley & Tubino Blanco (2013)

4.1.1 The data

In Hiaki, stems alternate between "free" forms (which appear in isolation and with mostly inflectional suffixes) and phonologically related "bound" forms (which appear with mostly derivational suffixes).

There are different *stem classes* categorizing the alternations:

(5) *Major Hiaki stem classes (from Harley & Tubino Blanco 2013)*

stem class	*example*	*free*	*bound*
1. Truncation	'pound'	pona	pon
2. Echo vowel	'heal'	yore	yore'e
3. Invariant	'break'	hamta	hamta

Some verbs have suppletive forms conditioned on the number of their internal argument (subject if unaccusative, object if transitive) – these may belong to different stem classes:

(6) *Some Hiaki suppletive verbs (from Harley & Tubino Blanco 2013)*

verb	*number*	*free*	*bound*	*stem class*
'go (pres.)'	SG	sime	sim	1. Truncation
	PL	saka	saka'a	2. Echo vowel
'bring'	SG	kivacha	kivacha	3. Invariant
	PL	kima	kima'a	2. Echo vowel

4.1.2 The analysis

In DM, morphophonological alternations like those in Hiaki are often analyzed with *readjustment rules* that apply to phonological forms after spell-out but before phonology proper.

Harley & Tubino Blanco (2013) argue that bound forms are created by readjustment rules in a morphosyntactically defined environment: "Any element which is not left-adjacent to a phase edge is subject to the stem-forming readjustment rules."

Though they do not formalize these, I take a stab here:

(7) *Readjustment rule for Hiaki Echo vowel stems*
$\emptyset \rightarrow$?[+syll]$_1$ / ___[+syll, class:2]$_1$ +

That is: add a glottal stop and copy morpheme-final (but not phase-final) vowels (from morphemes) marked with a [class:2] diacritic.

- All stems in the Echo Vowel class have the [class:2] diacritic which makes them undergo (7)
- For some suppletive verbs (like 'bring'), one allomorph undergoes (7) while the other does not
- Thus, diacritics like [class:2] must be properties of the allomorphs themselves, not the abstract syntactic roots they spell out

(8) *Vocabulary Items for Hiaki 'bring'*
a. $\sqrt{}_{364} \leftrightarrow$ kima$_{[\text{class:2}]}$ / [+pl] ___
b. $\sqrt{}_{364} \leftrightarrow$ kivacha / [−pl] ___

4.1.3 The problems

Haugen (2016): readjustment rules in general are unconstrained and unnecessary.

- The free and bound forms are *suppletive*, as in (9) (the free form is used when nothing intervenes between the stem and the Asp head)
- Although this leaves synchronically unrelated forms suspiciously similar, we can say that this is for diachronic reasons

(9) *Alternate Vocabulary Items for Hiaki 'bring'*

a. $\sqrt{_{364}} \leftrightarrow$ kima / [+pl] ___ Asp
b. $\sqrt{_{364}} \leftrightarrow$ kima'a / [+pl] ___
c. $\sqrt{_{364}} \leftrightarrow$ kivacha / [−pl] ___

An attack from the opposite direction: these stem classes are phonological in a way that diacritics selecting sets of inflectional affixes are not

- Harley & Tubino Blanco (2013) themselves (foot)note that stem alternations could be handled in a (morphologically informed) phonology proper: "[R]eadjustment rules could be analyzed as sub-phonologies or co-phonologies constrained to apply to small subsets of the lexicon."
- In other words, just because *Hiaki* class diacritics are properties of exponents rather than the syntax, it does not mean that *all* class diacritics should be analyzed in this way (to be clear: they do not make this claim)
- A sufficiently motivated morphophonologist (*NOTE*: not me, or at least not now) could probably capture these alternations with highly abstract phonological underlying forms in the style of Trommer (2021)
- This will not be the case for the following cases, which are more "purely" morphological

4.2 Gouskova & Bobaljik (2022)

4.2.1 The data

Russian has a productive suffix that forms baby animals. It suppletes for number: [ón(o)k] in the singular, [át] in the plural. Some forms shown for the baby of [rɨsʲ] 'lynx':

(10) *Partial paradigm of Russian 'baby lynx' (from Gouskova & Bobaljik 2022: p. 1088)*

	SG	PL
NOM	rɨsʲónok	rɨsʲáta
GEN	rɨsʲónka	rɨsʲát
DAT	rɨsʲónku	rɨsʲátam

This noun is split between two different inflection classes: Ia in the singular, Ib in the plural:

(11) *Russian inflection classes Ia and Ib*

	Ia 'law'		Ib 'dish'	
	SG	PL	SG	PL
NOM	zakón	zakón**ɨ**	blʲúd**o**	blʲúd**a**
GEN	zakóna	zakón**ov**	blʲúda	blʲúd
DAT	zakónu	zakónam	blʲúdu	blʲúdam

Inflection class is somewhat correlated with gender:

- 1a is the default for masculines
- 1b is the default for neuters
- Syntactically (i.e. in agreement and concord) gender is neutralized in the plural, leaving inflection class as the only residue of gender differences

4.2.2 The analysis

How is the declension of this suffix represented?

- Since the class membership of [át] (in the plural) is not predictable from its (neutralized) gender, it must be marked with a [1b] diacritic
- However, [ónok] (in the singular) must be marked with a [1a] diacritic, or else get assigned it as the default class for masculine (cf. Kramer 2015)
- This is "consistent with the view that declension class is associated with exponents, rather than with the underlying abstract morphemes"

(12) *Vocabulary Items for the Russian baby animal affix*

a. ONOK ↔ át_{Ib} / ___ [+pl]

b. ONOK ↔ ónok_{Ia}

4.2.3 The problems

There are nouns that have the same number split as the baby animals but without suppletion, like [otʃʲkó] 'point', which has the opposite pattern from before – Ib in the plural and Ia in the singular (Parker & Sims 2020):

(13) *Partial paradigm of Russian 'point'*

	SG	PL
NOM	otʃʲkó	otʃʲkʲí
GEN	otʃʲká	otʃʲkóv
DAT	otʃʲkú	otʃʲkám

The inflection of [otʃʲkó] can be represented as a hybrid class without reference to separate exponents – so its inflection diacritic(s) can be in the syntax.

- We can do the same with the baby animals
- In this case, the coincidence between inflectional suffixes and allomorphy is not explained synchronically – though it has a clear diachronic explanation, as with the suppletion analysis of Hiaki from Haugen (2016) above

(14) *Alternate Vocabulary Items for the Russian baby animal affix*

a. ONOK, [1a/b] ↔ át / ___ [+pl]
b. ONOK, [1a/b] ↔ ónok
c. NOM ↔ a / [1a/b] ___ [+pl]
d. NOM ↔ Ø / [1a/b]

Matushansky (2025): This syntactic representation of inflection class is *gender* (eliminating diacritic features)

- Baby animals are masculine in the singular and neuter in the plural
- [otʃʲkó] is neuter in the singular and masculine in the plural

4.3 Variable root suppletion in Czech

The gist of the counterargument so far: if two suppletive allomorphs of a morpheme have different inflection properties, we can say that inflection is conditioned on the same syntactic features as allomorphy, but that the diacritic features controlling this, like [1a/b] in (14), are syntactic.

So, what would be a stronger argument that diacritic features belong to exponents (in the phonology) rather than abstract morphemes (in the syntax)? If two suppletive exponents of a root had different inflectional properties even with *the same* syntax – this is only possible if the suppletion applies *variably*.

In Czech, the masculine noun [rok] 'year' typically suppletes in oblique plural cases, borrowing forms from the neuter noun [lɛːto] 'summer' – but sometimes, the [rok] allomorph is used here too:

(15) *Paradigm of Czech 'year'*

	SG	PL	
NOM	rok	roky	
GEN	roku	lɛt	∼roku:
DAT	roku	lɛtu:m	∼roku:m
ACC	rok	roky	
LOC	rotsɛ	lɛtɛx	∼rotsi:x
INS	rokɛm	lɛty	∼roky

In the genitive and locative, these always take a different case ending. The locatives are predictable from phonology so the main difference is the genitive.

Rates in Czech-language texts in the Czech National Corpus's SYN2020 corpus (Křen et al. 2020) show low rates of non-suppletion (most numerals require a genitive plural complement):

(16) *Rates of root suppletion for Czech oblique plural 'year'*

construction	[lɛt]	[rok]	% [rok]
[numeral] years.GEN	23609	328	1.4%
in years.LOC	4325	3	<0.1%
between years.INS	435	173	28.5%

These differences are at least in part due to sampling of individuals: some authors only use [lɛt], while others vary, and at different rates.

Other contextual factors also have an effect – in particular, [svjɛtɛlniː rok] 'light year' has higher rates of non-suppletion (27/124 = 21.8%) in the genitive plural.

The two suppletive allomorphs also select for different adjectivizers (one of which triggers a stem alternation):

(17) *Adjectives built from Czech 'year'*

a. mɛzi -rotʃ -ɲ-iː
between -year -ADJ
'year-over-year'

b. dvou -lɛt -Ø-iː
two.GEN -year -ADJ
'two-year(-old)'

Here, too, we have optional, though rare, non-suppletion:

- [dvoʊlɛtiː] has 1,158 hits
- [dvoʊrotʃɲiː] has 9 hits

In these cases, the suppletive allomorphs are used in *the same* syntactic contexts, so their selectional properties cannot be syntactically determined.

Natural conclusion: for some individuals, [lɛt] is variably inserted with an inflectional diacritic (or, more realistically, a suite of inflectional diacritics) and selectional properties are downwind of that – that is, diacritics are associated with phonological exponents, not the abstract syntactic objects they spell out.

(18) *Vocabulary Items for Czech 'year'*

a. $\sqrt{}_{18} \leftrightarrow \text{lɛt}_{\text{L}}$ / ___ [+pl, −direct] (variable conditions)
b. $\sqrt{}_{18} \leftrightarrow \text{rok}_{\text{R}}$

(19) *Vocabulary Items for some Czech suffixes*

a. GEN ↔ Ø / [L] ___ [+pl]
b. GEN ↔ uː / [R] ___ [+pl]
c. *a* ↔ [L] ___ ɲ
d. *a* ↔ [R] ___ Ø

The "(variable conditions)" is of course hiding a lot of assumptions – for the sake of concreteness, we can assume:

- Rules can be categorical or variable
- In each derivation, a variable rule is randomly chosen with a certain probability to be visible or not
- This probability can be context-dependent – thus, (18-a) has a lower probability in the context of the instrumental or the adjective [svjɛtɛlniː] 'related to light' than in the context of the genitive and locative

What happens if we try to push the inflectional diacritics into the syntactic representation as before?

- They cannot enter the derivation through the rules in (18), but rather during the syntactic insertion of the root (or the *n* head)
- So the variability must be pushed into the syntax: [L] and [R] are inserted onto the root/*n* head with "(variable conditions)"
- In turn, the root suppletion is conditioned on the same diacritic(s) as the suffix allomorphy in (19) – these remain the same

(20) *Alternate Vocabulary Items for Czech 'year'*

a. $\sqrt{}_{18}$, [L] ↔ lɛt / ___ [+pl, −direct]

b. $\sqrt{}_{18}$ ↔ rok

In this case, as before, the cooccurrence of suppletive allomorphy and suffix allomorph selection is rendered a synchronic coincidence.

But: let's go back to those "variable conditions"!

- Common assumption: syntactic structure is built, then shipped to spellout (usually, in phases)
- Thus, at the moment the root is *spelled out*, there is some context that can be used to condition variable application of (18-a) – case, (arguably) nearby modifiers, etc.
- Common assumption: syntactic structure is built from the root outward
- Thus, at the moment the root (or *n* head) is *inserted* into the syntax, none of that outward syntactic context exists yet – it won't be built until later!
- So even if we allow for "synchronic coincidence", the diacritics *must* be inserted at spellout, not structure-building – that is, they are properties of exponents, not syntactic objects

Can we wriggle out of this one? Well, suppose variation works differently (cf. Tabachnick 2023):

- Each variable point splits the derivation into multiple candidates and assigns each a score corresponding to their probability
- Later points of variation can split the derivation further and adjust the scores for each
- At the end of the derivation, all candidates are assigned a probability based on their score and one is chosen

This solves the lookahead problem for variable insertion of the diacritic in the syntax: at the point

of insertion, we consider *both* diacritics and evaluate them based on criteria determined by the context later on

- This seems like a good way to handle cases of phonology influencing syntax when the latter is variable, as in English ditransitives
- However, allowing it in the sorts of cases like 'light year' would be *extremely* unrestrictive
- It would also render the hypothesis of DM with diacritics in the syntax *completely unfalsifiable*

5 Case study 2: Semantically conditioned variable allomorph selection

Now that we have argued that diacritic features in DM must be in the phonology, let's look at another example of variable allomorphy in Czech showing that this assumption creates a problem.

5.1 Background

Field of contention: some Czech nouns vary between [u] and [ɛ] in the locative at different rates (cf. Bermel & Knittl 2012, Guzmán Naranjo & Bonami 2021)

(21) *Lexically conditioned Czech locative allomorphy (from Guzmán Naranjo & Bonami 2021: p. 23)*

		[-u]	[-ɛ]	% [-ɛ]
[most]	'bridge'	1006	13823	93.2%
[uːr̩ad]	'office'	21012	17876	46.0%

5.2 Analysis

Tabachnick (2023), simplified and distorted: variable lexical items have the [le] diacritic (on their phonological exponents, remember) with a strength that corresponds to its likelihood of being active in a particular derivation

(22) *Vocabulary Items for Czech variable locative nouns*

a. $\sqrt{}_{285} \leftrightarrow \text{most}_{\text{[le]: .932}}$
b. $\sqrt{}_{94} \leftrightarrow \text{uːr̩ad}_{\text{[le]: .460}}$

5.3 Problem: polysemy

As in English, Czech [jazɪk] can mean both 'language' and 'tongue'. For both meanings, the variable is locative, but with very different rates. Ditto [tiːl], which can mean 'back of the head' or 'rear of troops':

(23) *Semantically conditioned Czech locative allomorphy (from Tabachnick 2023: p. 271)*

		[-u]	[-ɛ]	% [-ɛ]
[jazɪk]	'language'	59	407	87.3%
	'tongue'	196	5	2.5%
[tiːl]	'back of the head'	12	57	82.6%
	'rear of troops'	103	7	6.4%

Thus: the two meanings of [jazɪk] and [tiːl] have [le] with different scores, meaning that they are *two distinct exponents* (since [le] is in the phonology)

- Recall: in contemporary DM, the link between meaning and PF has been severed and rerouted exclusively through the syntax
- Here, we have covariance between phonology (that is, variable inflectional diacritics) and semantics (polysemy)
- Thus, the difference must be upwind of both, in *syntax*
- Although there seems to be no principled way to distinguish polysemy from homophony, it seems odd to call these two distinct roots

A possible solution (suggested by Neil Myler, p.c.):

- It has been argued (by e.g. Acquaviva 2009) that the locus of basic meaning in DM is the categorized root, i.e. root + categorizing head (or root in the context of categorizing head)
- So perhaps 'language' and 'tongue' are the same root with two different *n* heads
- The *n* heads differ in their interpretation (LF) and inflection diacritics (PF)
- PF and meaning covary, but the difference is mediated by syntactic objects, as desired

(24) *PF Vocabulary Items for Czech [jazɪk] and categorizing heads*

a. $\sqrt{}_{409} \leftrightarrow$ jazɪk
b. $n_{346} \leftrightarrow \emptyset$ [le]: .873
c. $n_{214} \leftrightarrow \emptyset$ [le]: .025

(25) *LF Vocabulary Items for Czech [jazɪk]*

a. $\sqrt{}_{409} \leftrightarrow [\![\text{language}]\!]$ / ___ n_{346}
b. $\sqrt{}_{409} \leftrightarrow [\![\text{tongue}]\!]$ / ___ n_{214}

Advantages:

- Routes PF–LF connections through syntax
- Polysemy, not homophony for clearly related roots
  - A structural definition of homophony vs. polysemy: homophony is multiple roots, polysemy is one root with multiple categorizing heads
- One exponent, not two accidentally homophonous exponents for a single root
  - The *n* heads can then also be marked in PF as selecting for different (allomorphs of) additional categorizing heads, as in [tiːlɲiː] 'related to the back of the head' vs. [tiːloviː]

'rearward (military)'
  - Or the *n* heads can be totally unmarked/phonologically transparent, allowing the root's default selectional properties etc. to surface
- Perhaps: pushes semantic free choice into the syntax, where it arguably belongs (since free choice has been eliminated from the PF branch)

Disadvantages:

- Leads to a proliferation of categorizing heads individuated like roots, with identical syntactic feature content (one for each meaning of each root – far more than has been proposed)
- Perhaps makes all these structural hypotheses unfalsifiable again (to be worked through)

6 Summary

Two cases of variable allomorphy in Czech with implications for DM architecture, in particular the location of inflectional features:

- Variable root suppletion
  - These features must be in the phonology (associated with exponents), not in the syntax (associated with roots)
  - Otherwise, we can't get the right context to condition the variable process
  - There are no real counterarguments, only evasions
  - The evasion (allowing an unfettered end run around the lookahead problem) are not insightful and only weaken the theory
- Semantically conditioned variable allomorph selection
  - These features must be in the syntax (associated with roots), not in the phonology (associated with exponents)
  - Otherwise, semantics and phonology are communicating directly without being routed through syntax
  - There are no real counterarguments, only evasions
  - In this case, the evasion (individuated *n* heads) is at least intriguing and arguably leads to a more consistent, if less restrictive, theory

Also: we need to take variation seriously!

- Empirically: Do the attested locality restrictions on e.g. categorical allomorphy hold for variable allomorphy, or is the latter looser (suggesting a distinct system of evaluation)?
- Theoretically: Is the ideal of a categorical generative grammar really tenable, and if not, how do we incorporate individual variation into morphosyntactic derivations?

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