Diminutives of English irregular plurals and optionality of umlaut: Evidence for late-merge within words*

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August 2023

Abstract: I describe and analyze the morphology of the English diminutive suffix /-i/, as in *doggy, birdie, horsie*, and so on. After describing the basic properties of this morpheme, which I argue is productive given a particular phonological constraint, I examine how it interacts with nouns that normally have irregular plural forms. I show that this diminutive can block irregular plural morphology, but optionally allows the persistence of plural umlaut. I explain these facts using an analysis in which morphological rules require adjacency between the triggering node and the affected one, along with a proposal that the English diminutive /-i/ is an adjunct/modifier which can be attached late in the derivation.

1 Introduction

Here I analyze facts about plurals of English diminutives formed by the suffix /-i/. This morpheme's orthographic form is generally *-(e)y* or *-ie*:

(1) *The diminutive /-i/*
   a. Look at the cute **doggy**.
   b. Some **birdies** live in this tree.
   c. There's a little **fishie** in the pond.

I argue that the effects of this diminutive in certain plural contexts provide new evidence for several important hypotheses about syntactic and morphological derivations. Before introducing the proposals I defend here, I will overview some basic facts about this diminutive, and preview the core puzzle.

Diminutive /-i/ is common in colloquial and child-directed speech. It usually encodes that the noun in question is small and/or endearing, and is usable with animates and inanimates. We most often find this diminutive used with mono-syllabic nouns, as (2) shows:

(2) *Diminutive of mono-syllabic nouns*
   a. horse ⟶ horsie
   b. sheep ⟶ sheepie
   c. foot ⟶ footie
   d. snack ⟶ snackie
   e. Ann ⟶ Annie
   f. Jim ⟶ Jimmy

*The data reported here is the aggregate of judgments gathered from conversations with 12 native English speakers, including American, Australian, and British dialects. The IPA transcriptions here reflect the author's rhotic dialect, but the generalizations reported here also apply to non-rhotic dialects.

Thanks to feedback from Eualia Bonet, Canaan Breis, Miriam Butt, Noam Faust, Leah Doroski, Romi Hill, Bozhil Hristov, Jane Lorenzen, Andrew Murphy, Gereon Müller, Max Papillon, Nate Shaftoe, Soren Tebay, Xico Torres, Christian Uffman, George Walkden, Bartosz Wiland, as well as audiences at the University of Konstanz, the University of Leipzig, the 29th Manchester Phonology Meeting, the 98th Linguistic Society of America meeting, and the 2023 Olomouc Linguistics Colloquium.

English has various other diminutive morphemes which are not fully productive. For an overview see Schneider (2003), and Huddleston and Pullum (2002) chapter 19:

(3) *Some un- or semi- productive English diminutives*

a. *-(l)et(te)*
drop**let**, pig**let**, cigar**ette**

b. *-ling*
gos**ling**, seed**ling**, dar**ling**

In the next section, building on Schneider (2003) I argue that diminutive /-i/ is fully productive, given a certain phonological constraint. Specifically, the morpheme must be right adjacent to a stressed syllable—a requirement that sometimes motivates truncation in diminutive nouns. Luckily, this phonological requirement turns out to not interfere with the examination of this paper's main topic: the diminutive's behavior in certain plural noun phrases.

In regular plurals, the diminutive suffix sits between the noun and the plural suffix:

(4) *Diminutive with regular plurals*

a. dogs → dogg-ie-s

b. pigs → pigg-ie-s

c. birds → bird-ie-s

English also has irregular plural nouns, which interact interestingly with the diminutive. These do not use the usual plural suffix *-(e)s*, and many of these also undergo a vowel shift, known as *umlaut*. For example, the noun *mouse* is normally pluralized via umlaut to *mice*, and shows no overt plural suffix. Importantly, however, the diminutive plural of this and similar nouns can optionally show umlaut, but always uses the regular plural suffix:

(5) *Diminutive interaction with irregular plural nouns*

a. *Normal singular*
one mouse

b. *Normal plural*
two mice / *two mouses

c. *Diminutive singular*
one mousie

d. *Diminutive plural*
two **mousies** / two **micies**

Deriving this pattern is the main goal of this paper. I argue that these facts emerge from well-supported principles about syntactic and morphological derivations, along with a particular proposal about the diminutive.

Some previous works have argued that diminutives can be modifiers, analogous to adjuncts in syntax (see Gouskova and Bobaljik (2022) and references therein). Furthermore, research in syntax and semantics has argued that adjuncts/modifiers can be introduced into the derivation late (Lebeaux 1991; Sauerland 1998, a.o.). I argue that the patterns previewed above emerge from the possibility of late-merging the diminutive suffix, along with two widely-adopted morphological principles. The first is the proposal that adjacency is required for one syntactic head to trigger a special allomorphy rule on another (Embick 2010; Bobaljik 2012; Bobaljik and Harley 2017). The second is that the assignment of morpho-phonological information to a

structure proceeds bottom-up, starting at the root (Embick 2010; Bobaljik 2000, 2012). To make this analysis concrete, I adopt Distributed Morphology (Halle and Marantz 1993; Harley and Noyer 1999, and many others). In this theory, after a syntactic structure is built the underlying phonological form of its terminal nodes is assigned in step-by-step fashion, as we'll see. In essence, I argue that we predict the right results by positing that attachment of the diminutive suffix can occur before or after the noun's form is determined.

1.1 Contents

In section 2, I provide empirical background on this English diminutive suffix, including its behavior in plural noun phrases. In section 3, I overview the hypothesis that late merger is possible for certain elements, and justify my proposal that diminutives are among the elements that we expect, in at least some languages, to be capable of merging late. In section 4, I argue that early merger of the diminutive yields plural diminutive noun phrases which lack the expected umlaut. In section 5, I show that the possibility of merging the diminutive late derives the facts about plural diminutive noun phrases in which umlaut succeeds. In section 6, I show that such late merger is limited by a constraint from Nissenbaum (2000), which prevents over-generation of diminutive nouns. Section 7 concludes, and mentions a remaining puzzle.

2 The facts about the diminutive and the plural puzzle

Here I will provide some background on the phonological distribution of the diminutive, as well as its behavior in irregular plurals, which sets the stage for the main analysis.

2.1 Stress-adjacency and truncation

I observe the following generalization about this diminutive suffix:

(6) *Generalization about diminutive /-i/*
The diminutive suffix /-i/ is always right-adjacent to a stressed syllable.

Since mono-syllabic nouns are inherently stressed, it is no surprise that the diminutive is compatible with such nouns, as we have already seen:

(7) *Compatibility with mono-syllabic nouns*
   a. tooth → toothie
   b. cup → cuppy
   c. snake → snakey

Schneider (2003) states that forms using diminutive /-i/ are always bisyllabic, forming a trochaic prosodic foot. I argue that this is not strictly so. Speakers frequently accept diminutives of multi-syllabic nouns, provided that the diminutive is indeed stress-adjacent:

(8) *Compatibility with multi-syllabic nouns with final stress*
   a. giraffe ([ʤɪ.ˈɹæf]) → giraffie
   b. raccoon ([ɹæ.ˈkun]) → racoonie
   c. baboon ([bæ.ˈbun]) → baboonie
   d. gazelle ([gə.ˈzɛl]) → gazellie

In contrast, the diminutive is not usable with nouns that do not end in a stressed syllable:

(9) *Incompatibility with non-final-stress nouns*
- a. hamster ([ˈhæm.stɹ]) ⟶ *hamsterie
- b. chipmunk ([ˈʧɪp.məŋk]) ⟶ *chipmunkie
- c. vegetable ([ˈvɛʤ.tə.bl]) ⟶ *vegetablie
- d. blanket ([ˈbleɪŋ.kɪt]) ⟶ *blanketie

However, it is possible to successfully produce diminutives of such nouns by deleting material intervening between a stressed syllable and the diminutive suffix:

(10) *Stress-adjacency satisfied by truncation*
- a. hamster ⟶ *hamsterie / ✓hammie
- b. chipmunk ⟶ *chipmunkie / ✓chippie
- c. vegetable ⟶ *vegetablie / ✓ veggie
- d. blanket ⟶ *blanketie / ✓ blankie

All irregular plural nouns that clearly show umlaut are mono-syllabic,[1] and thus avoid any potential phonological confound. Thus we can ignore this constraint from here on.[2]

2.2 The puzzle about plural diminutives

As mentioned, with nouns that use regular plural morphology, the diminutive sits between the noun and the plural suffix:

(11) *Diminutive with regular plurals*
- a. dogs ⟶ dogg-ie-s
- b. pigs ⟶ pigg-ie-s
- c. birds ⟶ bird-ie-s

[1] A potential exception is *woman - women*. A diminutive of this noun is not possible (plausibly due to blocking by the form *girl*), so this noun is not informative for this paper's topic of investigation.

[2] We can analyze the facts shown here, in an Optimality Theoretic context (Prince and Smolensky 2004), by positing a phonological aligment constraint (McCarthy and Prince 1993) like the following:

(i) Align(ˈσ-dim): Assign a * if the syllable to the left of diminutive /-i/ is not stressed.

If ranked over the constraint that penalizes deletion (Max-IO), this constraint will motivate truncation to achieve stress adjacency:

(ii) *blanket ⟶ blankie*

	/bleɪŋkɪt/ + /i/	Align(ˈσ-dim)	Max-IO
1.	ˈbleɪŋ.kɪ.ti	*	
2. ☞	ˈbleɪŋ.ki		**

The homophonous adjectival suffix /-i/ is not subject to the above alignment constraint, and thus can be attached to nouns that do not end in stressed syllables (iii), in contrast to what we saw for the diminutive in (10) above. The constraint in (i) thus must indeed be morpheme-specific as I have assumed here (Pater 2000, 2009).

(iii)
- a. Drinking water with your nose is a very **elephanty** thing to do.
- b. John hasn't cleaned his hamster's cage, so his room has a **hamstery** smell.

The same is true in the Slavic languages, for instance (Moskal 2015; Gouskova and Bobaljik 2022), where diminutives are very frequent.

English also has nouns which are morphologically irregular in the plural. The irregular nouns relevant here do not use the usual plural suffix *-(e)s*, but instead either replace it with an alternative suffix (12a-b) or simply silence it (12c-h). Among the nouns that lack an overt plural suffix, several of them undergo *umlaut*—a vowel alternation in the noun itself (12c-g).

(12) *Irregular plurals*

a.	one ox / two ox-en (*oxes)	[Alternative plural suffix]
b.	one child / two child-ren (*childs)	[Alternative plural suffix]
c.	one mouse / two mice (*mouses)	[Umlaut, no plural suffix]
d.	one louse / two lice (*louses)	[Umlaut, no plural suffix]
e.	one goose / two geese (*gooses)	[Umlaut, no plural suffix]
f.	one tooth / two teeth (*tooths)	[Umlaut, no plural suffix]
g.	one foot / two feet (*foots)	[Umlaut, no plural suffix]
h.	one sheep / two sheep (*sheeps)	[No umlaut, no plural suffix]

The diminutive has a complex interaction with these nouns, as I've previewed. One possibility is for the diminutive to totally block all irregular plural morphology. In this case, umlaut does not apply, and the default plural suffix *-(e)s* re-appears, as (13) shows. For concreteness I assume that when there is no overt plural suffix, the plural is expressed by a silent affix -∅, as we will see in the coming analysis.

(13) *Irregular plural morphology prevented by diminutive*

a. ox-en ⟶ ✓ox-ie-s / *ox-ie-en

b. mice-$\varnothing_{PL}$ ⟶ ✓mous-ie-s / *mice-ie-$\varnothing_{PL}$

c. geese-$\varnothing_{PL}$ ⟶ ✓goos-ie-s / *geese-ie-$\varnothing_{PL}$

d. feet-$\varnothing_{PL}$ ⟶ ✓foot-ie-s / *feet-ie-$\varnothing_{PL}$

e. teeth-$\varnothing_{PL}$ ⟶ ✓tooth-ie-s / *teeth-ie-$\varnothing_{PL}$

f. sheep-$\varnothing_{PL}$ ⟶ ✓sheep-ie-s / *sheep-ie-$\varnothing_{PL}$

However, another possibility is for umlaut to persist in diminutive forms, though we still see the emergence of the default plural suffix in these cases:

(14) *Persistence of umlaut with the diminutive*

a. mice-$\varnothing_{PL}$ ⟶ ✓mice-ie-s / *mice-ie-$\varnothing$

b. geese-$\varnothing_{PL}$ ⟶ ✓geese-ie-s / *geese-ie-$\varnothing$

c. feet-$\varnothing_{PL}$ ⟶ ✓feet-ie-s / *feet-ie-$\varnothing$

d. teeth-$\varnothing_{PL}$ ⟶ ✓teeth-ie-s / *teeth-ie-$\varnothing$

Plural diminutive examples both with and without umlaut can be heard in spoken colloquial English, and are easy to find in informal writing on the internet.[3]

[3]Here are some examples to prove it:

In summary, the puzzle is as follows: The diminutive always triggers the default plural suffix in irregular plural nouns. However, in this situation umlaut is optional, when applicable. I argue that permitting late-merger of the diminutive suffix solves this puzzle. In the next section, I provide background on late-merge and why we should expect it to be possible for the diminutive suffix. After this we will be ready for the analysis.

3 Justifying late-merge of the diminutive suffix

Some work in syntax and semantics argues that certain constituents can be added into a structure at a relatively late point (Lebeaux 1991; Sauerland 1998; Nissenbaum 2000; Stepanov 2001; Fox 2002). Such late merger is generally argued to be available only for adjuncts. This is because adjuncts are not required by selection needs, and they are semantically "extra" modifiers that are not obligatory for a structure's interpretation.

Some of the clearest evidence for late merger of adjuncts comes from interactions between movement and Principle C of Binding Theory, demonstrated in (15) below:

(15) *Binding Principle C*

a. *Definition*
A referring expression (such as a name) must not be co-indexed with a c-commanding antecedent.

b. *Example*
She_1 thinks that $\text{Mary}_{2/*1}$ is smart.

As the works mentioned above argue, since adjuncts can be externally merged late, to a phrase that has already been constructed and moved, referring expressions inside of adjuncts can sometimes avoid Principle C. In contrast, selected phrases like arguments and complements cannot be late-merged, and thus interact with Principle C differently. To see this, notice the contrast between the following examples:

(i) a. Ice Fishing Live Bait: **Mousies**
(https://www.youtube.com/watch?v=x4PUa1W8_5I&ab_channel=ExpertVillageLeafGroup)

b. The **miceies**! They love the heat! So they hang around the oven and you know how it is
(https://www.thehairpin.com/2012/06/ask-a-clean-person-whats-cookin-oh-ew/)

c. Silly **goosies** had fun "helping" with the mail today
(https://www.facebook.com/The-Adventures-of-Beaker-the-Goose-105468131174523/videos/silly-goosies-had-fun-helping-with-the-mail-today-/218106479519623/)

d. Happy Tuesday from the **Geesies**! These guys are super chatty and curious
(https://ne-np.facebook.com/102417658382199/videos/324955213105089/?_so_=permalink)

e. Her **footies** were sticky and she stuck to my palm.
(https://www.flickr.com/photos/vickisnature/9534308889)

f. The way my old man tucks in his **feeties** for loaf mode
(https://www.pinterest.com/pin/the-way-my-old-man-tucks-in-his-feeties-for-loaf-modehttpsifttt2oyd3pt–639089003348460550/)

g. Gonna brush my **toothies**
(https://twitter.com/TheStarLi/status/1446828012561858565)

h. The fish special! Nice **teethies**!
(https://www.tripadvisor.com/LocationPhotoDirectLink-g187819-d1088126-i254111485-Trattoria_Dal_Billy-Manarola_Cinque_Terre_Italian_Riviera_Liguria.html)

(16) *Principle C in complement versus adjunct of wh-moved phrase*

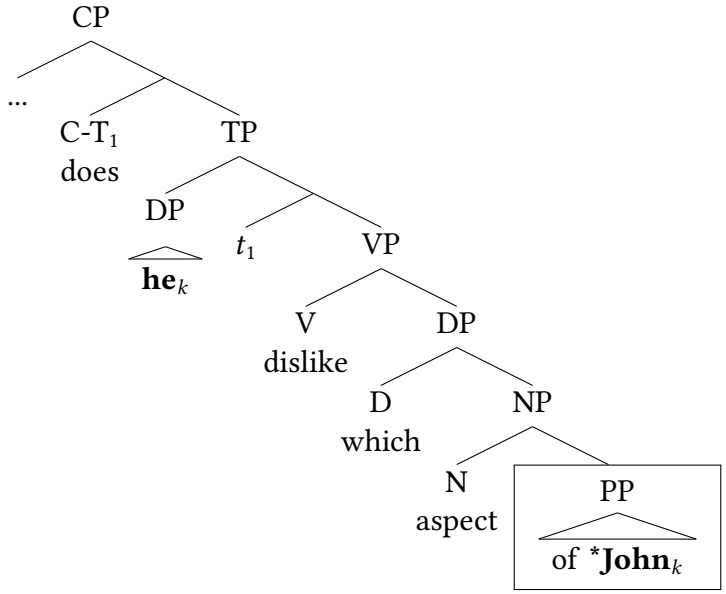
a. *Principle C violation for complement of moved phrase*
*[Which aspect [of John$_k$]]$_1$ does he$_k$ dislike t_1?

b. *No principle C violation in adjunct of moved phrase*
[Which cookies [that John$_k$ ate]]$_1$ did he$_k$ enjoy t_1?

Notice that in the unacceptable (16a), the *wh*-moved phrase contains a complement PP, which in turn contains a name that is co-referential with the matrix subject. In contrast, as (16b) shows, a comparable sentence where the name is in a relative clause of the moved *wh*-phrase is acceptable.

In (16a) the PP in the complement of N is obligatorily merged in NP right away, before the containing DP *wh*-moves. This is necessary because complements cannot be late-merged. Consequently, there is a stage of the derivation where this complement is c-commanded by the matrix subject, and therefore the name it contains incurs a Principle C violation.

(17) *Simplified structure for (16a) before wh-movement: Principle C violated*

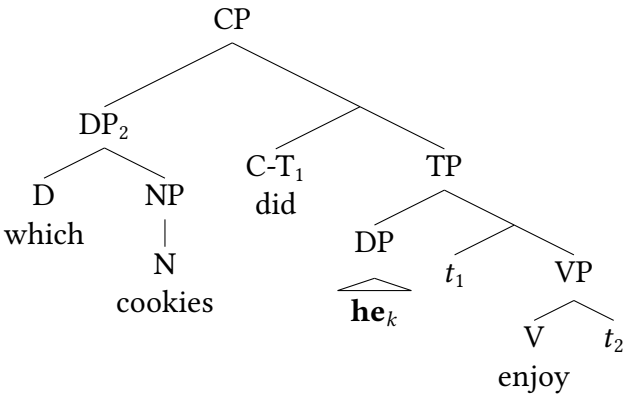


Later *wh*-movement of this DP over the subject to spec-CP does not change the fact that Principle C was violated early on, so the derivation fails regardless.

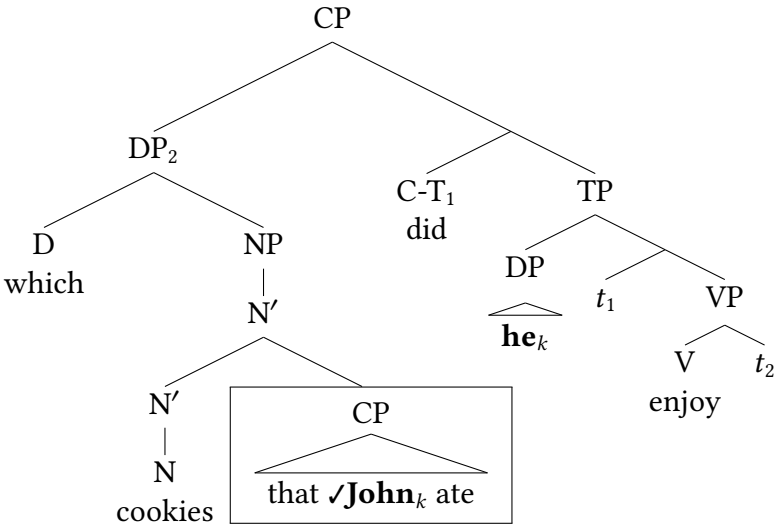
In contrast, because relative clauses are adjuncts, the relative clause in (16b) can be externally merged after its host DP moves over the subject.

(18) *Simplified derivation for (16b)*

a. *Wh-movement occurs, relative clause not yet present*



b. *Relative clause late merged after wh-movement: Principle C avoided*



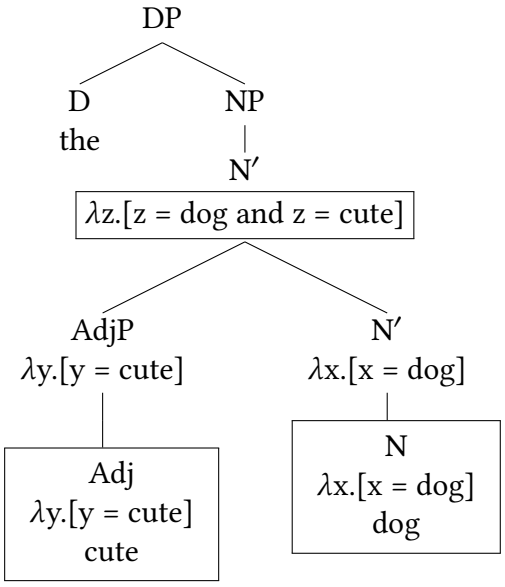
In this situation the name in the relative clause was never c-commanded by the matrix co-referential subject, and thus there is no Principle C violation. In this way, the hypothesis that adjuncts can merge late accounts for the unique way that adjuncts can avoid Principle C.

Next, I argue that diminutives are adjunct-like and should be capable of late-merge, which I use to derive the morphological patterns shown in the previous section.

3.1 Diminutives are adjuncts/modifiers and hence can be late-merged

The diminutive suffix in English, among at least some other languages, can likely be characterized as semantically adjective-like. This parallel supports the hypothesis that diminutives are sometimes adjuncts, since adjectives are canonical adjuncts. Following Heim and Kratzer (1998), nouns and adjectives are both type <e,t>. For instance, a noun λx.[x = dog] and adjective λy.[y = cute] are both type <e,t>, and thus can be semantically united via the rule of Predicate Modification:

(19) *Semantically uniting a noun and adjective*



We can posit the very same template for the meaning of a diminutive. For instance, λx.[x = small/endearing] would also be type <e,t> , just like an adjective. Thus a diminutive can be considered semantically the same as an adjective, justifying the analogy between diminutives and syntactic adjuncts.[4]

As recently discussed by Gouskova and Bobaljik (2022), whose main goal is to analyze Russian, there is precedent for the idea that diminutives can be adjuncts/modifiers. Some evidence that they gather for this distinction comes from the way that diminutives in different languages interact with nominal morpho-syntax. For example, in German, diminutives formed with the suffix *-chen* always have the neuter gender, regardless of the gender that the base noun would normally have:

(20) *German diminutive overrides original gender*

Base	Gender	Diminutive	Gender
Wein ('wine')	MASC	Wein-**chen**	NEUT
Feder ('feather')	FEM	Feder-**chen**	NEUT
Kind ('child')	NEUT	Kind-**chen**	NEUT

(Adapted from Gouskova & Bobaljik, ex. 3)

In contrast, in Italian diminutives do not change noun gender:

(21) *Italian diminutive preserves original gender*

Base	Gender	Diminutive	Gender
ragazz-o ('boy')	MASC	ragazz-**in**-o	MASC
alber-o ('tree')	MASC	alber-**in**-o	MASC
person-a ('person')	FEM	person-**cin**-a	FEM
mamm-a ('mama')	FEM	mamm-**in**-a	FEM

(Adapted from Gouskova & Bobaljik, ex. 4)

Drawing from previous work, Gouskova and Bobaljik (2022) argue that the German diminutive projects its label onto the constituent formed by merger of the diminutive and the noun, whereas in Italian the diminutive is a non-projecting adjunct/modifier. Next let's consider

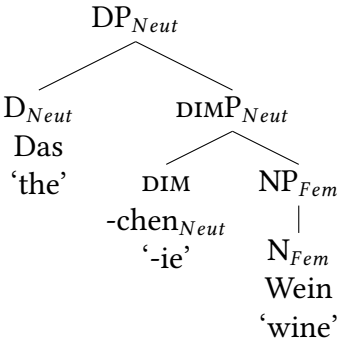
[4]See Davis (2020) for evidence for late-merge of adjectives.

how we can diagram projecting versus adjunct diminutive suffixes, which will be useful for the coming analysis.

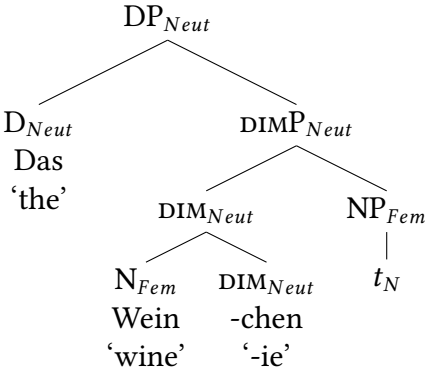
Much work in Distributed Morphology, which I will use in my analysis, posits that each morpheme in a complex word is a syntactic head. Those heads form one word because they have been united by head-movement.[5] I will assume this here as well. Therefore let's assume that in German, the diminutive *-chen* projects a phrase that dominates NP (22a), and that N moves to the diminutive head (22b), uniting them into one word. Importantly, because the diminutive head projects when it combines with NP, the gender of the diminutive head overrides that of the original noun:

(22) *German diminutive projects and overrides original gender*
(DIMP = DiminutiveP)

a. *Before head movement*



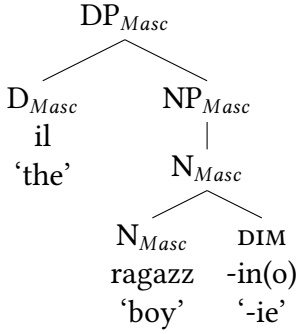
b. *After head movement*



In contrast, following Bobaljik & Gouskova, in Italian the diminutive does not project. Thus in Italian, the diminutive merges with N but N projects, so there is no chance for the diminutive to contribute any gender that would override that of the noun:

[5]For more about this hypothesis, see for instance Embick (2010); Arregi and Nevins (2012); Bobaljik (2012). In short, head movement is not the only way to understand how heads are united into complex words, but this is a hypothesis with significant support which does not pose any problems for the analysis of this paper.

(23) *Adjunct diminutive suffix in Italian*



This is analogous to how adjoining an adjective to an NP still yields an NP, or adjoining an adverb to VP still gives you a VP: adjuncts do not project their category label. Notice that in the above tree for Italian, the non-projecting diminutive head adjoins to N and creates a configuration which is the same as that typically formed by head-to-head movement. The only difference is that here the adjoining head is introduced by external merge rather than internal merge (=movement).

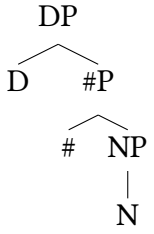
Returning to English, recall that in diminutives of regular plurals, the diminutive appears between the noun and plural suffix:

(24) *Diminutive with regular plurals*

a. dogs → dogg-ie-s
b. birds → bird-ie-s
c. ducks → duck-ie-s

This is consistent with a syntactic structure in which nouns are dominated by a number phrase (#P), and that the diminutive intervenes between N and # if present (essentially following Moskal 2015).

(25) *#P between NP and DP*

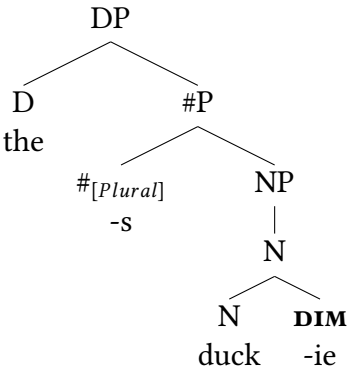


I will assume the presence of #P throughout my analysis. In contrast, given my proposal that the diminutive suffix is an adjunct in English, I will assume that it does not project a phrase, but rather adjoins to N in the way diagrammed above for Italian.

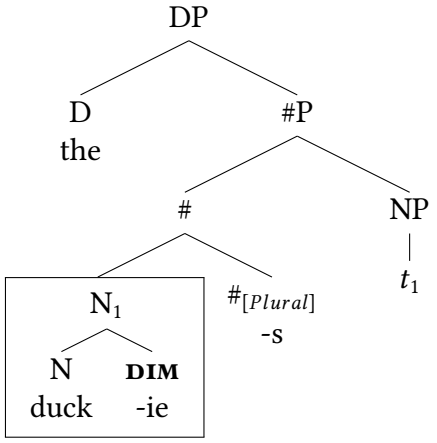
Importantly, I will show that whether the English diminutive late-merges to N, or not, yields different effects in diminutives of plurals that would normally have umlaut. The analysis will address English irregular plurals of all varieties, though the interaction of diminutives with umlaut is the most significant. In the early-merge situation, I assume that the diminutive adjoins to N immediately, after which N and the containing diminutive move to #, uniting them into one word:

(26) *Option 1: Diminutive adjoins to N before head movement*

a. *Step 1: Diminutive adjoins to N*



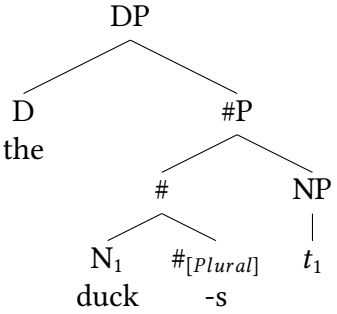
b. *Step 2: N containing diminutive moves to #*



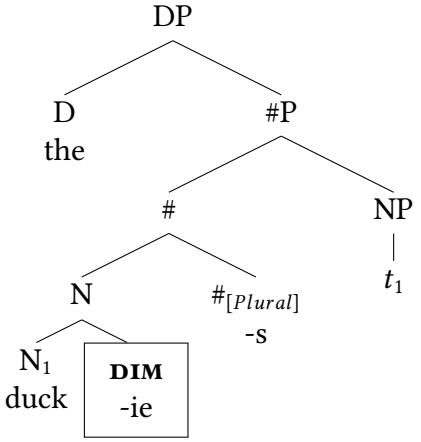
In contrast, in the late-merge situation I assume that N moves to # before the diminutive is adjoined:

(27) *Option 2: Diminutive adjoins to N after head movement*

a. *Step 1: N moves*



b. *Step 2: Diminutive adjoins to N*



For the regular noun *duck* that I have used in the diagrams immediately above, merging the diminutive early or late makes no difference. However, as I show next, we predict the right results for nouns that (normally) show plural umlaut, by positing that such late-merge can occur either before or after the noun's form is determined.

4 Early merge and umlaut-less diminutive plurals

As we saw above, the diminutive can totally block use of irregular plural morphology:

(28) *Irregular plural morphology prevented by diminutive*

a. ox-en ⟶ ✓ox-ie-s / *ox-ie-en

b. mice-$\varnothing_{PL}$ ⟶ ✓mous-ie-s / *mice-ie-$\varnothing_{PL}$

c. geese-$\varnothing_{PL}$ ⟶ ✓goos-ie-s / *geese-ie-$\varnothing_{PL}$

d. feet-$\varnothing_{PL}$ ⟶ ✓foot-ie-s / *feet-ie-$\varnothing_{PL}$

e. teeth-$\varnothing_{PL}$ ⟶ ✓tooth-ie-s / *teeth-ie-$\varnothing_{PL}$

f. sheep-$\varnothing_{PL}$ ⟶ ✓sheep-ie-s / *sheep-ie-$\varnothing_{PL}$

To analyze this and the other facts we have already seen, it is now necessary to be explicit about the functioning of Distributed Morphology. In this theory, a syntactic structure is first built, after which the underlying phonological form of its terminal nodes is assigned. This is achieved by a listed set of Vocabulary Insertion (VI) rules, which define the correspondences between syntactic nodes/features and phonological forms. Some VI rules are context-neutral, and apply by default. Other VI rules are context-dependent. These apply under specific circumstances, and supersede default rules, yielding certain instances of allomorphy/suppletion.

In (29) below, I provide a set of VI rules that illustrates the type of analysis I adopt for nouns that normally show umlaut in the plural:

(29) *Some VI rules for English*

a. $\#_{[Singular]} \leftrightarrow \varnothing$ (Default rule)

b. $\#_{[Plural]} \leftrightarrow$ -(e)s (Default rule)

c. N ↔ goose (Default rule)

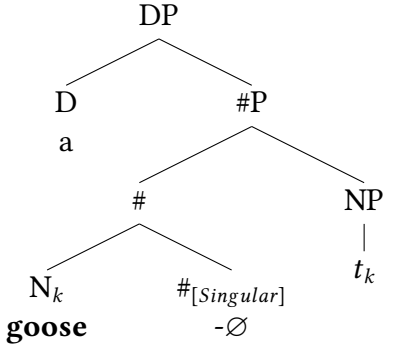
d. N ↔ geese / ___ $\#_{[Plural]}$ (Context-sensitive rule, overrides 29c)

e. $\#_{[Plural]} \leftrightarrow \varnothing$ / N ___ (Context-sensitive rule, overrides 29b)

Rules (29a) and (29b) respectively encode that a singular version of # is expressed as -∅, while by default its plural version is *-(e)s*. In (29c) we have a rule for the noun *goose*, and in (29d), a rule stating that this noun is *geese* when adjacent to $\#_{[Plural]}$.[6] Finally, in (29e) we have a rule stating that $\#_{[Plural]}$ is null when adjacent to that noun.

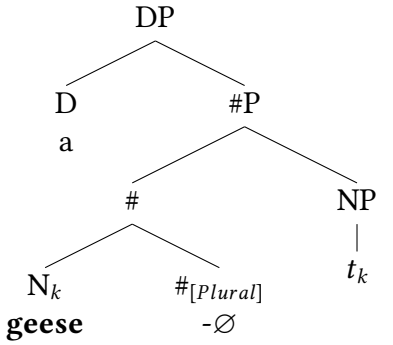
First let's consider how these rules function when the diminutive is not present. In this situation, N will simply move to #. If # is singular its form is -∅, and cannot trigger umlaut, so the default form *goose* is assigned to N in this case:

(30) *Plain singular of 'goose'*



If # is plural, it is also realized as -∅ in this situation due to the presence of this noun, and at the same time, adjacency of that noun to $\#_{[Plural]}$ triggers use of the VI rule with umlaut, yielding *geese*:

(31) *Typical plural with umlauted 'geese'*



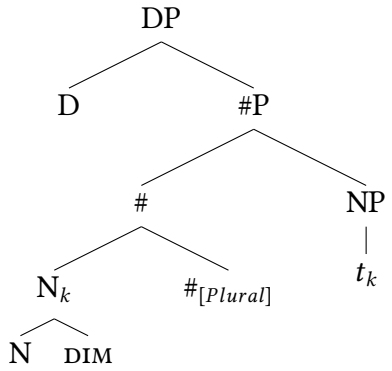
This is essentially a case of bi-directional suppletion: this N and $\#_{[Plural]}$ trigger use of context-specific VI rules for each other.

Importantly, much work has observed that the node that triggers a context-specific VI rule, and the node that undergoes it, must be adjacent (Embick 2010; Bobaljik 2012; Bobaljik and Harley 2017). Thus if another element intervenes between the N and $\#_{[Plural]}$, we expect them to be forced to take their default forms instead. As we have seen, diminutive examples fitting this description are indeed attested. Such examples are properly predicted if the diminutive is merged as early as possible to N, followed by movement of N to #, after which VI rules apply. Since N and $\#_{[Plural]}$ are not adjacent due to the intervening diminutive, they cannot receive their context specific forms, respectively the umlauted *geese* and a silent suffix. Rather they must receive their default forms, *goose* and *-(e)s*, as we see in reality:

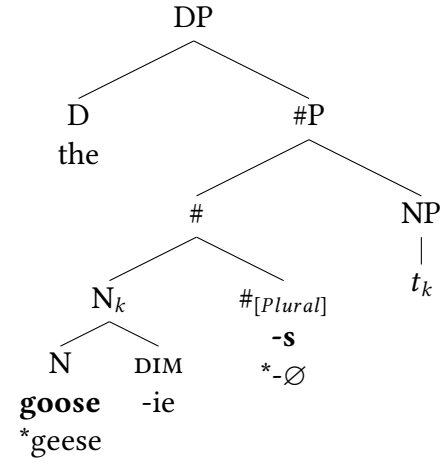
[6] We will see various instances of N in this analysis (*goose, ox, sheep*, etc.). In order to ensure that the VI rule for *goose* is not used, for example, to express an N that should be realized as *cat*, we could distinguish different versions of N with numerical indices that are referenced in the definition of VI rules, essentially following Harley (2014). Here I have aimed to present the facts in a step by step manner that prevents this issue from arising in the implementation, so I set this detail aside.

(32) *Intervening diminutive forces N and $\#_{[Plural]}$ to take default forms*

a. *Step 1: Build structure*



b. *Step 2: Apply VI rules*



The same analysis derives all the examples with failed umlaut that we saw in (28) above, such as *mousies*, *footies*, *toothies*, and so on.

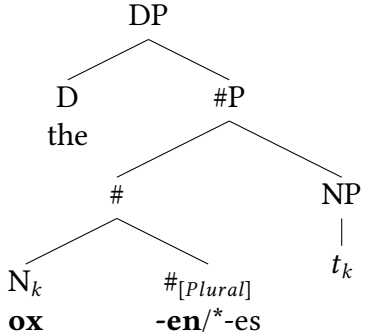
This analysis also straightforwardly applies to examples like *oxies*, which are even simpler given that umlaut is not applicable. Normally the N for *ox* triggers use of a special plural form *-en*, as these VI rules state:

(33) *More English VI rules*

a. $\#_{[Plural]} \leftrightarrow$ -(e)s
b. N $\leftrightarrow$ ox
c. $\#_{[Plural]} \leftrightarrow$ -en / N ___

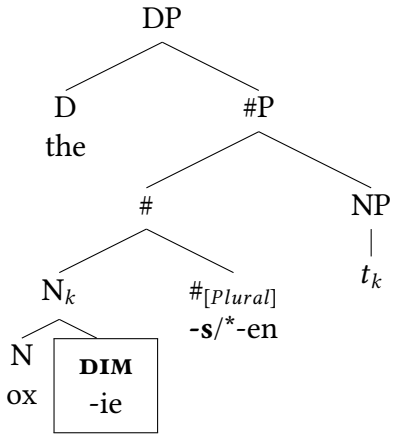
When *ox* is adjacent to $\#_{[Plural]}$, that special VI rule for $\#_{[Plural]}$ must apply:

(34) *An irregular plural suffix*



However, if the diminutive intervenes between the two, $\#_{[Plural]}$ must be realized by its default form instead, as we have seen in reality:

(35) *Irregular plural form blocked due to lack of adjacency with trigger node*



The same form of analysis is also applicable to nouns like *sheep*, which trigger use of an exceptional null plural suffix (*sheep*-$\varnothing_{PL}$), except when the diminutive intervenes (*sheep-ie-s*).

Here we have considered early merge of the diminutive. Next, we will see that late merger correctly predicts a different result in nouns for which umlaut is applicable.

5 Late-merge and diminutive plurals with umlaut

As we saw above, it is also possible for nouns that show plural umlaut to maintain it when the diminutive is used. Importantly, in this situation the default plural suffix still occurs rather than the silent one, as (36) shows again:

(36) *Persistence of umlaut with the diminutive*

a. mice-$\varnothing_{PL}$ ⟶ ✓mice-ie-s / *mice-ie-$\varnothing$

b. geese-$\varnothing_{PL}$ ⟶ ✓geese-ie-s / *geese-ie-$\varnothing$

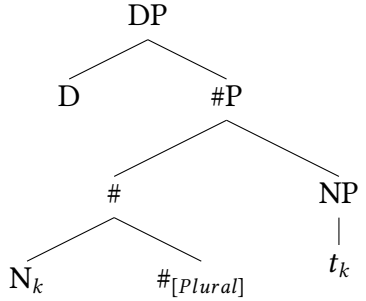
c. feet-$\varnothing_{PL}$ ⟶ ✓feet-ie-s / *feet-ie-$\varnothing$

d. teeth-$\varnothing_{PL}$ ⟶ ✓teeth-ie-s / *teeth-ie-$\varnothing$

We are thus faced with a paradox: Here N and $\#_{[Plural]}$ are not adjacent, and use of the special -$\varnothing$ variant of $\#_{[Plural]}$ fails as expected, but the umlauted form of N is surprisingly still possible.

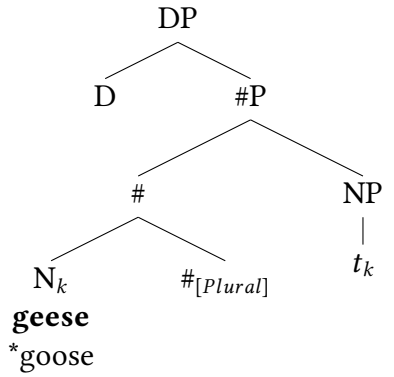
We correctly predict this result by permitting late-merge of the diminutive immediately after the form of N is determined, as I will now demonstrate with *geese*. In this situation, first N moves to #, after which VI rules begin to apply:

(37) *Structure before VI*



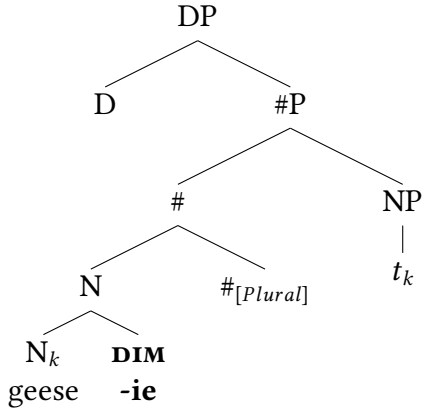
Works in Distributed Morphology frequently argue (or assume) that VI proceeds from bottom to top, starting at the root node (Embick 2010; Bobaljik 2000, 2012). This hypothesis will be essential here. Thus I assume that VI applies at N first. At this time, N is adjacent to $\#_{[Plural]}$, so we must select the umlauted form if applicable, in this case *geese*:

(38) *VI begins at N*



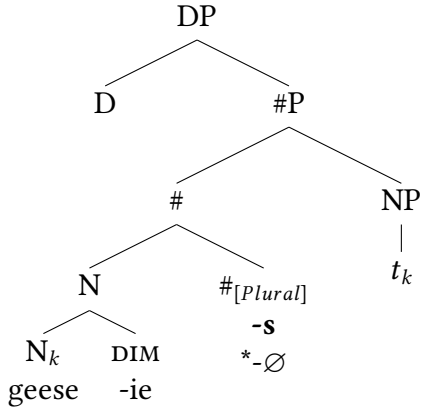
I argue that next, the diminutive late-merges to N. Assume that the diminutive node is subjected to its appropriate VI rule at this time.[7]

(39) *The diminutive late-merges to N*



Next VI applies to $\#_{[Plural]}$. Since it is currently not adjacent to N due to the intervening diminutive, we must use its default form *-(e)s*:

(40) *VI applies at $\#_{[Plural]}$, default form required*

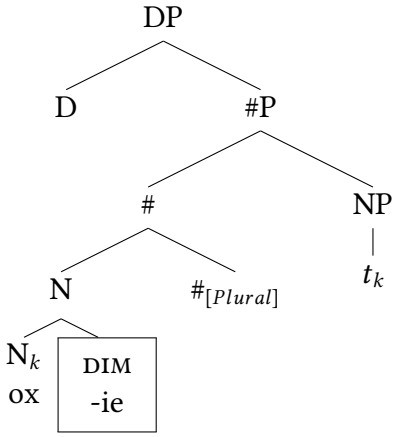


[7] Alternatively, we can assume that the diminutive was introduced in a separate workspace and spelled-out there, before being merged into the plural noun. See Piggott and Travis (2014) for such an implementation for adjunction into words in Ojibwe.

We have thus derived an example where umlaut succeeds, though the default plural suffix is required. The same analysis can derive similar examples we have seen above like *feeties, teethies, miceies*, and so on. The assumption that VI proceeds bottom-up, starting at N, is essential for this analysis. This is what makes it possible to apply VI at N and achieve umlaut, before establishing the form of $\#_{[Plural]}$.[8] This analysis thus opposes theories permitting top-down VI or 'everything at once' VI. See Deal and Wolf (2017) and references therein for discussion about VI direction.

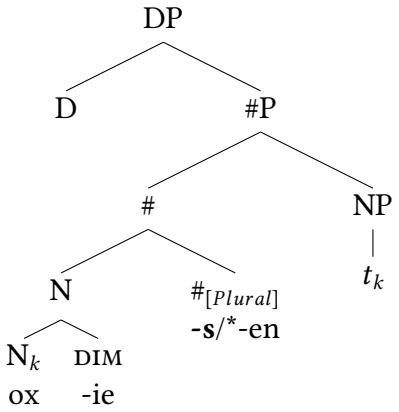
To conclude this section, note that allowing late-merge of the diminutive does not make any incorrect predictions about plural morphology with nouns like *ox*. Consider a situation where we have assigned the N for *ox* its appropriate form, and late-merged the diminutive right after:

(41) *The diminutive late-merges after VI at N*



After this late-merger, $\#_{[Plural]}$ is not adjacent to *ox*, so its default form must be assigned:

(42) *Default form of $\#_{[Plural]}$ required due to lack of adjacency*



This discussion brings to mind another option, however: late-merging the diminutive after both N and $\#_{[Plural]}$ have been realized. I address this possibility in the next section.

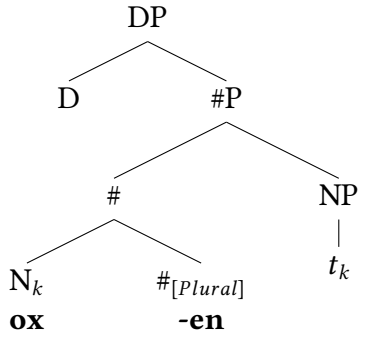
[8] Allowing the top-down VI, by contrast, makes the incorrect prediction that it should be possible to have a silent $\#_{[Plural]}$ but no umlaut. This would generate examples that look exactly like diminutive singulars (*mousie, toothie, geesie*, etc.) but which are interpreted as plural. This is unattested. The specific derivation is as follows: Step 1 - merge N and $\#_{[Plural]}$. Step 2 - realize $\#_{[Plural]}$ with its suppletive null form since it is adjacent to N. Step 3 - late-merge the diminutive between N and $\#_{[Plural]}$. Step 4 - assign N its default umlaut-less form since at that time it is not adjacent to $\#_{[Plural]}$. Maintaining that VI is strictly bottom-up avoids incorrectly predicting the possibility of this derivation for irregular plural nouns.

6 Preventing over-generation through merging even later

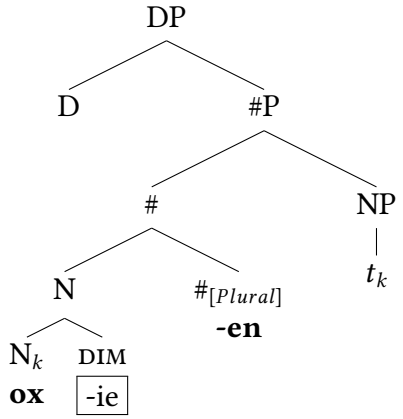
Nothing I have said so far rules out late-merging the diminutive between N and $\#_{[Plural]}$, after VI has already applied to both of them. For instance, consider the possibility of expressing N and $\#_{[Plural]}$ as *ox* and *-en*, afterwards late-merging the diminutive between them. This would incorrectly generate an unattested example where a special plural suffix is used despite not being adjacent to the triggering node:

(43) *A derivation to be ruled-out*

a. *Step 1: N and $\#_{[Plural]}$ are expressed while adjacent*



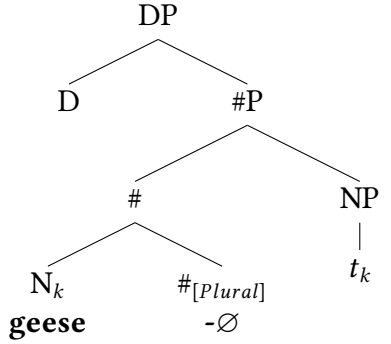
b. *Step 2: Diminutive merges between*



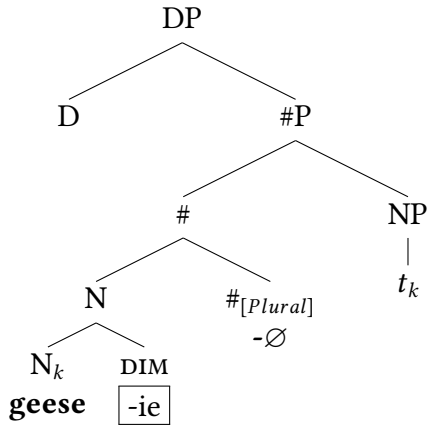
Similarly for *goose/geese*, we wrongly predict the possibility of realizing N and $\#_{[Plural]}$ using the special VI rules for each (*geese*, -∅) while they are adjacent, before merging the diminutive between:

(44) *Another derivation to be ruled-out*

a. *Step 1: N and $\#_{[Plural]}$ are expressed while adjacent*



b. *Step 2: Diminutive merges between*



Since these forms are unattested, we must rule out derivations of this sort.

This is achieved by the *Linear Edge Condition* of Nissenbaum (2000), which states that late merge can only target the edge of a spelled-out structure. In other words, you can late-merge on top of structure that has been morphologically realized, but not inside of it. In the representative undesirable derivations in (43) and (44) above, late-merge of the diminutive between N and $\#_{[Plural]}$ after they have been subject to VI violates the Linear Edge Condition. This is because in these cases late-merge applies structurally below the spelled-out $\#_{[Plural]}$. Importantly, the fact that $\#_{[Plural]}$ is realized as -∅ in (43) does not change this. Nissenbaum explicitly argues that the Linear Edge Condition also applies for structure that has been realized with null morphology (despite the condition's name).[9] Thus you can't merge under a spelled-out node, regardless of whether that node received overt morphology or not. This hypothesis is analogous in spirit to the Phase Impenetrability Condition (Chomsky 2000, 2001), which posits that spelled-out structure is unalterable. This line of reasoning provides a justification for banning late merger of a diminutive between a N and $\#_{[Plural]}$ that have already been spelled out.

7 Conclusion

I have shown that the productive diminutive suffix /-i/ has puzzling behavior when combined with irregular plural nouns. That is, the diminutive always forces use of a default plural suffix, but optionally allows plural umlaut to persist. I argued that these facts emerge from: The proposal that diminutive morphemes in English are adjuncts, for which late-merge is permitted. The adjacency requirement of context-sensitive VI rules. The hypothesis that VI proceeds bottom-up, starting at N in these cases. In essence, this analysis reduces the optionality of umlaut in plural diminutives to the optionality of late-merge. It is also consistent with my arguments to hypothesize that the English diminutive is either an adjunct or not, and that when it is an adjunct, it must be late-merged.[10] This analysis demonstrates a successful application of a syntactic concept (late-merge) in the domain of morphology. This is something we expect to see if the foundation of morphology is syntactic structure, as argued in theories like Distributed Morphology.

[9]This is a potentially counter-intuitive result, but it is compatible with theories in which un-pronounced nodes are visible at PF and thus subjected to linearization (Arregi and Nevins 2012; Haugen and Siddiqi 2016).

[10]See Stepanov (2001) for discussion of optional versus obligatory late-merge.

7.1 A further puzzle

In this work, I have discussed how the diminutive interacts with independent morphological rules like umlaut. However, there are two suppletion rules in English triggered by the diminutive itself. First, the diminutive causes an irregular vowel change of *cat* to *kit* (45a). Second, we also see suppletion of *rabbit* to *bun*, though we would have expected mere truncation to *rab* here (45b):

(45) *Potential noun suppletion triggered by the diminutive*

a. cat ([kæt]) ⟶ kitty (['kɪ.ti]) / *catty

b. rabbit (['ɹæ.bɪt]) ⟶ bunny (['bʌ.ni]) / *rabbitie, *rabbie

If diminutives can be merged after N has undergone VI, we would expect these instances of suppletion to be optional, contrary to fact. This is because this possibility leads us to predict that we should be able to assign the form *cat* to N, then merge the diminutive on top of it, ultimately deriving **cattie*. A similar derivation could yield **rab(bit)ie*. Descriptively speaking, these predicted but unattested forms constitute paradigm gaps, which hopefully can be attributed to some independent factor. I leave this puzzle for future work.

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