ON THE ANALYSIS OF ALLOMORPHY
A BASIC ISSUE: MORPHO-PHONOLOGICAL ANALYSIS

The main goal of the theory of the PF component is to account for the surface phonological shape of linguistic forms, i.e., their allomorphy.

This is achieved by submitting the forms to a morpho-phonological analysis.

As traditionally assumed (and simplifying a little bit), morpho-phonological analysis involves collecting sets of words with similar meanings, comparing them, and then extracting or segmenting the recurring parts.

At this stage, forms that share common syntactic or semantic features but differ in phonetic form—commonly called the contextual allomorphs of the same morpheme, and in DM the different exponents of the same morpho-syntactic feature bundle—are grouped together and analyzed to determine if the distribution of their formal differences can be explained phonologically.

If the distribution of their formal differences can be explained phonologically, these forms derive from a single exponent (a single underlying VI) and are related by rules.

Generalizations must be extracted

Morphophonological generalizations

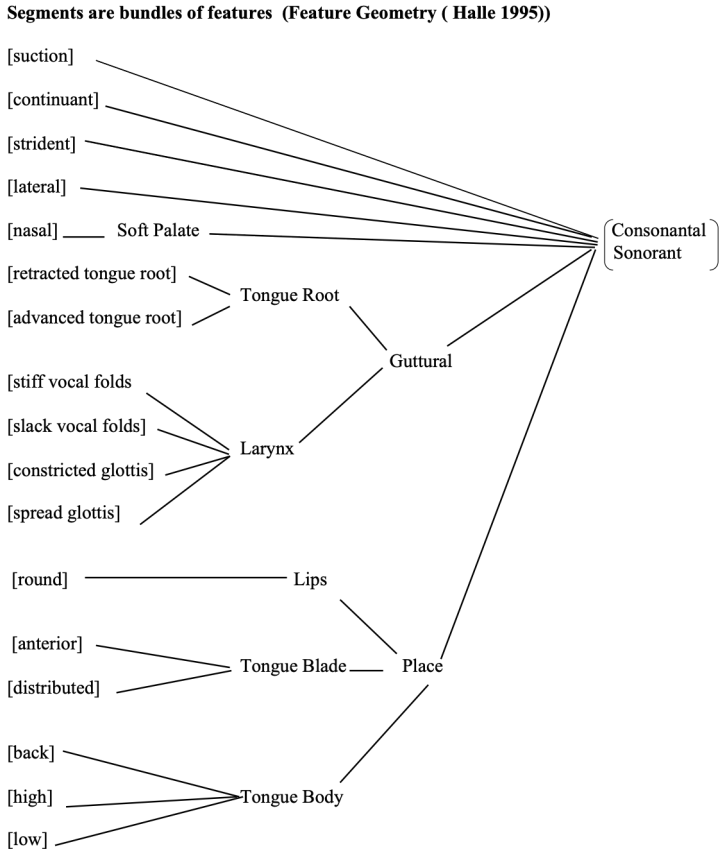
Humans can extract fine and detailed generalizations from the linguistic data they are exposed to (see, for example, Albright and Hayes (2003) and Pierrehumbert (2006), among others). Linguists studying language should be able to do the same.

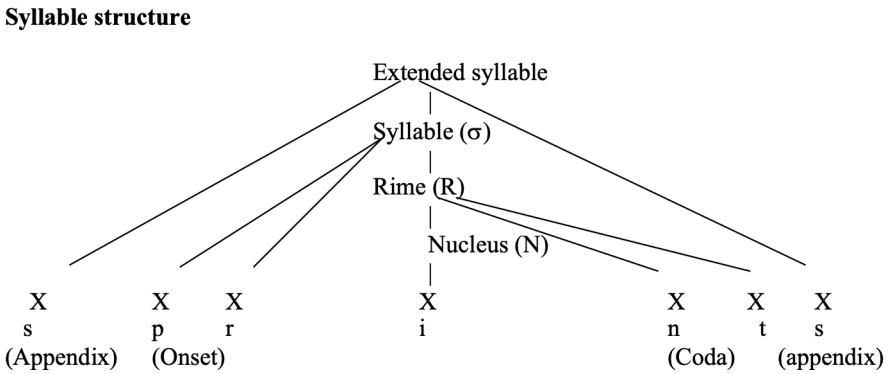
This human ability should be grounded in analysis-by-synthesis, or internal-forward, systems of linguistic perception (Halle & Stevens 1962, Poeppel, Idsardi & van Wassenhove, 2008; Bever & Poeppel, 2010; Poeppel & Mohanan, 2010; Poeppel & Idsardi, 2010, Bever 2017). This idea could be extended to language learning.

The generalization must be formulated in terms of adequate phonological representations including features and syllable structure.

Phonological representations

Exponents are built in terms of standard non-linear phonological representations. Phonological and morpho-phonological instructions operate on these representations.





ON THE ANALYSIS OF ALLOMORPHY LEARNING BY LANGUAGE-BY-SYNTHESIS

The goal of the linguist is that of rendering explicit all of the patterns that should be implicitly known by the speaker/listener, under the assumption that by analysis-by-synthesis all types of phonological patterns can be discovered and postulated as rules (or filters+repairs, see below). This also applies to morpho-phonological alternations, which are restricted to specific morphological environments.

Chomsky and Halle (1968): the goal of the morphologist and the phonologist dealing with allomorphy is to achieve all possible linguistically significant generalizations on the phonological shape of the language.

The theory used by the linguist to achieve this goal must be as simple and parsimonious as possible, efficient, with no redundancies or internal duplications, as in all sciences.

Rules in Phonology

The most interesting generalization for the morpho-phonologist: a process to account for an allomorphic alternation.

The phonological process: a certain configuration A is modified into B in a given context C __ D.

In classical generative phonology, **a process** is directly encoded as a rule of the form A-->B/C__D operating on **feature matrices**.

This rule describes an input configuration (the structural description CAD) and something to be done to it (the structural change A-->B) .

ON THE ANALYSIS OF ALLOMORPHY: Introducing Distributed Morphology

Following Distributed Morphology, allomorphy is accounted by the **rules of exponence**:

(3) i) vocabulary insertion rules
ii) morpho-phonological rules, and
iii) phonological rules.

Vocabulary insertion rules

Vocabulary insertion rules add phonological material (exponents) to morphemes formed by bundles of morphosyntactic features; it can be assumed that the exponents contain only basic, idiosyncratic properties, i.e., they introduce the underlying representations of SPE.

Vocabulary Items are essentially instructions that insert phonological material into a terminal node given certain specific feature configurations in the terminal node and its surrounding environment.

Morphophonological and phonological rules

Along with the Vocabulary Items, additional operations that modify the phonology of the exponents are necessary. These operations account for systematic regularities characterizing surface exponents within words.

They include a set of morpho-syntactically conditioned phonological operations (called Readjustment Rules in DM but simply known as morpho-phonological (MP) rules here), as well as a set of standard phonological processes.

Morphemes are said to be *spelled out* after the application of the rules of exponence.

The Allomorphy principle

The analysis of allomorphy of surface phonological forms must satisfy the Allomorphy Principle.

(4) Allomorphy Principle

To predict the surface phonological form of a word in a language L, it is sufficient, and necessary, to know:

i. The constituent pieces of the word.
ii. Their morpho-syntactic structural arrangement.
iii. Exponency instructions of L (Vocabulary Items, Morphophonological rules, Phonological Instructions)

The application of exponency instructions is governed by general locality principles

BASIC ASSUMPTIONS IN THE ANALYSIS OF ALLOMORPHY

Assumption:
The principle that governs the selection of the analytic options is (Kenstowicz and Kisseberth 1979: Chapter 6).

(5) Morphophonological analysis always starts at the lowest level of abstraction.

All alternations are at first considered to be instances of suppletion. The analysis proceeds forward towards higher levels of abstraction only when gains in linguistically significant generalizations can be achieved.

The natural analytic sequence in terms of abstraction is the following:

1) Alternations are first analyzed as involving suppletion, i.e., in terms of different VIs.

2) If there is evidence that they can be accounted for in terms of phonologically plausible processes,
   i. MP rules are postulated unless there is also evidence for a pure phonological analysis, in which case
   ii. phonological rules are postulated.

The Elsewhere principle

The application of the rules of exponence is governed by the Elsewhere principle.

When multiple rules of exponence meet the conditions for application, the rule with the highest number of matching features in the input must be selected.

Regarding the abstraction properties discussed earlier, vocabulary insertion rules will always take precedence over other rules of exponence, and morpho-phonological rules will always take precedence over phonological rules.

Similarly, if multiple Vocabulary item insertion rules satisfy the conditions for insertion, the rule matching the greatest number of features specified in the terminal morpheme must be chosen for that morpheme.

All phonological spell-out operations are applied such that more specific operations take priority over more general ones. Additionally, these operations are restricted to operate under strict locality conditions; in some cases, a trigger of a given rule may be too far away to activate that rule

Stages of morpho-phonological analysis:

If after comparison and segmentation, a morpheme M has always the same shape A, assume a suppletive analysis = a Vocabulary insertion rule:

(6) M→ A

Stages of morpho-phonological analysis:

If the morpheme has the alternants A and B in the context W__ Z if the distribution of their formal differences can be explained phonologically, these forms derive from a single exponent (a single underlying VI) and are related by rules.

Thus, given a morpho-phonological alternation C between A and B in the context W__ Z, where W__ Z realizes the the lexical or grammatical feature G, first assume that the alternation is suppletive and then proceed with the extraction of further generalizations, if possible.

If C can be analyzed in terms of a plausible phonological operation but nothing in the context W__ Z triggers it in phonological terms, assume that the operation is triggered in the context of G. This is a **morpho-phonological rule.**

If the context W__ Z can be reduced to phonology, then it is a straightforward **phonological rule**.

If the distribution of their formal differences between the alternants WAZ and WBZ cannot be explained phonologically, then they are in a suppletive relationship, meaning they result from the application of **different VIs.**

An illustration: Plural allomorphy in English

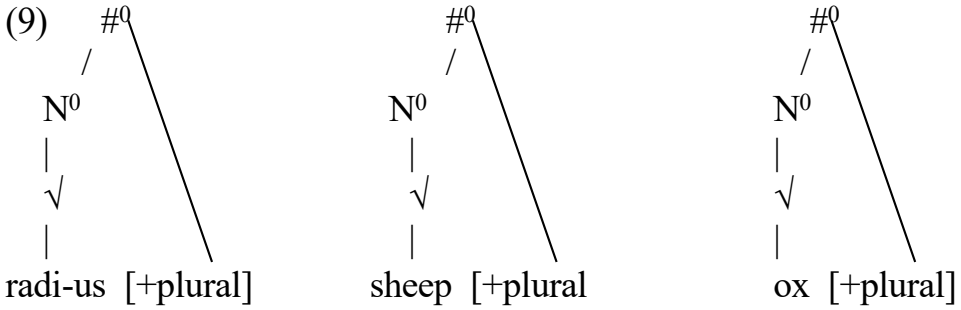
(7) SAMPLE ENGLISH PLURALS:

i. seraf/serafim, cherub/cherubim
ii. rad-us/radi-i, mag-us/mag- i, alumn-us/alumn -i, sarcophag-us/sarcophag –i
iii. dat-um/dat-a, strat-um/strat-a, bacteri-um/bacteri-a, memorand-um/memorand-a
iv. sheep/sheep, fish/fish, deer/deer, moose/moose
v. goose/geese, foot/feet, tooth/teeth, mouse/mice, louse/lice, man/men, woman/women,
vi. child/childr-en, ox/ox-en, brother/brethr-en
vii. dog/dog-s, cat/cat-s, bush/bush-es

(8) Another case of plural allomorphy in English:

i. wife/wi[v]es vs. fife/fifes
house/hou[z]es

(9)



Analysis in terms of DM Rules of Exponence:

The allomorphic alternations in the case of the English plurals can illustrate these different types of allomorphy.

If one considers the allomorphic alternations in (7)-(8), the morphological analytic method outlined above leads to the postulation of the VIs in (10) and of the phonological rules (11) to account for the distribution of the alternants in (7vii) derived from the VI (10g):

(10) VIs (i.e., rules inserting exponents)

a.	[+plural]	→	/-im/	/ $Root^{H}$ _____, $Root^{H}$ = *cherub, sefirot, seraf, etc*.
b.		→	/-i/	/ if the root ends with the suffix /us/
c.		→	/-a/	/ if the root ends with the suffix /um/.
e.		→	Ø	/ $Root^{Ø}$ _____, $Root^{Ø}$ = *sheep, man, moose, etc,*
f.		→	/-en/	/ $Root^{en}$ _____, $Root^{en}$ =*child, ox, brother etc*..
g.		→	/-z/	

(11) Phonological Rules:

i.	[-son] → [-voice]	/ [-voice] ____
ii.	Ø→ I	/ [-son, +cont, +cor] __ [-son, +cont, +cor]

Morpho-phonological Rules

If one assumes the possibility of morpho-phonological rules, i.e., phonological rules with morphological conditioning, alternations such as those in i) *mag-us/mag-i*, (iii) *foot/feet*, (iv) *child/child-r-en*, (vi) *wife/wi[v]e-[z]* can be accounted for by rules such as those in (12) can be postulated, some of which crucially rely on lexical diacritics:

(12) Morpho-Phonological Rules:

In the env. ___ [+plural]

i. Ø → /r/ / child ___

ii. /us/ → Ø / ____ [-i]

iii. /um/ → Ø / ____ [-a]

iii. [-cons] --> $\begin{pmatrix}\text{-back}\\ \text{-low}\end{pmatrix}$ / [___]$_{\text{Root}}$A, Root$^{\text{A}}$= *foot,, tooth, woman , man etc*.

iv. [+cons] --> [+voice] / [___]$_{\text{Root}}$v, Root$^{\text{v}}$ = *calf, elf, half, knife, leaf, life, scarf, self, shelf, thief, wharf, wife, wolf, bath, mouth, truth, house, etc.*

Classification of phonological alternations

Morpho-phonological processes can be classified based on whether they are restricted to the exponents of specific morphemes (Target Specific) or not (Target Indifferent); moreover, they can be triggered by Morphological features or by Phonological features. (For the sake of the exposition here, only right-to-left processes are considered, but they could also be left-to-right ones) (Embick and Shayder 2018). Classification of phonological alternations

(13)	**Phon-Triggered**	**Morph-Triggered**
Phon-Target	1	2
Morph-Target	3	4

Classification of phonological alternations: Examples

The voice assimilation rules in (11)are morphologically target indifferent and phonologically triggered, therefore **plain phonological rules** (i.e., (1) in (13).

Italo-Romance Metaphony—general mid-vowel raising in plurals and other morphological contexts— is a typical phonologically targeted and morpheme triggered rule (i.e., 2 in (13). Cases of this type involve what is traditionally called **grammaticalization**. They must be accounted for by morpho-phonological rules triggered by grammatical features.

The rule of fricative voicing in (8) is a typical rule of the morphologically target specific type (i.e., 3 in (13). Cases of this type involve what is traditionally called **lexicalization.** They must be accounted for by morpho-phonological rules whose application is restricted by lexical diacritics characterizing certain morphemes, usually roots.

Ablaut in (7v) or a rule like below (Halle and Marantz 1993), which accounts for the shape *should, would, could, stood* of the verbal element *shall, will, can, stand* in the past, are both target specific and morphologically triggered (i.e., 4 in (13). The rules are triggered by a grammatical feature ([+plural[or [+past]) and their applications are restricted by lexical diacritics characterizing the root, i.e. root^{u} in (14).

(14) [-cons] --> $\begin{pmatrix} +\text{high} \\ +\text{back} \end{pmatrix}$ / [___]$_{\text{root}^{u}}$ [+past] where root^{u} =shall, will, can, stand

Processes should be represented by rules

Morpho-phonological rules as in and easily explain all these cases, providing a unified framework for analyzing allomorphic alternations.

This suggests that analyses using MP-rules should be preferred over those that rely on unnecessary suppletive VIs containing contextually predictable phonology or other abstract defective devices (e.g., floating features, floating moras, floating feet, radically underspecified root nodes, etc. cf. Bye and Svenonius (2013)) in morphological analyses, at least in terms of simplicity and parsimony (see below for further discussion).

HYPOTHESIS: processes should be represented by rules unless there is evidence to the contrary.

It follows that non-suppletive contextual allomorphy is mainly governed by rules.

This results in an expansion of morphophonological processes within a piece-based morphology model like DM, significantly limiting the use of unnecessary suppletion and other abstract devices mentioned earlier.

ON THE CRITICISM OF MORPHO-PHONOLOGY

The framework adopted in this article is grounded in the work of Chomsky and Halle (1968).

They proposed that all phonological processes had to be accounted by rules regardless of their type of conditioning. So universal phonetically natural processes, and language-specific idiosyncratic, or morphologically conditioned, processes were accounted by the same rule formalism, and were all included in the same phonological component.

Morpho-phonological rules such as mentioned above are thus fully justified in that model.

Against (morpho-)phonological rules

Singh 1985:

Rules that are not governed by well-formedness conditions are not phonological processes: "*what are called phonological rules… are merely positivistic descriptions of the effects of [..] repair-strategies*"

The only phonological processes are repairs triggered by UG well-formedness constraints: epenthesis as a repair of illicit consonantal clusters. Phonological processes that cannot accounted in this way are part of the morphological component.

OT (Prince and Smolensky 1993):

"[Rule-based] phonology itself simply doesn't have much content, is mostly 'periphery' rather than 'core', is just a technique for data-compression, with aspirations to depth subverted by the inevitable idiosyncracies of history and lexicon."

Bermúdez-Otero (2013):

"DM routinely …. resorts to devices, like the unconstrained use of readjustment rules, that blur the line between allomorphy and phonology, and destroys the empirical content of the theory" (p. 80). The "powerful readjustment rules" "utterly destroy the empirical content of morphological and phonological hypotheses" (p. 83).

Readjustment rules=Morpho-Phonological rules

Bermúdez-Otero (2012)

Bermúdez-Otero (2012) (following Baudouin de Courtenay (1895=1972), Martinet (1965), and others on the autonomy of morphology) proposes the principles in :

(15) a. Morphological operations do not alter the syntactic or phonological contents of morphs.(his (41), p. 50)

b. A phonological constraint may not refer to syntactic, morphological, or lexical information […] (his (71), p. 77))

According to (15), morphological processes can only alter morphological configurations. Similarly, phonological processes can only alter phonological configurations. Mixing of phonological and morphological features is not possible.

Alternative analyses

If we assume and exclude the possibility of morpho-phonological rules, we must expand the role of vocabulary insertion rules.

There are two analytical options in this case:

i. The first is the simplest: we can suggest that the morpho-phonological alternations are due to suppletion, where the alternants are in a suppletive relationship and are inserted by different VIs.

ii. The second assumes that the two alternants are related by a phonological process; it then proposes a special VI that inserts an abstract, defective exponent—an idiosyncratically underspecified configuration—that can account for the process relating the alternants in terms of plain phonological operations.

Suppletion

Given two alternants WAZ and WBZ where WBZ appears in the lexical or grammatical context G, under suppletion, there are two VIs (S includes semantico-syntactic features):

(16) a. S--> WAZ
b. S-->WBZ/ ___ G

In this case, all the phonological generalizations identified in the process A-->B are stipulated in the exponent of the second VI.

Defective devices

Given two alternants WAZ and WBZ where WBZ appears in the lexical or grammatical context G, the process A>B is identified first.

This process is explained by determining what is changed and then postulating that a VI inserts an idiosyncratically underspecified configuration that can produce this change through a phonological operation, such as spreading.

Therefore, in addition to a VI inserting the basic alternant—let us assume a)—there is a VI like the one in , where X is a defective configuration.

(17) a. S--> WAZ
b. G-->X/ W __ Z (where X phonologically affects A in such a way that A>B)

- It must be an idiosyncratically underspecified configuration so that the general principles governing phonological representations trigger simple repair operations that fully specify the configuration. For example, feature specifications cannot remain floating and must be attached to a feature bundle; melodic contentless skeletal positions must be assigned features, etc.

Example of a defective VI

Thus, in the alternation *foot/feet*, the process [+back] to [-back] is identified.

This change can then be determined by a VI inserting the feature [-back].

As long as a single property of the alternant is preserved—otherwise, it would be a fully suppletive VI—the inserted configurations are radically and idiosyncratically underspecified (e.g., floating features, floating moras, floating feet, radically underspecified root nodes, etc., as proposed by Bye and Svenonius (2013), Bermúdez-Otero (2013)).

I will refer to the configurations inserted by the VIs in this approach as defective configurations and the relevant VI as defective VIs.

Properties of defective VIs

Two properties of defective VIs must be noted:

i. Defective VIs can only insert material; therefore, they cannot account for morpho-phonological changes involving deletion, resyllabification, or repositioning of elements.

ii. Defective configurations can only be inserted by a VI, specifically a defective VI. Otherwise, a defective VI would become identical to morpho-phonological rules—rules that insert phonological material in morphological contexts, which this approach aims to exclude. Therefore, they apply early in the spell-out process, clearly before phonological rules.

It follows that they cannot be sensitive to phonologically predictable properties of exponents, such as stress for example. Furthermore, insofar as the grammatical features in the input of a VI become obsolete after a VI applies (Bobaljik 2000), defective VIs cannot appear in a derivation where the same grammatical feature is used for another VI.

Note on defective VIs

Defective VIs involve a roundabout approach to morpho-phonological alternations. This approach can result in complex stipulations that often rely on the analyst's technical skills or linguistic intelligence (see the analyses in Bye and Suenonius (2013)). The impression is that analytic success depends on good luck.

Clearly, they are not a parsimonious and efficient way to handle morpho-phonological alternations.

However, I want to emphasize that I am not opposed to using abstract representational devices in phonological analysis. As discussed with filters later, I argue they should be employed only when there is converging evidence for them, specifically a conspiracy. Otherwise, the default, less abstract analysis requires the use of rules (or the types of instructions discussed in Section 2).

No Rule analysis

G. Hudson (1975): all morpho-phonemic alternations are suppletive➔ Storage of stems

(18) a. {go, wen} - b. wai- {f, v}

LEVELS OF ABSTRACTIONS:

(19) a. {waif-, waiv-} → b. wai {f, v} → c. wai [+cons, -son, +cont, +labial, {+voice, -voice}]

An informal selection rule (a lexical redundancy rule (Jackendoff 1975) or a morpholexical rule) (Lieber 1981, 1992) is given below:

(20) Select the feature [+voice] in the allomorphs in c) if the allomorph is in the context _____ [+Plur], otherwise select [-voice]. = (12iv)

LEVELS OF ABSTRACTIONS

(21) a. { foot- / feet- } → b. f { U / i } t → c. f [-cons, +high, { -back / +back }] t

b. Select the feature [-back] in the allomorphs in c) if the allomorph is in the context _____ [+Plur], otherwise select [+back]. =(12iii)

On suppletion

Note that although the suppletion solution, at least in this case, is simply a notational variant of a morpho-phonological rule, the case of the *go/went* alternation is clearly different since there are no phonological similarities between the two forms. The suppletion solution tends to group cases that are, in fact, quite different ontologically (Embick and Halle, 2004).

Alternative analysis

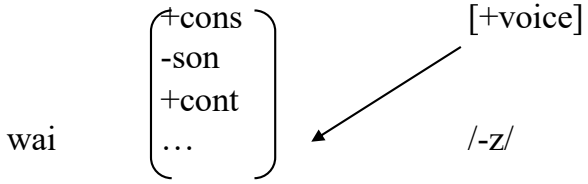
Additional VIs=Defective configurations

Floating [+voice] feature + phonological attachment:

(22) [+voice]

/z/ <--> [+plural]/ Root^{v} ___

(23)



(24) Ablaut cases:

[-back]

Ø <--> [+plural]/ Root^{A} ___

IMPORTANT: It cannot account for processes of Insertion of full segments, subtraction/deletion, or for changes in syllable structure

(25) child/childr
mag-us/mag-i