

Distributed Morphology

An Introduction

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1 Introduction

- The foundation for DM was laid by [Halle and Marantz \(1993, 1994\)](#).

! **Central idea: there is no principled difference between word-level and phrase-level syntax.**

- The stored knowledge of a language is distributed across three lists ([McGinnis-Archibald, 2016](#)):
 1. The Lexicon: elements that constitute the terminal nodes of a syntactic derivation (further divided into functional morphemes and lexical roots);
 2. The Vocabulary: elements with phonological content, inserted post-syntactically after Spell-out;
 3. The Encyclopedia: associates lexical roots with their meanings.

There is no Lexicon in DM in the sense familiar from generative grammar of the 1970s and 1980s. In other words DM unequivocally rejects the Lexicalist Hypothesis. The jobs assigned to the Lexicon component in earlier theories are distributed through various other components. For linguists committed to the Lexicalist Hypothesis, this aspect of DM may be the most difficult to understand or to accept, but it is nevertheless a central tenet of the theory.

<https://www.ling.upenn.edu/~rnoyer/dm/>

- The three most important properties of DM ([Halle and Marantz, 1993, 1994](#)):

1. **Late Insertion;**

2. **Underspecification;**

3. **Syntactic hierarchical structure all the way down.**

- Syntax combines abstract, phonology-free items, to create interpretable structures.

Phonological material is added post-syntactically.

- For example, in case of root/stem allomorphy, we don't have to insert a whole word based on some kind of 'look-ahead' towards what syntactic relations will be established later on ([McGinnis-Archibald, 2016](#)).

- Vocabulary items (the 'morphemes') can be underspecified. This means that the features of a vocabulary item may merely constitute a *proper subset* of the features present on a syntactic node. In case of a competition, the most specific VI is inserted (Subset Principle).

Q What is the difference between a subset and a proper subset?

- What we pronounce as 'words' are entities assembled from lexical roots and functional morphemes, lumped together phonologically.¹

¹ For example, in polysynthetic languages, complex words often correspond to entire sentences. Their construction is syntactically constrained.

☞ Words are therefore constructed in syntax just as phrases are.

- The consequences:
 1. Paradigms are not entities that exist independently;
 2. Contextual allomorphy instead of multiple exponence;
 3. Zero morphology can realize non-empty nodes;
 4. Restriction of blocking phenomena to items competing to be inserted into a single node.
- Since paradigms are not real grammatical ‘objects’, they cannot easily be referred to. A rule in DM cannot base an inflected form upon another form in the inflectional pattern of a given word.

2 The Subset Principle and Competition

- In DM, the Subset Principle plays a very central role because it regulates Vocabulary Insertion.
- According to the Subset Principle, a Vocabulary Item (VI) can be inserted into a terminal node if its feature bundle is a subset of the feature bundle on the terminal node.
- If multiple VIs are compatible with the feature bundle of a given terminal node, the most specific VI will be inserted (i.e. the VI with the highest number of features) (McGinnis-Archibald, 2016).
- Let us assume the following terminal node:

(1) F [+ α - β + ϵ]

- And the following set of VIs:

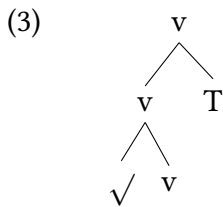
(2) a. /-a/ \leftrightarrow [+ α + ϵ]
b. /-b/ \leftrightarrow [+ α - ϵ]
c. /-c/ \leftrightarrow [+ α - β + ϵ + δ]
d. /-d/ \leftrightarrow [+ α - β]
e. /-e/ \leftrightarrow [- β]

Q Which of these VIs are compatible featurally with F? Why? Can we determine which one will actually be inserted? How?

☞ It is also possible to postulate extrinsic orderings of insertion rules, but this may pose a problem for language acquisition. Ordering rules extrinsically is therefore not considered a good practice in DM. Moral of the story: unless you have to, use the specificity-based ordering.

3 Vocabulary Insertion

- The syntax and the post-syntactic operations (see Section 4) determine in what order the terminal nodes are to be pronounced.
- For example, the syntax and post-syntax may create the following structure for an inflected verb form in English (one of multiple possible analyses):



- The VIs are normally inserted in the inside-out manner, i.e. starting with the deepest levels and progressing up the tree [Bobaljik \(2000\)](#).

- [Baker \(1985\)](#): *Morphological derivations must directly reflect syntactic derivations (and vice versa)*.
→ In DM, we get this basically for free (but consider also the post-syntactic operations below!).

☞ The implication of this assumption is that inner morphemes cannot react allomorphically to the phonological content of the outer morphemes, while the opposite is generally possible.

- (4)
- The accusative marker is /-l/ after bases ending in /-a/, and /-m/ after all other vowels
→ a **possible** rule;
 - The stem-final consonant changes from /-k/ to /-b/ before affixes beginning with /-ε.../
→ an **impossible** rule.

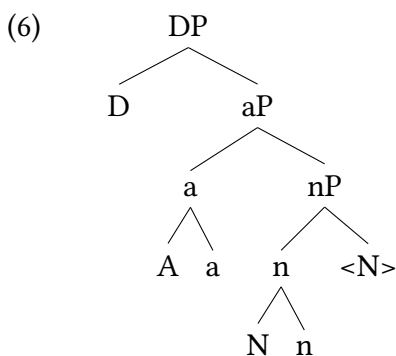
- Only the syntactic/semantic features of outer nodes can play a role in the allomorphy of inner nodes.

- If morphology happens pre-syntactically, there is no easy way to explain these locality restrictions.

☞ In Standard German, attributive adjectives have two series of inflectional suffixes, strong and weak. The strong affixes are used if there is no overt determiner, or if the determiner has a *phonologically overt* inflectional suffix.

- (5)
- (kein-Ø) groß-es Buch
(no-N.SG.NOM) big-N.SG.ACC.**STR** book.N
'(No) big book.'
 - da-s groß-e Buch
DEF-N.SG.NOM big-N.SG.ACC.**WK** book.N
'The big book.'

- If we assume the following basic syntactic structure for German -



- what predictions does standard DM make about the interaction between the determiner and the adjective?

3.1 Contextual allomorphy

- For contextual allomorphy, the affected elements have to be in a local syntactic domain ([McGinnis-Archibald, 2016](#)).
- Some (e.g. Embick) also argue that linear adjacency is required for contextual allomorphs.
- Thus, root verbs may trigger allomorphy on T because the v-head is empty, and the root and T are adjacent:

- (7) *Past tense exponents:*
- a. /-Ø/ ↔ [+pst] / $\sqrt{HIT}, \sqrt{BEAT}, \sqrt{RUN} \dots$
 - b. /-t/ ↔ [+pst] / $\sqrt{SLEEP}, \sqrt{BUY} \dots$
 - c. /-d/ ↔ [+pst]

- The observation is that verbs that have an overt *v* all take /-d/ in the past.
- Stem/root allomorphy can also be captured in terms of contextual rules:

- (8) a. /ɪæŋ/ ↔ \sqrt{RUN} / T [+pst]
b. /ɪʌŋ/ ↔ \sqrt{RUN}

4 Post-Syntactic Operations

- Several post-syntactic operations have been proposed for DM.
- These operations may move or modify the terminal nodes, as well as their feature bundles.
- The relative timing of these operations is still subject to debate ([McGinnis-Archibald, 2016](#)).

4.1 Impoverishment

- **Impoverishment** is the deletion of morpho-syntactic features in a given configuration.
- Impoverishment is particularly important for capturing systematic syncretism.
- Syncretism occurs when the same form is used in two distinct grammatical contexts.
- For example, all verbs in German have the same form in the 1st and 3rd person plural:

- (9) wir/sie *fahren/lesen/sind/haben* ...

- In the past tense, this extends to the singular, as well:

- (10) ich/er *war/sah/flog/hatte/musste* ...

- The fact that the aforementioned forms are the same for *all* verbs in the plural and for *all* verbs in the singular of the past tense suggests that this form identity is not accidental.
- The German verbal agreement markers:

		Prs.Sg	Prs.Pl	Pst.Sg	Pst.Pl
(11)	1	-ə	-n	-∅	-n
	2	-st	-t	-st	-t
	3	-t	-n	-∅	-n

- Let us assume the following features for person:

- (12)
- [+part -addr] → speaker
 - [+part +addr] → addressee
 - [-part -addr] → third person

- The vocabulary items:

- (13)
- st ↔ [+part +addr -pl]
 - t ↔ [+part +addr +pl]
 - ə ↔ [+part -pl]
 - n ↔ [+pl]
 - t ↔ [-pl]
 - ∅ ↔ []

- In order to capture the non-insertion of /-ə/ in the 1SG.PST and the non-insertion of /-t/ in 3SG.PST, we can introduce the following Impoverishment rules:

- (14)
- [±part] → ∅ / [_____ -addr] [PST]
 - [±part] → ∅ / [_____ -addr +pl]

- The first rule will apply across-the-board to all non-second-person configurations in the past tense, thus blocking the insertion of the VIs from 3. and 5., and a tentative more specific marker for 1.PL or 3.PL. The second rule will apply in the plural contexts of the non-past tense.

- ☞ With systematic syncretism, try and capture them using Impoverishment, not the inventory of vocabulary items (Noyer, 1998).

4.1.1 Impoverishment and differential object marking

- In some languages, the case marking of a verb's argument depends on some of its intrinsic properties (local case split). [Q What is a *global* case split?]
- For example, in Russian, masculine singular nouns and all plural nouns do not have a dedicated accusative exponent. Instead, animate nouns use the genitive exponent, while inanimate nouns appear in the nominative.

- (15) *An excerpt from Russian nominal declension:*

	animate		inanimate		F.Sg
	M.Sg	F.Pl	M.Sg	F.Pl	
	<i>cat</i>	<i>goats</i>	<i>sweat</i>	<i>roses</i>	<i>rose</i>
N	kot-∅	koz-y	pot-∅	roz-y	roz-a
G	kot-a	koz-∅	pot-a	roz-∅	roz-y
A	kot-a	koz-∅	pot-∅	roz-y	roz-u

- The featural decomposition of case (Alexiadou and Müller, 2008):

- (16) a. Nom: [+sbj -gov -obl]
 b. Gen: [+sbj +gov +obl]
 c. Acc: [-sbj +gov -obl]

- The Vocabulary Items:²

- (17) a. $-\emptyset \leftrightarrow [+gov +pl]$
 b. $-a \leftrightarrow [+gov -pl]$
 c. $-y \leftrightarrow [+pl]$
 d. $-\emptyset \leftrightarrow []$

- The ‘genitive’ VIs (a and b) are actually underspecified for $[\pm obl]$. They are technically compatible with both accusative and genitive environments.
- In order to ensure the fallback to the nominative for inanimate plural and singular masculine nouns, the following Impoverishment rule may be suggested:

- (18) $[+gov] \rightarrow \emptyset / [___ -obl +m \vee +pl -anim]$

4.2 Fission

- There are two possible definitions of Fission:
 - A terminal node is split into two nodes, with the resulting nodes inheriting disjoint subsets of the original node’s features (Halle, 1997);
 - A terminal node which has undergone a Vocabulary Insertion operation targeting a proper subset of its features remains active for subsequent insertion operations targeting the rest of its features which have not yet been discharged (Noyer, 1997).
- The idea behind Fission was the observation that, sometimes, one syntactic position is associated with more than one surface morpheme.
- Consider the following conjugation pattern from the Modern Hebrew future tense:

- (19) *Future tense of ‘ktb > katav (write)’ in Hebrew:*³

	SG	PL
1	ʔε-xtov	ni-xtov
2.M	ti-xtov	ti-xtəv-u
2.F	ti-xtəv-i	ti-xtəv-u / ti-xtov-na
3.M	ji-xtov	ji-xtəv-u
3.F	ti-xtov	ji-xtəv-u / ji-xtov-na

- The person-gender-number bundle is expressed using one morpheme in the first person of both numbers, and in the third person singular feminine. In the rest of the forms, person is marked on the prefix, and gender/number are expressed via a suffix.

² There are three further cases and multiple inflectional classes in Russian. In the big picture, the analysis would evidently need to be adjusted to accommodate the full inflectional set.

³ The consonants /k-x/ and /b-v/ alternate morphophonologically.

☞ Idea: let's capture this using just one Infl slot.

- Following [Kramer \(2015\)](#), we will henceforth assume that gender in Semitic is restricted to one feature: $[\pm f]$ (feminine is marked, masculine is default).
- The obligatory Impoverishment rule (systematic loss of gender distinctions in the first person):

(20) $[\pm f] \rightarrow \emptyset / [+part -addr]$

- The optional Impoverishment rule (optional loss of gender in the plural):

(21) $[+f] \rightarrow \emptyset [_ +pl]$

- The Vocabulary Items:

- (22)
1. $/ni-/ \leftrightarrow [+part -addr +pl]$
 2. $/ʔε-/ \leftrightarrow [+part -addr -pl]$
 3. $/ti-/ \leftrightarrow [-part +f -pl]$
 4. $/ti-/ \leftrightarrow [+part +addr]$
 5. $/ji-/ \leftrightarrow [-part]$
 6. $/-na/ \leftrightarrow [+f +pl]$
 7. $/-u/ \leftrightarrow [+pl]$
 8. $/-i/ \leftrightarrow [+f]$

- Sample derivations:

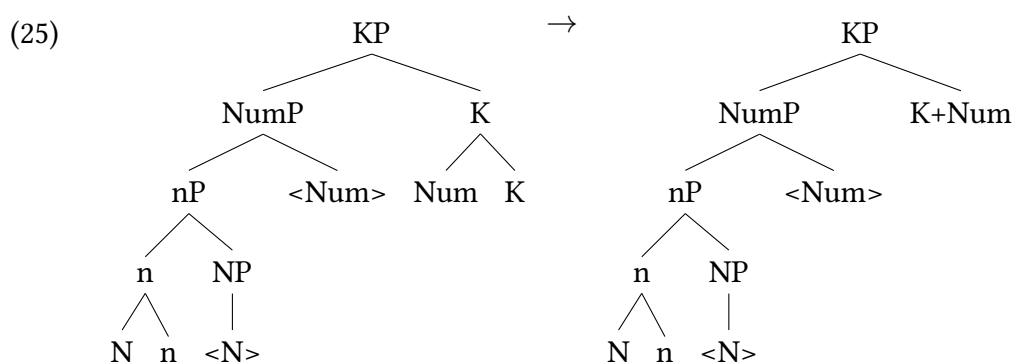
- (23)
- a. 1PL.F $[+part -addr +pl +f] ::$
Impoverishment: $[+part -addr +pl]$
First insertion: **ni-**, features: $[+part -addr +pl]$
*Had Impoverishment not applied, the /-i/ for [+f] would have been inserted in a second insertion cycle, resulting in: *ni-xtəv-i.*
 - b. 3SG.F $[-part -addr -pl +f] ::$
Impoverishment: N/A
First insertion: **ti-**, features: $[-part -addr -pl +f]$
 - c. 3SG.M $[-part -addr -pl -f] ::$
Impoverishment: N/A
First insertion: **ji-**, features: $[-part -addr -pl -f]$
 - d. 2SG.F $[+part +addr -pl +f] ::$
Impoverishment: N/A
First insertion: **ti-**, features: $[+part +addr -pl +f]$
Second insertion: **ti-...-i**, features: $[+part +addr -pl +f]$
 - e. 2PL.F $[+part +addr +pl +f] ::$
Impoverishment: *-does not apply-*
First insertion: **ti-**, features: $[+part +addr +pl +f]$
Second insertion: **ti-...-na**, features: $[+part +addr +pl +f]$

- f. 2_{PL,F} [+part +addr +pl +f] ::
 Impoverishment: [+part +addr +pl +f]
 First insertion: **ti-**, features: [+part +addr +pl +f]
 Second insertion: **ti...-u**, features: [+part +addr +pl +f]

4.3 Fusion

- Fusion occurs when two syntactic nodes fuse into one node under sisterhood. The features of both nodes are then present on the resulting node. However, only one VI may be inserted.
- For example, many languages mark case and number separately, while others use one morpheme for both features.

- (24) a. Georgian: shvil-i ‘child-NOM’ » shvil-s ‘child-DAT’ »
 shvil-eb-i ‘child-PL-NOM’ » shvil-eb-s ‘child-PL-DAT’
 b. German: Kind-Ø-Ø ‘child-SG-NOM’ » Kind-Ø-es ‘child-SG-GEN’
 Kind-er-Ø ‘child-PL-NOM’ » Kind-er-n ‘child-PL-DAT’
 c. Lithuanian: vaik-as ‘child-SG.NOM’ » vaik-ui ‘child-SG.DAT’ »
 vaik-ai ‘child-PL.NOM’ » vaik-ams ‘child-PL.DAT’



- Another example of Fusion would be the contracted preposition+article forms in French:

- (26) a. à + le → au /o/
 b. de + le → du /dy/

☞ The idea is that the P-head and the D-head fuse together into one terminal.

4.4 Merger

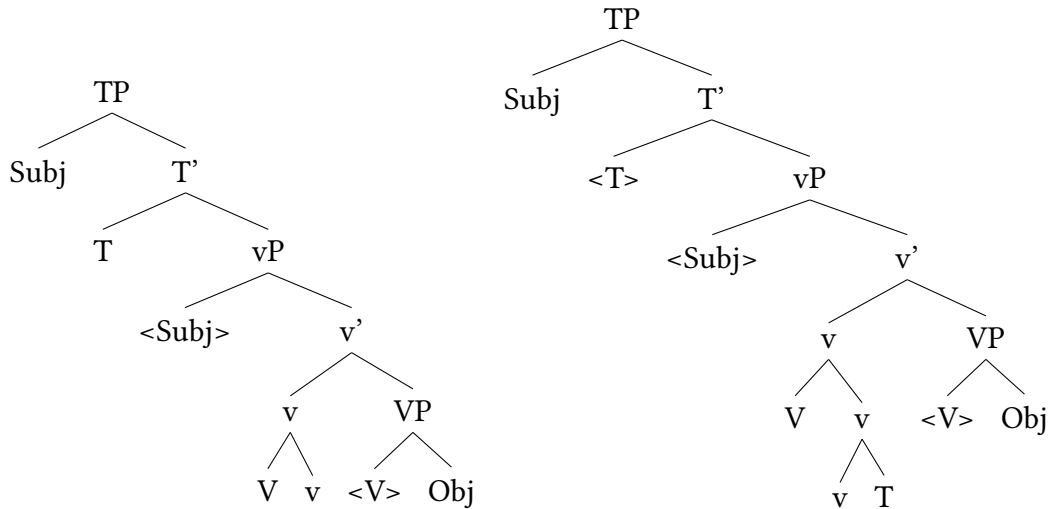
- A morphological Merger (Embick and Noyer, 2001) replaces a syntactic relation between two elements with that of linear adjacency by the means of affixing one of the two elements to the other.

- (27) At any level of syntactic analysis (D-Structure, S-Structure, phonological structure), a relation between X and Y may be replaced by (expressed by) the affixation of the lexical head of X to the lexical head of Y.

4.4.1 Lowering

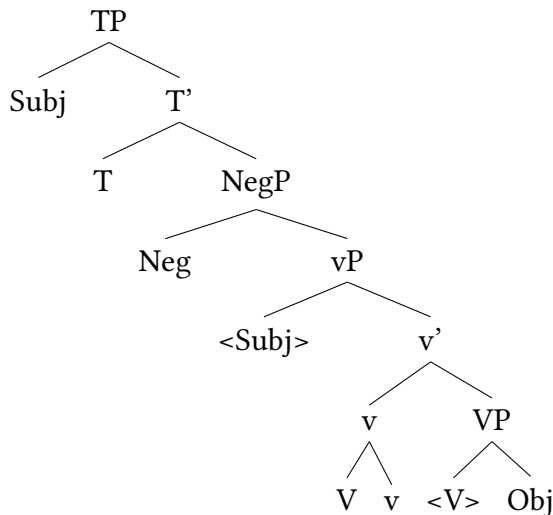
- An example of a Merger is the so-called Lowering.
- Lowering is a post-syntactic operation whereby the head of a functional projection is lowered to the projection it immediately dominates and adjoined to it. Lowering is, therefore, a type of Merger.
- For example, it can be assumed that the T-head bearing tense and agreement features is lowered to *v* in English, forming a complex head with it.

(28) Lowering of *T* to *v*:



- The [V v T] string will correspond to, for instance, forms like *work-Ø-s/-ed*.
- If NegP intervenes between TP and vP, then Lowering becomes impossible:

(29) No Lowering across NegP:



- In this case, in order to pronounce the tense features in the original position, the dummy verb *do* is inserted to host the tense morpheme:

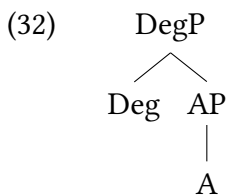
(30) He *do-es/did* not work.

4.4.2 Local Dislocation

- Consider the following two comparative forms in English:

- (31) a. smarter, *?more smart
 b. more intelligent, *intelligenter

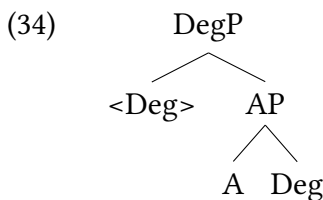
- Traditionally, the difference was dealt with as an instance of competition between words (synthetic inflected comparative) vs phrases (periphrastic analytic comparative). In other words, the synthetic comparative and the analytic comparative differ syntactically.
- According to DM-based analyses (Embick and Marantz, 2008; Embick and Noyer, 2001), the two types of comparatives go back to the exact same syntactic structure.



- In Local Dislocation, a syntactic head adjoins to another head under linear adjacency:

- (33) $X*Y \rightarrow [[Y]X]$

- In this specific case with English comparatives, the degree head undergoes Local Dislocation with the adjectival head:



! This process takes place under a strict phonological condition: the lexical adjective has to be monosyllabic.

- The two resulting structures are pronounced in two different ways:

- (35) a. $[_{DegP} Deg [_{AP} A]] \rightarrow \text{more Adj}$
 b. $[_{DegP} - [_{AP} A+Deg]] \rightarrow \text{Adj-er}$

- The Vocabulary Items for Comp:

- (36) a. $/-\partial.i/ \leftrightarrow [+comp] / [A+ __]$
 b. $/m\partial.i/ \leftrightarrow [+comp]$

☞ In DM, there is no competition between words and phrases per se. The competitions are restricted to the VIs competing to be inserted into one terminal node.

- Another example comes from Cibemba (McGinnis-Archibald, 2016). Here, the causative suffix causes consonant lenition on both the verbal root and the applicative morpheme:

(37) -lub-il-*j*- → -lufis*j*-

- The idea is that the causative is initially attached closer to the root, triggering a mutation on it. The applicative is added later on the right-hand side and then locally dislocated for phonological reasons, whereupon the aforementioned mutation takes place again.

4.5 Enrichment???

- Previously, we have seen that Impoverishment can ensure the so-called ‘Retreat to the general case’.

Q Can we have the opposite operation whereby a feature is inserted in a given environment prior to Vocabulary Insertion?

- In the Algonquian language Plains Cree, there is a hierarchy of person features rendering certain features more salient than others:

(38) 2/1 » 3 » 3.OBV

- The gloss OBV stands for ‘obviative’, a third-person DP marked morphologically as sell discourse-central.
- In a given sentence, only one third-person argument may be 3, all others have to be 3.OBV.
- The grammar of the language is sensitive to how large the distance between the subject and the object is along the salience hierarchy. If 2/1 is the subject and 3 is the object, nothing appears in the relevant inflectional slot:

(39) ni-waapam-∅-aa-w
1-see-∅-1/2-3.ANIM
‘I see him/her [prox].’

- The same is observed if 3 is subject and 3.OBV is object:

(40) ∅-waapam-∅-ee-w
3-see-∅-3-3.ANIM
‘(S)he [prox] sees him/her [obv].’

- However, if the subject is 1/2 and the object is 3.OBV, or if the subject is 3 and the object is possessed by 3.OBV (the so-called ‘further obviative’), then the morpheme /-im-/ appears:

(41) a. ni-waapam-**im**-aa-w
1-see-IM-1/2-3.ANIM
‘I see him/her [obv].’
b. ∅-waapam-**im**-ee-w
3-see-IM-3-3.ANIM
‘(S)he [prox] sees him/her [f.obv].’

! Problem: the morpheme /-im-/ appears if the subject is two or more steps ahead of the object on the salience scale. However, the grammar cannot really ‘count’ the distance between the subject and the object on the salience scale.

- We may assume that an obviative object that is possessed by another obviative DP has a special feature marking it as ‘further obviative’. Let us call this feature [+dep] for now.
- The idea is that the feature [+dep] is inserted into a [+obv] DP in the context of a first- or second-person subject:

(42) *The Enrichment rule:*
 $\emptyset \rightarrow +\text{dep} / [\text{---} +\text{obv}] [+part +\text{sbj}]$

☞ More on feature changing operations: [Noyer \(1998\)](#).

5 Conclusions

- Most, if not all, morphological phenomena can be reduced to computations done in syntax ([Bruening, 2018](#)).
- An utterance is built cyclically in bottom-up manner, and the structure initially lacks phonological information. There are no ‘words’ at this stage.
- Phonological material is inserted into the terminal nodes post-syntactically, in an inside-out manner.
- Some purely morphological rules may operate in post-syntax to adjust the structure. Thus, terminal nodes may be moved and adjoined to each other, sometimes even fused together or split.
- The operation of Impoverishment is very central to DM because it helps capture systematic form homophonies.

6 Exercises

6.1 Swedish adjectives

- In Swedish, the masculine and the feminine genders have, for the most part, merged together, leaving a system of two classes: common (c) and neuter (n).
- Below are shown the forms of a Swedish adjective in various contexts:⁴

- (43)
- a. en stor-Ø man (c) / kvinna (c) ‘a big man / woman’
 - b. ett stor-t hus (n) ‘a big house’
 - c. stor-a män / kvinnor / hus ‘big men / women / houses’
 - d. den stor-a kvinnan ‘the big woman’
 - e. det stor-a huset ‘the big house’
 - f. de stor-a männen / kvinnorna / husen ‘the big men / women / houses’

- For singular definite nouns denoting male human beings and animals, the adjective optionally has the masculine suffix **-e** as a relic from Old Norse:

- (44) den stor-**e**/**-a** mannen ‘the big man’

- Develop a DM-based system that would account for the distribution of the adjectival forms in Swedish.

6.2 Greek nouns

- Greek nouns have three genders (masculine, feminine and neuter) and inflect for two numbers (singular and plural) and three cases (nominative, genitive, accusative).
- Below are presented two masculine nouns belonging to two different inflectional classes. Many Greek nouns inflect according to these two patterns.

- (45) *Greek declension excerpt:*

	filos ‘friend’		elinas ‘Greek man’	
	Sg	Pl	Sg	Pl
N	fil-os	fil-i	elin-as	elin-es
G	fil-u	fil-on	elin-a	elin-on
A	fil-o	fil-us	elin-a	elin-es

- Assuming that *filos* has an abstract inflectional class feature [α] and *elinas* has [β], propose a DM-based analysis capturing the data in the example above. What possible avenues can one take to account for the distribution of the inflectional formatives? The existence of other inflectional classes may be ignored for the purposes of this task.

⁴ In Swedish, DPs do not inflect for case, so the forms provided in the examples can be used in virtually any broader syntactic context.

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