Contextual allomorphy*

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1. Introduction

In the best of all morphosyntactically possible worlds, one might well suppose the pieces of syntax and the pieces of morphology would be a one-to-one correspondence. In the real world, many factors impinge on this maximally simple relationship: allomorphy, accidental homophony, principled syncretism, non-cumulative exponence, ... In this chapter, we concentrate on the first of these, aiming to lay out the empirical boundaries that distinguish allomorphy from other sources of variation and the theoretical issues that a fully fledged account of allomorphy should, in our opinion, address.

What we mean by *allomorphy* is most simply expressed graphically. As a preliminary, the exponence relation between a feature set and an exponent is represented as:

(1) [F] $\Leftrightarrow \phi$

This is read as '[F] has exponent ϕ'; for instance, if [F] is the feature specification of the English present participle, then ϕ is /ɪŋ/.

To serve breadth of readership, we understand 'feature set' loosely, leaving it to specific theoretical proposals, rather than to our definition, to determine whether [F] is restricted to features bundles at terminal nodes or may include larger syntactic structures. Similarly, although we will use terminology familiar from post-syntactic theories of morphology, we regard such notation, and most of our discussion, as equally relevant to presyntactic (lexicalist) models. (For simplicity, we will frequently adopt two notation devices: first, we use glossing labels rather

*Acknowledgements to go here.

than actual features for [F], writing, e.g., [PL] rather than attempting to decide between [plural], [+plural], [−singular], etc.; and we use orthographic instead of phonological strings for ϕ, writing e.g., *ing* for /ɪŋ/.)

Given (1), we use *allomorphy* to refer to such exponence relations as:

$$(2) \qquad [\mathrm{F}] \Leftrightarrow \begin{cases} \phi_1 & \mathrm{Context}_1 \\ \phi_2 & \mathrm{Context}_2 \\ \vdots & \vdots \end{cases}$$

That is to say, [F] is said to exhibit allomorphy if, instead of having a unique exponent, it has two or more contextually conditioned exponents. In this case, ϕ_1, ϕ_2, ... are said to be allomorphs (of [F]).

Examples of allomorphy abound. In English, for instance, the nominal plural has allomorphs (*e*)*s* and *en*, amongst several others:

$$(3) \qquad [\mathrm{PL}] \Leftrightarrow \begin{cases} en & [_{\mathrm{N}}\ ox\ ] \_\_\_\_ \\ (e)s & [_{\mathrm{N}}\ \ \ ] \_\_\_\_ \end{cases}$$

This relation captures why the plurals of *ox* and *fox* are respectively, *oxen* and *foxes*, not *oxes* and *foxes* or *oxen* and *foxen*: *en* is specified as the way the plural is pronounced in the presence of *ox*, with (*e*)*s* used if no specific pronunciation is otherwise specified. (The latter type of exponent is known as the *default* or *elsewhere* item, capturing the fact that it is used where other, more contextually specified items are not required.) Tables 1–3 present three further examples from Australia, Austronesia, and Papua New Guinea, concerning genitive marking, accusative marking, and person in numberless pronouns, respectively.[1]

Superficially considered, allomorphy might seem a somewhat exceptional process, one that should be quite peripheral to the ambit of theories of grammar. Consider the English plural (3) and the Imonda pronoun (table 3): in both, there is a clear majority pattern (*s*-suffixation for English, *f*-suffixation without other change for Imonda), with a second allomorph restricted to a small set. The same holds to some extent for Hawaiian (table 2), as the majority of nouns are common nouns and can even be true in cases, like Kalkatungu (table 1), where allomorphs

[1] In all our examples, we have adhered, in so far as possible, to Carstairs' (1987) useful heuristic for identifying allomorphy, namely, that an irregular form occurs with otherwise regular inflection: i.e., suppose that [F] $\Leftrightarrow \alpha$ and [G] $\Leftrightarrow \beta$; then, if [FG] is pronounced $\alpha\gamma$, [G] can be said to have allomorphs β and γ; if, however, [FG] is pronounced δ, then it cannot, without further argument, be claimed that δ is an allomorph of [G] (or [F]) as it might be an exponent of the pair simultaneously. For a dissenting view, see Trommer (1999); see also section 3.5.3 below.

Table 1: *Genitive allomorphy in Kalkatungu*

$$[\textsc{gen}] \Leftrightarrow \begin{cases} \textit{-ku} & \text{C}\_\_\_\_ \\ \textit{-ja} & \text{V}\_\_\_\_ \end{cases}$$

Final	Genitive
C	*t̪uat-ku* ‘snake’, *upun-ku* ‘frog’, *t̪untal-ku* ‘moon’
V	*macumpa-ja* ‘moon’, *ntia-ja* ‘snake’, *kupu-ja* ‘spider’

Blake 1969: 33

Table 2: *Accusative allomorphy in Hawaiian*

$$[\textsc{acc}] \Leftrightarrow \begin{cases} i\bar{a} \\ i \end{cases} \quad \_\_\_\_ \text{ name/pronoun}$$

Noun	*Ua honi au ...*	‘I kissed ...’
name	*Ua honi au iā Lani*	‘I kissed Lani’
pronoun	*Ua honi au iā ia*	‘I kissed it’
noun	*Ua honi au i ka wahine/moa*	‘I kissed the woman/bird’

Fieldnotes, speaker ʻŌiwi Parker Jones

Table 3: *Pronominal allomorphy in Imonda*

$$[2] \Leftrightarrow \begin{cases} be \\ ne \end{cases} \quad \_\_\_\_ \textsc{emph/refl}$$

	Pronoun	Emphatic/Reflexive
1EX	*ka*	*ka-f*
1IN	*pəl*	*ple-f*[a]
2	*ne*	*be-f*
3	*ehe*	*ehe-f*

[a]The first inclusive alternation *pəl* ~ *ple* is presumably phonological, as, despite presence of word-final *-lf* (e.g., *nõffe-ual-f* ‘search-DL-PRES’, p. 114; *e-lõl-uagl-f* ‘DL-talk-do-PRES’, p. 108), we cannot find any complex codas on monosyllables in schwa.

Seiler 1985: 44

are phonologically conditioned (C-final nouns are substantially less frequent in Blake's glossary than V-final ones). The impression that allomorphy is a marginal phenomenon might be further reinforced by the difficulty of finding cases of allomorphy in a randomly chosen grammar: much concatenation is invariant (modulo low-level phonology).

In reality, however, allomorphy is so abundant a process that we often fail to notice its presence. To see this, consider the following sentences of Biak, an Austronesian language of Western Papua:

(4) a. Mansuar- **su**-ya **su**- yom snon mamuni
cassowary-DL-the 3DL-chase the hunter
'The two cassowaries chased the hunter'

b. Mansuar- **sko**-ya **sko**-yom snon mamuni
cassowary-PC- the 3PC-chase the hunter
'The few cassowaries chased the hunter'

c. Mansuar- **s**- ya **s**- yom snon mamuni
cassowary-PL-the 3PL-chase the hunter
'The cassowaries chased the hunter'(fieldnotes, speaker Suriel Mofu)

What is striking about these sentences is that the number marking is identical on noun and verb: *su* for dual, *sko* for paucal, *s* for plural. However, it is surprising that one should find this surprising: if agreement relations simply share information between parts of the clause, then one might naively expect Biak-like identity to predominate. Though we are not aware of any typological studies addressing the issue, our impression is that it does not. Instead occasional matching between adjective/participle and noun though never with the verb seems to be the predominant pattern, exemplified here by the plural in Hebrew (5) and Georgian (6) and the inverse (which functions, here, like a plural) in Kiowa (7):

(5) mṣaa'-**uu**-niy haš-šomr- **iym** has-soḇḇ- **iym** baa'iyr
found-PL- 1SG.CL the-guard-M.PL the-go about-M.PL in the city
'The guards who go about the the city found me' (Cant. 3:3)

(6) rom bič'-**eb**-s cxen- eb-is- tvis mo-e- vl- o- **t**
that lad- PL- DAT horse-PL- GEN-for ASP-APPL-look after-IRR-PL
'that the lads look after the horses' (Hewitt 1995: 193)

(7) [phɔ́ɔ́- **gɔ** **e**- dɔ́ɔ́]-**gɔ** **e**- yây
[buffalo-INV INV-be]-REL.INV INV-disappear.PF
'The buffaloes that there were disappeared'

If this is so, then allomorphy is a near ubiquitous property of any language with agreement across nominal and verbal, or other similarity disparate, categories.

In this chapter our aim is not to propose a theory of allomorphy. Instead we have two more modest aims. The first, broadly speaking empirical aim is to clarify the criteria according to which a given alternation can be classified as allomorphic. In slightly more concrete terms, this involves determining when an alternation should be regarded as resulting from a representation like that in (2) as opposed to other factors, such as phonology, morphology, or syntax.

The second, broadly speaking theoretical aim is to elucidate what each part of (2) can stand for. One such issue was hinted at the outset, where we said that the notion of feature set, represented by [F], was to be understood loosely, so as not to exclude whole syntactic structures. In fact, questions surround every part of (2). Besides the relatively obvious—such as the content of [F], of ϕ, and of context (____)—even the more innocuous notation devices disguise contentful questions—whether there are limits on the number of allomorphs (:), how and when the choice ({) between different allomorphs is made, whether exponence replaces [F] with ϕ or whether adds the latter on ($\Leftrightarrow$). Needless to say, many of these questions are mutually dependent particularly as concerns context: for instance, if ϕ replaces [F], then this impacts on what context can contain; the relative timing on which different exponence relation act can also affect context, supply it with or depriving it of information. Full elucidation of these issues is too great a task within current confines. Therefore, our aim will be to enumerate the theoretical issues, to highlight some cores claims, and to lay out some data that strikes us as germane to future attempts to construct the theory of allomorphy.

Two final notes before proceeding. First, our discussion—which is couched in realizational implementation of what Hockett (1954) terms an item-and-arrangement (rather than item-and-process) approach to morphology—aims to clarify what we think the empirical domain (section 2) and theoretical range (section 3) of an investigation into allomorphy ought approximately to be. However, as will become immediately apparent from our first example below, our understanding of the 'empirical' domain of allomorphy is hardly theory-neutral. This is, of course, unavoidable: to paraphrase Fodor 1981, data do not come with labels declaring 'I am for allomorphy', 'I am for phonology', and so such classifications are up to the researcher. Second, some authors use the term 'allomorphy' to cover any case of variation in a morpheme's surface form (e.g., Bye 2008); others use the term 'suppletion' to refer to multiple underlying forms (cf, e.g., Spencer 1991); and yet others use these terms differently again, restricting, e.g., 'suppletion' to

non-affixal allomorphy (e.g., Embick 2009). Here, we eschew the term 'suppletion' and use 'allomorphy' to refer only to differences arising from the existence of multiple underlying exponents.

2. Empirical characterization

Consider again the English plural. In (3), the entry (*e*)*s* abbreviates the three surface-distinct endings of the plurals of *grace*/*graze*, *grate*, and *grey*/*grade*, viz. *grac*/*graz*[ɨz], *grate*[*s*], and *grey*/*grade*[*z*]. The ending *en* of *oxen* is equally surface distinct. However, according to (3), these four surface variants comprise only two distinct allomorphs: *en* and the others. In this section, we will be concerned with the basis on which such decisions are made. Specifically, in the following subsections, we consider how and why true allomorphy must be differentiated from superficially similar variation that in fact arises from phonology (section 2.1), morphology (section 2.2), and syntax (section 2.3). We will furthermore address some more conceptual issues, concerning the role of diachrony in establishing allomorphy (section 2.1) and the status of free variation (section 2.4).

2.1. Phonology

Continuing with the English plural, the reason that we do not take (*e*)*s* to constitute separate allomorphs—that is, not to require listing as separate exponents of [PL]—is that application of regular phonology is sufficient to derive the surface variation from a single underlying form. More generally, we propose that the notion of allomorphy applies only to underlying forms of exponents. That is, if [F] has two surface-distinct exponents [ϕ_1] and [ϕ_2], then a necessary (though not sufficient; see sections 2.2–2.4) condition for these to count as allomorphs is the impossibility of deriving [ϕ_1] and [ϕ_2] from a single underlying /ϕ/ within the phonology of the language.

That English plural [ɨz]~[*s*]~[*z*] derive from one underlying exponent is probably familiar to most readers. Taking that form to be /z/, we posit ɨ-epenthesis if the preceding segment is identical (modulo voicing and distributedness, e.g., *grace*/*graze*); if epenthesis does not apply, we posit devoicing if the preceding segment is voiceless (*grate*); elsewhere, the underlying form surfaces (*grey*/*grade*). That this is part of the phonology of the language is indicated, first, by the fact that the phonotactic configurations thus avoided ([*zs*], [*sz*], [*tz*], [*ds*], ...) are absent from codas throughout the language, whether derived or primitive, and, second,

Table 4: *Phonological plural/tense alternations in English*

	Plural /Pres.	Past
grace	-[ɨz]	-[*t*]
graze	-[ɨz]	-[*d*]
grey	-[*z*]	-[*d*]
grade	-[*z*]	-[ɨ*d*]
grate	-[*s*]	-[ɨ*d*]
epenthesis to break identity otherwise parity of voicing		

by the identical behavior of the homophonous present tense and, *mutatis mutandis*, past tense [ɨ*d*]~[*t*]~[*d*] (see table 4, noting that the above *grace*, etc., are ambiguous between nouns and verbs).

Regarding the alternation [ɨz]~[*s*]~[*z*] as non-allomorphic is not uncontroversial. Almost the whole of Matthews' chapter on allomorphy (Matthews 1974, ch. 5; cf, Spencer 1991, ch. 4) is devoted to examples that we would not regard as allomorphic precisely because regular operations of the phonology are capable of yielding the surface variation from a unique underlying exponent, Matthews' prime example being the vowel-harmonic properties of Turkish number and case suffixes. The basis of this position goes back to the Structuralist comparatively restricted notion of allophony. However, rather than enter into discussion of Structuralist phonology, consider how the two accounts fare with respect to the parallel case in table 4. The anallomorphic approach posits underlying /z/ (plural/present) and /d/ (past) and derives the surface variation, as already mentioned, by applying phonological processes (informally, $\emptyset \mapsto$ ɨ / [place$_1$] ____ [place$_1$] and [+voiced] $\mapsto$ [–voiced] / [–voiced] ____) to the underlying forms. The allomorphic approach posits as underlying forms the outputs of these phonological processes (viz., /ɨz/, /s/, /z/; /ɨd/, /t/, /d/); and yet, it cannot do away with the information that the phonological processes require, but repeats it as the allomorphic context (e.g., the context of [PL] $\Leftrightarrow$ *s* / [–voiced] ____ is as in the devoicing process). Indeed, whereas the anallomorphic approach represents this information once, as a process applying to all three underlying forms, the allomorphic approach must repeat it triply, as the context for each stored allomorph. To assign such variation to the lexicon, when phonology is perfectly equipped to handle it, seems a significant

loss of insight and, so, we restrict allomorphy to cases that cannot be derived by regular phonology.

That said, it is not always trivial to decide where the boundary between phonological productivity and allomorphic listedness lies. First, there are cases where the cumulative effect of individually attested phonological processes can lead to surface alternations that appear to be non-phonological. For instance, Kiowa *khîi* ~ *thép* 'exit ~ exit.PF' is derived by successive application of concatenation (*khîi-p*) and the independently attested processes of vowel shortening, vowel lowering, tone simplification, and dental-velar switching (Watkins 1984, Harbour 2007: 123–125). Much Caddoan morphophonology too yields this appearance (e.g., Melnar 2004). However, such problems generally relent on proper acquaintance with the language in question.

A more difficult problem in distinguishing phonology from allomorphy arises in connection to diachrony. A regular phonological process of a language may be lost by descendant languages; however, some of the alternations induced by the process may nonetheless remain. For instance, in Anglo-Saxon (to judge by careful perusal of Sweet 1896), all verbs with roots that end in short *a* and a single consonant have principle parts analogous to those of 'shake' (viz., *scacan* 'to shake', *scæcþ* 'he shakes', *scōc* 'he shook', *scōcon* 'they shook', *scacen* 'shaken'). This class is traditionally called 'the "shake" class' and its pattern of vocalic alternations is distinct from all other classes (and also from purely suffixing so-called weak verbs). Of the full list,[2] a few maintain a similar pattern in Modern English: the past tenses of *shake* and *take* are *shook* and *took*, though *ache* and *bake* no longer yield *ook* and *book*. Furthermore, many new verbs—such as *fake*, *flake*, *snake*, *trache* (i.e., *tracheotomize*)—now fit the phonological frame of the modern analogue of the 'shake' class, whether as the result of sound change, neologism, or borrowing. However, these, like many descendants of the 'shake' class itself, are simply treated as regularly affixing roots, without vowel alternation. The result is that what was once a well established phonological process of a language in which vowel alternations were abundant has become an unpredictable alternation that must be learned on a case-by-case basis.

Given the unpredictability of modern *shake* (in contrast to *bake*), one might well be tempted to regard *shake* and *shook* as allomorphs, i.e., separate underlying

[2]Viz., *acan* 'ache', *bacan* 'bake', *calan* 'be cold', *dragan* 'drag, go', *faran* 'go', *gnagan* 'gnaw', *hladan* 'load', *sacan* 'quarrel', *spanan* 'instigate', *tacan* 'take', *wacan* 'be born'; and prefixed versions of these and other roots, such as *āgalan* 'sound', *āgrafan* 'engrave', *forþfaran* 'die', *ofsacan* 'deny charge', *ongalan* 'charm'.

exponents not derived from a single underlying phonological form.[3] However, within SPE and related frameworks, forms such as *shake* and *take* are subject to diacritic marking (Chomsky and Halle 1968/1991201–203), which makes them phonologically regular, but by dint of a more abstract underlying form (i.e., one that cannot be deduced from any single surface form). To understand the thinking behind this position, consider the continuum below:

(8) a. systematic across the entire language
b. systematic but with some exceptions (a regular rule with some exceptions)
c. systematic but only within a circumscribed environment (a 'minor' rule)
d. systematic but only within an arbitrarily listed set of cases (a 'minor' rule for a diacritically marked class)
e. wholly unsystematic

The extremes of this continuum are uncontroversial: (8a) is the domain of phonology, (8e) is the domain of the lexicon and so of allomorphy.

Anglo-Saxon 'shake' falls under (8c): systematic for phonologically like verbs, but inapplicable to nouns like *naman* 'names', which undergo no analogous vowel changes in declension, compounding, or category shift (witness invariant *nam* in, respectively, *namum* 'names.DAT', *namena* 'names.GEN'; *nambōc* 'register', *namcūþelīce* 'by name'; *namian* 'mention by name', *namnian* 'call by name').

The remaining cases (8b, d) are handled in SPE by diacritic marking. For a process with general application (8b), it is exempted elements that are diacritically marked. For instance, *obese* is so marked (Chomsky and Halle 1968/1991: 174) because *obese* ~ *obesity* is excluded from the vowel laxing that affects *serene* ~ *serenity* and *obscene* ~ *obscenity*. A similar phenomenon concerns lexical exceptions to general processes, such as unstressed vowel reduction in Catalan. There, only [i], [u] and [ə] can occur in unstressed positions (9a); where affixation causes stress shift, /a, ɛ, e/ neutralize to [ə] and /o, ɔ/ to [u] (9b). However, some words violate such constraints, which can be achieved by diacritic marking exempting them from the relevant grammatical requirements and processes (9c).

(9) a. [pəstə'naɣə] 'carrot' [munutə'izmə] 'monotheism'
[kunsuliðə'sjo] 'consolidation' [uspitəli'tat] 'hospitality'

[3] We address in section 3.2 the use of readjustment rules and whether roots, as opposed to affixes, are subject to allomorphy.

b.	['pal] ~ ['pəlɛt]		‘stick’ ~ ‘stick.DIM’	
	['pɛs] ~ [pə'zat]		‘weight’ ~ ‘heavy’	
	['sek] ~ [sə'ɣɛzə]		‘blind’ ~ ‘blind.DIM’	
	['pɔzə] ~ [pu'zɛm]		‘put.3SG’ ~ ‘put.1PL’	
	[pər'ðonə] ~ [pərðun'at]		‘forgive.3SG’ ~ ‘forgiven’	
c.	['boston]	‘Boston’	[ekə'tombe]	‘hecatomb’
	['klase]	‘class’	[o'tɛl]	‘hotel’

By contrast, for a process that is quite restricted (8d), it is elements subject to the rule that are diacritically marked. For instance, the negative prefix *in* undergoes assimilation which prepositional *in*, and other words with the same ending (e.g., *win*/*thin*), do not. Hence, compare *imprecise*/*irrelevant quantities* with (*w*/*th*)*in precise*/*relevant quantities*). Here, only the negative prefix is diacritically marked as subject to assimilation. Such differential behavior (and, hence, the call for diacritic marking) can be quite thoroughgoing in languages which have strata of vocabulary that arise from massive borrowing. For instance, Chomsky and Halle (1968/1991) observe many differences between the Germanic versus Greek/Latin-derived vocabulary of Modern English; cf, Itô and Mester (1999) on Yamato versus Sino vocabulary in Japanese (where the former is subject, e.g., to constraints on phonotactic and morphophonological voicing from which the latter is exempt). In some cases, the phonological process that is blocked is, in crosslinguistic and articulatory terms, a natural one. To take the Japanese, Yamato vocabulary undergoes post-nasal voicing (*tsukero* ‘attack’ and *haru* ‘stretch’, but *fun-dzukero* ‘trample on’ and *fum-baru* ‘resist’, **fun-tsukero*, **fum-baru*), but this is blocked in the case of Sino-Japanese vocabulary (*shin-tai* ‘body’, **shindai*). As Mascaró (2007) shows, discussing Basque and Catalan dialects, either the root or the affix may induce such exemption.

For all of the cases just discussed, phonological explanations have been proposed, in which case these are not to be counted as instances of allomorphy. For instance, for the exceptions like (9c), one can assume (as already mentioned) that diacritic marking blocks application of the general process. However, a variety of other approaches are available. Mascaró (1976) proposes that the underlying representations of the exceptions differ from those of regular items in ways that remove them from the structural description that triggers application of the regular process; this approach has been pursued more recently by Inkelas, Orgun, and Zoll (1997) within Optimality Theory (OT), for Turkish. Other recent phonological proposals for such data within OT invoke co-phonologies (e.g., Orgun 1996), according to which different morphological items are subject to specific constraint

rankings (an approach that parallels use of minor rules, that is, phonological rules that apply to a reduced set of items; (Lightner 1968)). Yet another approach within OT appeals to lexically indexed constraints: exceptional items are indexed for the application of specific faithfulness constraints (e.g., Itô and Mester 1999, 1999) or of specific markedness constraints (for extreme cases where a specific phonological process seems to apply to a very small set of lexical items or specific morphemes; e.g., Pater 2000). Comparisons between these types of approaches can be found, for instance, in Inkelas and Zoll (2007) or Pater (2009). What all share is the idea that all the alternations discussed here are to be accounted for within the phonology and without resorting to allomorphy. However, for cases like (8c), especially where a single phonological process applies to a very reduced set or even to just one morpheme, Mascaró (2007) argues that allomorphy is indeed the correct approach. In particular, he argues for this type of analysis for random classes of lexical items, which do not constitute phonologically or morphosyntactically natural classes. However, he argues, even in cases where phonology does not derive the surface variation from a single underlying form, it may nonetheless have a role to play in resolving competition between the allomorphs.

We have seen that the situation in (8b), the case of a general phonological process with a few exceptions, is generally handled through some diacritic marking on the exceptions that prevent them from undergoing the process. We have also seen that the situation in (8c) is sometimes treated as phonologically conditioned allomorphy. However (8b–c) are actually part of a continuum: one can find, from a general process with few exceptions to an extremely limited process, all sorts of phenomena that could be viewed as processes with more and more exceptions. The question arises, then, as to where to how to distinguish phenomena that should be treated as phonological processes from ones that should involve allomorphy (and, also, whether numbers of exceptions should be counted in terms of types or tokens).

Of course, extensionally equivalent I-grammars could treat the same surface variation as allomorphy for one individual and as phonology for another. However, an assumption implicit in most of the foregoing discussion is that I-grammars minimize lexical storage and maximize rule-based coverage even for potentially minor regularities. If so, then the scope for divergence between I-grammars may be quite narrow. To justify this assumption, it is sufficient to test either the general hypothesis (of list minimization, process maximization) or its specific relation to the issue of minor phonological alternations. Of the wealth of psycholinguistic literature on this topic, we pick just a few examples. First, neurolinguistic studies (e.g., Stockall 2004) have argued that English morphophonological 'irregularity'

is indeed synchronically decomposable and phonological. Second, psycholinguistic production experiments show that minority conjugations in English are generalized to cover nonce verbs, a fact easily explained if there is a rule to which they can be made subject (though the interpretation of this behavior is subject to debate; see, e.g., Bybee 2007). Third, acquisition of a low frequency vowel-alternating verbs in English is apparently faster when the alternation has already been mastered for another verb, again suggesting that the verbs are not acquired as isolated exponents, but as instances of more general phonological processes (Yang 1999).

Even if we determine, however, that *shake* and *take* are not subject to allomorphy, it must be recognized that, as the pool of irregular forms becomes smaller and smaller, the likelihood that I-grammars will settle on allomorphy increases. The precise point at which this occurs is far from obvious—(8) is, after all, a continuum, not a inventory of discrete types—and the debate is likely to turn on psycholinguistic, and possibly neurolinguistic, evidence. Such evidence is likely to be of interest to more mainstream linguistic concerns than pertain just to an eventual theory of allomorphy. For instance, opaque phonological processes are much more easily handled in serialist frameworks than parallelist ones. If the psycho- and neurolinguistic research suggests that opacity triggers storage of allomorphs, then this may well favor theories in which opacity is achievable only at high cost; if the finding is the reverse, then the opposite conclusion might be upheld.

2.2. Morphology

Just like phonology, the morphological system of a language can give rise to alternations that have the appearance of allomorphy. In this subsection, we exemplify this and discuss criteria by which the two can be teased apart. The main example we will focus on is the well known alternation between *le* and *lo* in Spanish.

The Spanish clitic system includes third person clitics for dative singular, *le*, accusative, *lo*(*s*) and *la*(*s*), and reflexive, *se*. However, as Perlmutter (1971) observes, these do not cooccur as expected: a sentence like 'I gave him (*le*) it (*lo*)', which demands both a dative and an accusative clitic, in fact uses the reflexive and accusative (*se lo*).

(10) a. Le doy esto
DAT (to him) I give this
'I give this to him'

b. **Lo** ve
ACC (him) he sees
'He sees him/it'

c. **Se** ve
REFL (himself) he sees
'He sees himself'

d. **Se** **lo** doy
"REFL" (to him) ACC (her) he gives
'I give it to him'

To account for this non-reflexive use of *se*, Bonet (1991) proposes two features structures for *le* and *se* according to which reflexive *se* realizes a proper subset of dative *le*. Simplifying matters for the sake of illustration, we can use the following:

(11) [CL DAT] ⇔ *le*
[CL] ⇔ *se*

To force *se* to appear where, semantically, *le* is expected, as in (10d), Bonet proposes an impoverishment (feature deletion) rule, triggered when the dative clitic precedes another clitic. On current terms:

(12) DAT ↦ ∅ / [____] [CL ...]

The effect of (12) is to reduce the feature bundle to be realized to something big enough only for *se*. On this analysis, the *le*~*se* alternation is regarded as the effect of a morphological operation.

However, for the data just given, an allomorphic account seems equally apt. Specifically, let us suppose, roughly following Sportiche (1996), that clitics are attracted to a particular clausal position, XP. Given that clitics precede finite verbs (10) but follow imperatives (*Dáselo* 'Give him it!'), we can assume that XP intervenes between Force (the locus of imperatives) and T (the locus of finite verbs):[4]

(13) a. [$_{XP}$ *se* [*lo* [X^0]] [$_{TP}$ *da* [...]]]
b. [$_{ForceP}$ *dá* [$_{XP}$ *se* [*lo* [X^0]] [$_{TP}$ ...]]]

[4]This may be a simplification. If tenseless participles such as *dando* 'giving' occur in functionally truncated clauses, the order *dándo-se-lo* 'giving him it' suggests that the clitics are initially below TP and move up to XP only when that head is present. Alternatively, the position of the clitics in *dándoselo* might be taken to be the same as in finite clauses, with the participle moving into the C domain.

We can then posit the following vocabulary item, in part recapitulating Perlmutter's 1971 analysis:

(14) $[\text{CL DAT}] \Leftrightarrow \begin{cases} le \\ se \end{cases} \quad \underline{\quad} X^0$

On this account, the dative clitic *le* must be linearly adjacent to the head that attracts the clitics. When another clitic, such as *lo*, intervenes, the allomorph *se* emerges.[5]

Restricted to the Spanish data, it is hard to argue for the superiority of the morphological approach over the allomorphic one. However, in crosslinguistic perspective, the two can be teased apart. The contextual restriction on *le* is a purely parochial fact about a single language: it provides no expectation or insight (beyond inheritance of historical accidental) as to how other languages might work. Impoverishment, on the other hand, has been argued to be a reflex to excessive markedness (Noyer 1992, Nevins 2008) and, though different languages may tolerate different thresholds of markedness, markedness is often consistent crosslinguistically. Consequently, we are led to expect similar effects in other languages.[6]

In fact, non-transparent realization of dative plus accusative clitics is a feature of other languages too. Particularly interesting are the Italian dialects presented by Manzini and Savoia (2005). They show that in exactly the configuration where Spanish, or the dialect of Làconi, Sardinia, resort to reflexives, others, such as the dialect of Nociglia in Apulia (15), use a partitive, and yet others, such as the Sant'Elia a Pianisi dialect of Molise (16), a locative:

[5]It is possible to treat *le* as subject to adjacency condition whilst eschewing allomorphy, namely, by positing [CL DAT] ⇔ /le/ ____ X^0 and assuming that *se* is an independent vocabulary item (not an allomorph) that is the next best match when *le* cannot insert. The main-text argument relating impoverishment to markedness applies with equal force against this anallomorphic recasting.

[6]Bonet (1995) and Nevins (2007), amongst others, regard the ban on *le lo* as dissimilation in the face of an OCP configuration. This again leads one to expect crosslinguistic consistency and so is preferable to the allomorphic approach. However, it is not unproblematic. As (16) shows, the 'dissimilation' cannot be phonological, as it occurs even when the clitics do not share an onset *l* (DIDN'T BONET SHOWS THIS FOR CATALAN TOO?). And, if a response to sequences of third person clitics, then it must first be shown, contra much argument (e.g., Anagnostopoulou 2003, Adger and Harbour 2007), that the accusative has person features, and, if so, it must further be explained why it should help to resort to another third person clitic (see, e.g., Kayne 1975 for arguments that the reflexive has person features).

(15) Nociglia (Apulia) (Manzini and Savoia 2005: 105)

a. li 'dajɛ 'kwistu
DAT (to him) he gives this
'He gives this to him'

b. **la** 'viʃu
ACC (her) I see
'He gives her/it to him'

c. **nɛ** li 'dajɛ 'dɔi
PART (of them) DAT (to him) he gives two
'He gives two of them to him'

d. **nɛ** **la** 'dajɛ
PART (to him) ACC (her) he gives
'He gives her/it to him'

(16) Sant'Elia a Pianisi (Molise) (fieldnotes, speaker Addolorata del Vecchio)

a. u tɛ'lɛfɔnə
DAT (to him) I phone
'I give him a call'

b. **a** satʃtʃ
ACC (it.FEM) I know
'I know it (e.g., the truth)'

c. **nə** vɔʎ trɛ
PART (of them) I want three
'I want three of them'

d. **n'** **a** 'di:kə
PART (to him) ACC (it.FEM) I say
'I tell him it (e.g., the truth)'

A version of the phenomenon apparently also arises in Kiowa, though it is more restricted, affecting only experiencer (dative) predicates when the source of the experience is animate (as in 'He likes them'). In such cases, the dative is treated, not as a reflexive, partitive, or locative, but as an agent, even though the dative-plus-animate agreement is entirely effable and is, indeed, used under other circumstances. Owing to the complexity of the data, we present just the syncretism between experiencer and transitive predicates, for a single combination of arguments:

(17) a. Em- háígyádɔɔ
3SGD+3AN.PLO-know
'He knows them (people)'

b. Em- góp
3SGA+3AN.PLO-hit.PF
'He hit them (people)'

What all these examples have in common is that a particular combination of grammatical entities is realized in a non-transparent fashion, even though it is clear what transparent realization would look like. In each case, we could write allomorphic vocabulary items to capture the effect. However, this would be tantamount to claiming that it is coincidence that the non-transparent realization arises in more or less the same configuration. Regarding these forms as the result of morphological simplification, prior to vocabulary insertion, in response to excessive markedness (or OCP configurations), is a more insightful and principled approach. Moreover, it allows latitude for each language to resort to a different form of clitic or agreement in lieu of the dative (cf, Halle's 2005 treatment of the diversity of velar softening).[7]

Similar arguments can be made from across-the-board syncretisms within single languages. For instance, in Warlpiri (Hale 1973, see also Nevins 2008), in some argument combinations, plural agreement is used where, semantically, dual is expected. This occurs when another dual argument is present. It would be possible to write vocabulary entries that treat this variation allomorphically. However, the fact that it affects all dual agreement in the same circumstances and to the same effect strongly favors a single morphological operation, rather than numerous, independent but coincidentally harmonized allomorphies. (In a similar vein, see Embick 2000 on deponence and the across-the-board use of passive in lieu of active desinence.)

2.3. Syntax

Although perhaps less obvious, syntax too can induce alternations that resemble allomorphy, a problem that is again remedied by paying closer attention to proper syntactic analysis before positing allomorphic relations. In fact, even when allomorphy is to be posited, it can still be necessary to attend to syntactic behavior

[7]The fact that the non-transparent realization is always another clitic/agreement form argues against the allomorphy approach too, as originally noted by Bonet, contra Perlmutter.

in order not to misdescribe the context under which the allomorphs are used. We illustrate these problems with examples from Yimas and Turkish, respectively.

In Yimas verbal morphology, there are a number of cases where arguments that at other times cooccur with an overt morpheme on the verb fail to do so. Some such zeroes have a clearly syntactic basis. For instance, there is an anti-agreement effect on elements in various A-bar constructions.

(18) a. namarawt [narmaŋ **m**- *n*- tpul-c- **ak**]
person.SG$_i$ woman$_j$ REL$_i$-3SGA$_j$-hit- PERF-SG.REL$_i$
'the person who the woman hit' (Foley 1991: 416)

b. **na**- *n*- tay
3SGO$_i$-3SGA$_j$-see
'He saw him' (Foley 1991: 202)

(19) a. nmprm [ŋarŋ **m**- *mpu*- *ŋa*- ŋa- na- **m**]
leaf.SG$_i$ yesterday REL$_i$-3PLA$_j$-1SGD$_k$-give-TNS-SG.REL$_i$
'the letter they gave me yesterday' (Foley 1991: 416)

b. uraŋ **k**- *mpu*- *ŋa*- tkam-t
coconut$_i$ 3SGO$_i$-3PLA$_j$-1SGD$_k$-show-ASP
'They showed me the coconut' (Foley 1991: 213)

The (b) examples show the agreement patterns typical of a given argument structure. The (a) examples show the same argument structure with the direct object relativized. Observe that, where (b) has agreement for the object (**na**-, **k**-), the (a) examples have none. Instead, they have only a *that*-like element (**m**-) prefixed to the verb and an appropriate gender/number suffix (such discontinuous marking is typical of Yimas; for an analysis, see Harbour 2008).

In contrast to syntactically determined zeroes, the language also has allomorphically determined zeroes. For instance, third person following the negative prefix *ta* in a (di)transitive verb is realized as either *pu* or as ∅. The conditioning factor is whether the following agreement morpheme begins with *n* (Harbour 2008: 201).

(20) a. ta- **pu**-*nan*- tpul-c- rm
NEG-3$_i$- 2SGO-hit- PF-DL$_i$
'Those two didn't hit you' (Foley 1991: 256)

b. ta- **pu**-*n*- tay-c- um
NEG-3$_i$- 3SGA-see-PF-PL$_i$
'He didn't see them' (Foley 1991: 257)

(21) a. ta- **Ø**- *ŋkl-* cpul-c- um
NEG-3_i-3PCA-hit- PF-PL_i
'Those few didn't hit them' (Foley 1991: 262)

b. ta- **Ø**- *mpan-* tkam-r- ŋ
NEG-3_i-1A+2SG-show-PF-SG_i
'I didn't show you it' (Foley 1991: 260)

An interesting question arises concerning third person object agreement when the agent is relativized. In the examples below, not only does the relativized argument lack agreement (as expected), but the non-relativized object does too (there is no *j*-subscripted morpheme on the verb).

(22) a. panmal [manpa m- tu- t- Ø]
man_i $crocodile_j$ REL_i-kill-PF-SG_i
'the man who killed the crocodile' (Foley 1991: 422)

b. namat [ŋaykum m- tpul-c- um]
person.PL $woman.PL_j$ REL_i-kill- PF-SG_i
'the prople who hit the women' (Foley 1991: 416)

Given that this cannot be an anti-agreement effect ('crocodile' and 'women' are not in A-bar configurations), and given its similarity to negative-conditioned zeroes (there is a prefix, *m*/*ta*, in both cases; there is no subsequent *n*-initial agreement morpheme; zero occurs for what would be the left-most agreement morpheme of the unnegated verb), it is reasonable to consider this to be an allomorphic effect:

(23) $[3O] \Leftrightarrow \begin{cases} \emptyset & [REL] \_\_\_\_ [TR] \\ \vdots \end{cases}$

However, Phillips (1993) argues that the zero here is syntactically determined: presence of object agreement would, he argues, constitute a Relativized Minimality violation (given the morpheme order REL-3O-3A-V and assuming, with Foley, that agreement morphemes are argumental). Interestingly, Phillips has supporting evidence for a syntactic approach. There is one case where anti-agreement is suspended, namely, when the agent in the configuration 3O-3A-V is questioned ('Who hit him?'). Phillips argues that independent constraints (similar to the EPP) prevent omission of 3O here and so 3A is realized resumptively, again to prevent a Relativized Minimality violation. Considerations of space prevent us from laying out the argument in detail, however the pertinent point should be clear: even if

Table 5: *Free variation in the Spanish imperfective subjective*

	'(that) *x* would sing'	
1SG	*cantara*	*cantase*
2SG	*cantaras*	*cantases*
3SG	*cantara*	*cantase*
1PL	*cantáramos*	*cantásemos*
2PL	*cantáreis*	*cantáseis*
3PL	*cantaran*	*cantasen*

the distribution of zeroes for objects resembles an allomorphic pattern elsewhere in the language, a syntactic analysis is to be preferred as it reduces the facts to principles operative in other languages, rather than consigning their treatment to an arbitrary fact about the lexicon of a given language.

Although instances of apparent allomorphic variation may more frequently be ascribed to phonology or morphology than to syntax, such cases are not without import. For instance, variation in Turkish conjugation, cited by Carstairs (1987) as a prime example of allomorphy, is argued by Bobaljik (2000), following Good and Yu (2005), to be syntactically determined (a fact of importance in the debate over directionality; see section 3.5.1). However, in other cases, the same variation may be explained either syntactically or via choices of exponents. For instance, Adger formalizes his treatment of free variation in the Bucky dialect of English in two distinct ways: one localizes the variation in choices of features merged in the syntax (Adger 2006a), the other localizes it in choices of exponents used postsyntactically (Adger and Smith 2005).

2.4. Free variation

Having raised the phenomenon of free variation, we wish briefly to point out that this too might be regarded as a form of allomorphy, as suggested by Adger's work.

Examples of free variation are the Spanish imperfective subjunctive (table 5) and the Catalan for 'nothing':

(24) Juan quería que cantaras/cantases una canción
John want.3SG.IMPF that sing.2SG.IMPF.SJNCT a song
'John wanted you to sing a song'

(25) No vol re/res més
NEG want.3SG nothing else
'(S)he doesn't want anything else'

One can regard this as the limiting case of allomorphy with regards to informativeness of context. Generally, the contextual specification is insufficient to determine which allomorph should be used. In the case of the current examples, there does not seem to be any contextual information, so either can be used (subject, doubtless, to extragrammatical, sociolinguistic factors):

(26) [IMPF.SJNCT] $\Leftrightarrow \begin{cases} ra \\ se \end{cases}$

(27) [nothing] $\Leftrightarrow \begin{cases} re \\ res \end{cases}$

Instances of free variation appear rare, at least in comparison to contextual allomorphy. Languages frequently move from free variation to situations in which each variant has a specialized context of occurrence. Carstairs (Carstairs 1987: 31) refers to this tendency in the domain of inflection as the Inflexional Parsimony Hypothesis, and he suggests it is relevant also for derivational morphology (Carstairs 1988). However, it should be noted that Adger's analysis of Bucky English, which introduced this discussion, argues that free variation too can be an intergenerationally stable state (cf, Ciarlo 2009).

3. Theoretical issues

So far, we have only been concerned with the data that should be ascribed to allomorphy. We have yet to say what a theory of that data consists of. Consider again our initial schema, repeated below.

(28) [F] $\Leftrightarrow \begin{cases} \phi_1 & \text{Context}_1 \\ \phi_2 & \text{Context}_2 \\ \vdots & \vdots \end{cases}$

As outlined in the introduction, every one of the notational devices in (28) raises a set of contentful questions. These are far too numerous, and some of them far too complex, to be treated in the current chapter. Immediately below, we lay out some of the questions and in subsequent subsections, we examine in more detail

what strike us as some of the more important ones and giving indications about core claims and current debates, as well as providing new data where possible.

3.1. Questions

A question already touched on in the introduction concerns the content of [F]. Uncontroversially, [F] must be able to stand for features such as number, person, and case given our initial examples (English plurals, Kalkatungu genitives, Hawaiian accusatives, and Imonda pronouns). Moreover, allomorphic analyses have also been proposed for variation in other functional elements, such as determiners, conjunctions, and (category-forming) derivational affixes: Bonet, Lloret, and Mascaró (2007) argue that the singular definite article in Haitian—*la*, or appropriately nasalized variants, after consonants, *a*, or appropriately nasalized variants, after vowels, hence *kat la* 'the card' but *ka a* 'the case'—is a case of allomorphy, presenting evidence against phonologically driven *l*-deletion. Mascaró (2007) suggests an allomorphic treatment of Spanish *y* [i] 'and' and *o* 'or' which, respectively, lower or raise to avoid [ii] and [oo] (hence, *ironía y humor* 'irony and humor' but *humor e ironía*, and *oraciones o palabras* 'sentences or words', but *palabras u oraciones*; p. 247).[8] And Embick and Marantz (2008) and Embick (2009) treat nominal affixes, such as *al* of *refusal*, *ment* of *amusement*, and (*t*)*ion* of *confusion*, as exponents of a category head, *n*, conditioned by the roots to which they attach. These and similar examples suggest that [F] may range over any simple functional item.

However, different theories entertain different types of features. Within Minimalism, Adger (2008) differentiates categorial features (such as number or aspect) from features that specify the value of those categories (such as singularity or perfectivity), as well as interpretable and uninterpretable, and value and unvalued ones. If singularity and the like are bivalent (i.e., contrast [+singular] with [−singular], rather than merely [singular] with its absence), then it is logically possible for features to be realized independent of their values, or even values independent of their features. In other theories, such as LFG and HPSG, features (or feature matrices), being recursive, correspond to phrase structures within GB/Minimalism. Therefore, we must equally ask whether [F] can include whole parts of phrase structure and, if so, what the upper bound on size is (the phase

[8] A phonological derivation of the alternations is possible, but not particularly compelling: it would require two minor, and otherwise inactive, phonological processes, lowering just for *y* and raising just for *o*.

being one proposal within Minimalist work; Embick and Marantz 2008, Embick 2009[9]).

The idea that [F] can include whole parts of phrase structure is implicit in Hale and Keyser's (1993) notion of l-syntax, according to which certain roots or affixes correspond in some cases to small subtrees, and is explicit in versions of Minimalism that reject the idea that features are bundled together at terminal nodes (as in Distributed Morphology and earlier related theories Halle and Marantz 1993), but are, rather, individual projections along the clausal spine (as in the so-called cartographic approach to clause structure; see Caha 2009 for detailed morphological analysis within this approach). The notion that roots are subject to exponence is not, however, the same as claiming that they are subject to allomorphy. Indeed, this has been explicitly rejected (e.g., Halle 1973, Marantz 1997; see section **??**).

The content of ϕ is also a matter of interest. Clearly, ϕ can contain segmental information. However, semi- and suprasegmental information can also be exponents. For instance, Banksira (2000) discusses at length the floating segment exponents of Chaha; for example, the impersonal imperative involves a floating segment that docks as a labial onto the rightmost non-coronal, as in *sɨrəf*^{w} 'be scared.IMPSN.IMP', *kɨf*^{w}*c* 'open.IMPSN.IMP', *f*^{w}*ɨcə* 'untie.IMPSN.IMP' (p. 207). (See Akinlabi 1996 for treatment of many such examples.) And in Kiowa, discussed at more length below, many grammatical properties, including transitivity and number agreement, are expressed tonally, as in *héíbé* 'enter.INTR', *héíbe* 'enter.TR', and *em* 3SG.REFL, *ém* 3PL.REFL. However, other values of ϕ are more controversial. Zero exponence (see Trommer this volume) is one such case, as are diacritic features (such as conjugation or declension class) introduced by specific roots (e.g., Chomsky and Halle 1968/1991) and phonological junctures (e.g., Adger 2006b). One might even imagine that ϕ could include syntactic structure (which would then itself be subject to exponence, as a way to capture syntactic periphrasis) or that it could be a phonological process, such as reduplication or truncation (thus moving away from item-and-arrangement to item-and-process models).

There are also questions of interrelations between different exponents. Continuing with issues just raised, one can ask whether or not segmental exponents can have all varieties of semi-segmental and non-segmental allomorphs. Equally, one can ask whether there is a limit on the number (:) of allomorphs that a single [F] can have, a position suggested by Carstairs (1987) (see section 3.3).

Implicit in the brace notation ({) is the notion that allomorphs of a given [F] are

[9]It should be noted, however, that the phase is at times an extremely low upper bound, if, as the cited works argue, the category heads, *n*, *a*, *v*, merged directly with roots, are phasal.

in competition: all exponents are potential realizations and, for each occurrence of [F], the correct one must be chosen. This raises the question of how and when this competition is resolved. With regard to how, two key concepts are that the subset relation on contexts determines an ordering relation on the choice of allomorphs (the Subset, or Pāṇini's, Principle; e.g., Halle 1997) and that the bottom element of that ordering, if lacking in context, is used where no other allomorph is licensed (the Elsewhere Principle; e.g., Kiparsky 1973a).[10] For instance, given the subset relation between the contexts in (29), it follows that ϕ_2 will be used only if ϕ_1 cannot.

(29) $$[\text{F}] \Leftrightarrow \begin{cases} \phi_1 & [G] \_\_\_\_ [H] \\ \phi_2 & [G] \_\_\_\_ \end{cases}$$

However, it should be observed that these principles do not induce a well-ordering.[11] For instance, if Context_1 is ____ [PL] and Context_2 is ____ [2], then there is no subset relation and so the competition has yet to be resolved. One might imagine that general principles of markedness determine the ordering here (if, say, person features are the more 'salient' to competition resolution). However, we are not aware of any thoroughgoing arguments for this position (and, indeed, if impoverishment is any indication, person and number are not in any universal markedness relation; Noyer 1992, Adger and Harbour 2008). This suggests that the notion of competition resolution is not yet properly understood or else may be somewhat arbitrary. In this light, it is interesting to note that a good amount of recent phonological work (see section 3.4) has argued for removing the choice between some allomorphs out of the specification of context and into the general workings of the phonology.[12]

A further question related to timing of competition resolution concerns whether exponence is determined simultaneously for all heads within a given spell-out domain or whether exponence sites are targeted sequentially. Answers to this question, and the ways in which such answers are implemented, entail differences in the information that is available to other targets of exponence. For instance, if

[10] See Caha (2007) on use of the Superset, rather than Subset, Principle, and hence the idea that the bottom element of the ranking has, in fact, the largest, rather than the smallest, context of all available allomorphs.

[11] Adger (2006a) explores the idea that variability arises precisely where there is no intrinsic well-ordering of exponents.

[12] As section 3.4 makes clear, assigning allomorph selection to the phonology is not the same as positing a single exponent and using the phonology to derive its surface variants, which we do not regard as allomorphy at all (section 2.1).

exponence proceeds sequentially, then, on a top-down sequence, the highest target of exponence can only be non-phonologically conditioned, whereas a root-out sequence predicts this for the lowest target.

In fact, answers to this question, like many of those already raised, are not independent of positions taken with regard to other issues. A simple example concerns interpretation of the exponence itself (⇔): different quantities and varieties of information are available depending on whether exponence is an exchange of morphosyntactic for phonological information (e.g., Trommer 1999, Bobaljik 2000) or an augmentation of the former by the latter (e.g., Anderson 1992). Moreover, both of the differences just mentioned and that of the preceding paragraph impact on the information available to context.

In fact, context raises a wide variety of questions. First, all the questions about variety of information and feature types that arise for [F] arise equally for context. Additionally, though, there are questions that arise only in connection to context. One, already implied above, is that of directionality, namely, which information (morphosyntactic and/or phonological) is available above and below a particular [F]. Another is that of distance, that is, whether a conditioning context can see only adjacent information and, if so, whether linear or structural adjacency is the relevant notion; or, indeed, whether different values of [F] (roots, features, phrases) might not have access to different types of context.

As is evident, there is an abundance of questions that a theoretical account of allomorphy might, or must, address, far more than can be addressed here. Below, therefore, we have selected some that strike us as important in one of several ways: either because they have been subject to much discussion, or because they ought to be subject to more, or because we believe that we have data that is particularly relevant and might move current debate forward.

3.2. Roots and allomorphy

Embick (2009), following a variety of earlier work, suggests a division between roots and (some) grammatical affixes: whereas the latter are subject to allomorphy, the former only ever have a single underlying form. This is equivalent, in our terms, to claiming that roots cannot occur as F in vocabulary entries such as (2) and only ever occur in (1). However, roots are clearly not invariant phonologically (witness *keep~kep-t* or *go~wen-t*). A number of authors have suggested means for accounting for such variation, such as minor phonological processes, distinctions between lexical and functional vocabulary, or between allomorphy and selection.

In this section, we review some data germane to these approaches and question whether they are indeed sufficiently general to motivate the view that root variation is fundamentally different from allomorphy. For a recent study of the topic, see Siddiqi (2009).[13]

The simplest form of variation that roots exhibit is that of minor phonological adjustment. Examples include /i/~[ɛ] (*creep~crep-t*, *leap~leap-t*, as opposed to *seep~seep-ed*), /ɛ/~[o] (*sell~sol-d*, *tell~tol-d*, as opposed to *well~well-ed*), and /ɪ/~[æ] (*ring~rang*, *sing~sang*, as opposed to *ding~ding-ed*). These cases require only a change to one or two vocalic features and so would constitute phonologically plausible processes. Chomsky and Halle (1968/1991) termed these 'readjustment rules'.

Such rules lead one to ask how much readjustment a readjustment rule can undertake. For instance, though *sing~sang* may represent a single featural difference, *bring~brough-t* and *think~though-t* clearly do not. Within Chomsky and Halle's system, which has the underlying segments [γ x], it might nonetheless be possible to derive these from /brɪnγ/ and /θɪnx/, via appropriate readjustments. However, it is implausible that such a derivation could exist for *go~wen-t*, *am~was*, *is~was*.

However, Marantz (1993), inter alia, suggests that such massive variation is restricted to roots that form part of the language's functional vocabulary, such as auxiliaries and light verbs. Though this is certainly the case of English *go* and *be*, it is not clear that all such variation can be so explained. Consider, for instance, number-conditioned allomorphy in Kiowa: four (individual-level) roots display a singular~dual/plural split and seven (stage-level) roots display a singular/dual~plural split. Some examples are given in table 6 and, with the exception of 'small', no well constrained readjustment rule suggests itself. However, it is also unclear that these roots can reasonably be termed 'functional'. Some belong to semantic categories that are not infrequently suppletive for number (such as predicates of bodily position and motion; Mithun 1988: 232), but it is doubtful that this alone is sufficient to classify these predicates as functional. Certainly, none is an auxiliary or light verb nor are they particularly well endowed with idiomatic meanings or senses. (This argument applies most forcefully in languages where such predicates are relatively numerous; see in particular Hale, LaVerne, and Pranka 1990 on Hopi and Tohono O'odham, f.k.a. Papago.)

However, Mithun (1988), concentrating precisely on North American languages, suggests that number-sensitive variation represents a real semantic dif-

[13] *(Add to main text: embick and noyer, oup: p 296, embick and halle.)*

Table 6: *Some allomorphic roots in Kiowa*

	SG	DL/PL
big	*ét*	*bîn*
small	*syɔ́n*	*syán*
tall	*kyóy*	*kíínií*
short	*xéí*	*xáádóú*

	SG/DL	PL
be sitting	*áágya*	*k!úl*
fall	*ól*	*p!él*
sever	*t!ál*	*tháá*
wander	*thóú*	*zéí*

Table 7: *One regular and two allomorphic nouns in Russian*

Case	'student'	'students'	'child'	'children'	'man'	'men'
NOM	*student*	*studenty*	*rebënok*	*deti*	*čelovek*	*ljudi*
ACC/GEN	*studenta*	*studentov*	*rebënka*	*detej*	*čeloveka*	*ljudej*
DAT	*studentu*	*studentam*	*rebënku*	*detjam*	*čeloveku*	*ljudjam*
INSTR	*studentom*	*studentami*	*rebënkom*	*det'mi*	*čelovekom*	*ljud'mi*
PREP	*studente*	*studentax*	*rebënke*	*detjax*	*čeloveke*	*ljudjax*

NOTE: Vocalic alternations in suffixes (e.g., NOM.PL *-i*~*-y*, GEN.PL *-ov*~*-ej*) and roots (e.g., *rebënok*~*rebënk-*) are part of standard Russian phonology.

ference between the verbs, one that we might translate into current terminology as selection. On this view, the feature [±singular] does not condition allomorphy of *ét* versus *bîn* 'big', but *ét* (or *bîn*) is the realization of a version of the root $\sqrt{\text{BIG}}$ that selects for a [+singular] (or [−singular]) complement.

If we accept that all these defenses of root variability are legitimate, then, in order to convince ourselves whether roots display allomorphy, we must discover whether there are roots that are not plausibly functional, that undergo alternations that are not mere phonology, and that cannot be said to select a complement with the property to which they are allomorphically sensitive. Although this may seem a tall order, such cases do apparently exist.

The simplest way to avoid the issue of complement selection is to leave verbs and turn to nouns. Consider such variation as the Russian for 'child(ren)' (table 7). The variation between the roots *rebënok* and *det* cannot be attributed to selection of a complement, as there simply is no complement, and it is clearly not the result of minor readjustment. Furthermore, *child* does not plausibly seem to be a

functional, or 'light' noun. That is, consider, in contrast, the behavior of Russian 'man'. As table 7 shows, 'man' is just as variable as 'child'. However, in a number of languages, 'man' assumes a partly grammaticalized status. For instance, in Scottish Gaelic, where there are two words for 'children', one count (*pàistean*), one mass (*cloinne*), 'person' is used as a classifier when numerals cooccur with the mass noun:

(30) Scottish Gaelic (David Adger, p.c.)

a. còig pàistean deug
five child.PL teen
'fifteen children'

b. còig daoine cloinne deug
five person.PL child.GEN.SG teen
'fifteen children'

More subtly, in German, 'man' may be used in the singular after a numeral. In such cases, it is functionally reduced, not only in having no number marking, but also in resisting adjectival modification; and it is semantically bleached, referring not only to men, but also women and children (its usual plural, which may be adjectivally modified, refers only to men).

(31) German (Domenica del Vecchio, p.c.)

a. Es sind fünfzehn (*unglückliche(r)) Mann ums leben gekommen
EXPL AUX fifteen unfortunate.SG/PL man perished
'Fifteen (*unfortunate) people (men, women, or children) perished'

b. Es sind fünfzehn (unglückliche) Männer ums leben gekommen
EXPL AUX fifteen unfortunate.PL man.PL perished
'Fifteen (unfortunate) men (not women or children) perished'

Corbett (2007: 23) shows that Russian 'man' displays a behavior somewhat similar to German (however, given the complexities of Russian numeral phrases, we do not discuss the data here). It is, therefore, plausible that 'man' is somewhat grammaticalized as, hence, part of the functional vocabulary of some languages. Consequently, its allomorphic behavior is possibly explicable in terms of grammatical allomorphy. For 'child', by contrast, we are unaware of any data that could make such an analysis possible. (See Corbett 2007 for more such examples, including the extremely non-functional, but nonetheless allomorphic, pair *biči~božd*o 'sack corner(s)', and for further discussion of morphologically regu-

Table 8: *One regular and two allomorphic verbs in Scottish Gaelic*

	'played'	'will play'	'saw'	'will see'	'did'	'will do'
DEP	*do chluich*	*cluich*	*faca*	*faic*	*d'rinn*	*dèan*
	[də xlʊɪɕ]	[klʊɪɕ]	[fa^{h}ca]	[fʌ^{ɕ}k^{j}]	[drʌjñ]	[d͡ʒiːæn̪]
IND	*chluich*	*cluichidh*	*chunnaic*	*chì*	*rinn*	*nì*
	[xlʊɪɕ]	[klʊɪɕiː]	[xʊn̪ə^{ɕ}k^{j}]	[ɕiː]	[rʌjñ]	[n̪iː]

lar, semantically irregular singular/plural of Russian 'child(ren)'.)

Even within the domain of verbs, there are examples that plausibly meet all criteria of true allomorphy. In Scottish Gaelic (again), verbs are inflected for past and future and according to whether they are 'independent' (e.g., matrix 'I will/did verb') or 'dependent' (e.g., subordinate 'I said I will/did verb). The nature of regular inflection varies somewhat depending on phonological properties of the verb root. However, the alternations of 'see' and 'do' fall well beyond this range of variation: for instance, given dependent future *faic*, the dependent past should be *dh'fhaic* [ɣʌ^{ɕ}k^{j}], not *faca*. (Note, nonetheless, that forms are not wholly irregular: the independent future forms, for instance, end in *i*, as expected.) More importantly, because the factors conditioning the allomorphy are high in the clause (in the C and T domains), there is no question of this resulting from selectional properties that the verbs exert on their complements. (Similar arguments can be made with respect to the Modern Greek present~past alternation.)

Given the examples of Russian nouns and of Scottish Gaelic verbs, it seems safe to assert that the alternations of nominal and verbal roots cannot be attributed to minor phonological readjustments, to selection specifications of the root, nor to the roots' status as functional items. We therefore conclude, contra a variety of work, particularly within Distributed Morphology, that root allomorphy is a real phenomenon.

3.3. Number of allomorphs

To our knowledge, no proposals have been made that directly claim limits on the number of allomorphs that may cooccur in a lexical entry. And languages with high numbers of noun classes—e.g., the ten or so phonologically conditioned allomorphs of the 'inverse' number suffix in Kiowa (Harbour 2007: 55) or the thirteen or so morphologically conditioned allomorphs of both singular and plural

in Arapesh (Fortune 1942: 48)—might well lead one to question whether there are empirical grounds for any such claims. However, some proposals by Carstairs-McCarthy do touch on this issue indirectly. As these issues have been discussed more thoroughly elsewhere, we touch on these points on briefly, but with some new data and, we hope, insight.

Carstairs 1987 and Carstairs-McCarthy 1994 propose, respectively, the Paradigm Economy Principle and the No Blur Principle. The point of departure for both principles is the observation that languages have the resources for far more noun classes that they actually attest. For instance, for Latin nouns (Carstairs 1987: 66f), there are various nominative singular suffixes (*domin-us*, *duc-s* (written *dux*), *bell-um*) and various nominative plural suffixes (*domin-ī*, *duc-ēs*, *bell-a*). If nominative singular formation and nominative plural formation are independent variables, then {*-s*, *-um*, *-us*} and {*-a*, *-ēs*, *-ī*} produce 3 × 3 = 9 logically possible noun classes. Each set of case-number endings increases the number of logically possible classes still further: ablative singular {*-e*, *-ō*} increases it to 18; ablative plural {*-bus*, *-īs*}, to 36; genitive singular {*-ī*, *-is*}, to 72; ... Quite familiar languages have the resources for hundreds of noun (or verb) classes. The motivating observation for the Paradigm Economy and No Blur Principles is that languages have nowhere near this number.

This observation relates to the number of possible allomorphs as follows. Carstairs argues that the number of noun/verb classes in a language can be limited to about the right number if we can rule out paradigms such as the left-hand part of table 9. According to Paradigm Economy (simplifying slightly), the number of classes cannot exceed the number of allomorphs in the paradigm row with the greatest number of distinctions. In (31), each row makes only two distinctions, so there should only be two classes. Now, if correct, this principle is extremely difficult to render in our model. We have assumed that each exponence relation is an autonomous entity. Here, however, one can only know that the exponence relation below is ill-formed in virtue of the fact that there is no other number (dual, plural, paucal, ...) in the language with three distinct allomorphs.

(32) $$[\mathrm{F}] \Leftrightarrow \begin{cases} a & \text{Class 1} \\ b & \text{Class 2/3} \end{cases} \overline{\quad}\ \underline{\quad}$$

To incorporate such restrictions would therefore require some significant globality- or paradigm-based reconceptualization. It is therefore reassuring to observe that Paradigm Economy is false. The Modern Hebrew nouns of table 9 (all of them feminine) display precisely the distribution of affixes that Paradigm Economy

Table 9: *Modern Hebrew: A Paradigm-Economy incompatible paradigm*

	Class 1	Class 2	Class 3
SG	*a*	***b***	***b***
PL	***c***	***c***	*d*

‘belly’	‘egg’	‘blessing’
beten-∅	*beyc-**ah***	*brax-**ah***
*btan-**im***	*beyc-**im***	*brax-ot*

Table 10: *Icelandic: A No-Blur incompatible paradigm*

Class 1	Class 2	Class 3	Class 4
a	***a***	***b***	***b***

	‘horse’	‘judge’	‘smith’	‘son’
NOM PL	*hest-**ar***	*dómar-**ar***	*smið-**ir***	*syn-**ir***
GEN SG	*hest-s*	*dómar-a*	*smið-s*	*son-ar*

Einarsson 1945: 32–48

rules out.

Real though this counterexample is, one should not attach too much significance to the counterexemplification of Paradigm Economy, for two reasons.

First, Carstairs-McCarthy has moved from Paradigm Economy to No Blur, a principle that rules out paradigms in which any row has more than one affix that occurs in more than one cell. This rules out the following type of exponence relation and the paradigm row in table 10.

$$(33) \qquad [\mathrm{F}] \Leftrightarrow \begin{cases} a \begin{cases} \mathrm{Context}_1 \\ \mathrm{Context}_2 \end{cases} \\ b \begin{cases} \mathrm{Context}_3 \\ \mathrm{Context}_4 \end{cases} \end{cases}$$

This revised principle is not relevant to whether there is an upper bound on the number of allomorphs, as it concerns, not numbers of allomorphs, but whether multiple items may insert into multiple contexts. However, as this too falls well within the purview of this chapter, it is worth observing, following Müller (2006:

172–173), that No Blur too is false: it is counterexemplified by the nominative plural of Icelandic masculine nouns, where neither *-ar* nor *-ir* is confined to a single cell (table 10; the second row is included to show that the four nouns are indeed from different classes). (See Müller for discussion of Noyer's 2005 related proposal concerning interclass syncretism.)

The second reason why one should not attach too much importance to counterexemplification of Paradigm Economy and No Blur is that motivating problem is, in fact, not well-defined. Halle and Marantz (2008) show that No Blur makes a number of problematic assumptions concerning both assignation of roots to single inflectional classes and in the differential treatment of horizontal versus vertical syncretism—problems that apply equally to Paradigm Economy. Furthermore, neither principle actually solves the problem that was their initial motivation: after proposing Paradigm Economy as a solution to the massive mismatch between the number of possible *versus* actual inflectional classes, Carstairs (1987) avoids a number of potential counterexamples by claiming that the principle only applies in cases where semantic factors (such as animacy), or syntactic factors (such as argument structure), or morphological factors (such as gender), or phonological factors (such as phonotactics) do not. However, in reality, it is these factors that bear the explanatory burden. For instance, they, and not Paradigm Economy, reduce the number of potential Hungarian verb classes from 276,480 (Carstairs 1987: 43) to just 2.

Given that there is no clear problem to motivate Paradigm Economy (or No Blur), and given also the existence of counterexamples such as Modern Hebrew (and Icelandic), we do not believe that are sound grammatical grounds imposing upper bounds on numbers of allomorphs. We leave open the role that learnability and usability may play in keeping complexity in check.

3.4. Competition resolution

The resolution of competition between allomorphs can, in some cases, be resolved by general considerations (e.g., by a subset-induced ranking). However, as mentioned above, not all contexts are in a subset relation and so prompt the question as to whether there are general grounds that determine choice of allomorph. MORE INTRO!

More controversial issues arise when the context of allomorphy involves not lists of specific roots or morphosyntactic information but also (or only) phonological information. The core of the debate stems from the fact that, in some cases,

the distribution of the allomorphs is phonologically predictable (phonologically natural), while, in other cases, the distribution is totally idiosyncratic. An example of completely predictable distribution is provided by the Korean accusative suffix, which has the allomorphs *lul* and *ul* (data from Lapointe 1999). A couple of examples appear in (34).

(34) *cho-lul* (**cho-ul*) 'Cho-ACC'
kim-ul (**kim-lul*) 'Kim-ACC'

In Distributed Morphology, it is claimed that the choice of these two allomorphs must be determined at the point of Vocabulary insertion (see, for instance, Embick 2009). The relevant Vocabulary Items would be as shown in (35).

(35) $[\text{ACC}] \Leftrightarrow \begin{cases} lul & \text{V}\_\_\_\_ \\ ul & \text{C}\_\_\_\_ \end{cases}$

Reference to segmental information, and more crucially prosodic information (needed for cases like the Tzeltal example below), is possible if one assumes that phonological computation takes place inside out.

Within Optimality Theory, this type of approach is often rejected because of its 'putative loss of generalization' (to use Embick's 2009 phrase). That is, the context is stipulated: (35) just states that one allomorph is inserted after a vowel and the other one, after a consonant. The Vocabulary Items do not express the fact that the choice of allomorph gives rise to a more unmarked syllable structure (namely, CV); that is, it is optimizing (in Paster's 2006 sense). If the choice of allomorph is left to the phonology, phonological constraints that are needed independently account for the distribution of the allomorphs. This version of Optimality Theory accepts then the possibility of having multiple inputs. The tableau in (36), adapted from Lapointe 1999, illustrates the choice of allomorph for the Korean accusative suffix; other examples can be found in the literature. In the approach sketched in (36), none of the candidates shown violates any faithfulness constraint because the two allomorphs are present in the input; the choice is then left to markedness constraints, in this particular example the syllabic well-formedness constraints ONSET and NOCODA.[14]

[14]Footnote on compatibility with DM, incompatibility with constraints on outward phonological sensitivity.

(36)

input: *kim*-{*ul*, *lul*}	ONSET	NOCODA
a. ☞ *ki.mul*		*
b. *kim.lul*		**!

input: *cho*-{*ul*, *lul*}	ONSET	NOCODA
a. ☞ *cho.ul*	*!	*
b. *cho.lul*		*

At the other extreme, it is possible to find examples where the context for allomorph selection is phonological but does not give rise to a more unmarked configuration. A much cited example comes from Tzeltal. In this language, the perfective suffix has two allomorphs: *-oh* after monosyllabic roots, and *-ɛh* after polysyllabic one (examples from Walsh Dickey 1999):

(37) a. *-oh* after monosyllabic roots
s-mah-oh 'he has hit something'
s-pas-oh 'he has made something'
s-jom-oh 'he has gathered it'

b. *-ɛh* after polysyllabic roots
s-majlij-ɛh 'he has waited for something'
s-tikun-ɛh 'he has sent something'
s-maklij-ɛh 'he has listened to something'

Contrary to the Korean case, it seems clear that the relation between the allomorph *-oh* (not *-ɛh*) and monosyllabic stems in Tzeltal is idiosyncratic; it is this allomorph, and not the other one, that selects a monosyllabic stem, and the choice cannot be attributed to anything in the grammar or to any specific property of the allomorphs. Therefore the distribution of the allomorphs must be explicitly stated in either Distributed Morphology or a version of Optimality Theory that posits multiple inputs.

The fact that not all instances of phonologically conditioned allomorphy can be accounted for like the Korean example in (36)—together with some other observations to be mentioned below—has led some linguists to reject a phonology-based account to allomorphy for all cases, not just the Tzeltal type cases. As we have seen, for Embick (2009), and more generally within Distributed Morphology, all competition has to be resolved at the point of Vocabulary insertion, as a matter of principle. Paster (2006, in press) advocates a subcategorization model, where all selection is sensitive only to underlying representations. In Korean, for instance, the allomorph *lul* would subcategorize for a preceding vowel, and *ul*

would subcategorize for a preceding consonant. It is unclear, though, how her model would work for examples like the Tzeltal perfective suffix, because usually prosodic structure is not assumed to be present in underlying representations. However, there are many cases of phonologically conditioned allomorphy where the context contains a prosodic requirement. Bye (2008) also argues for generalized phonological subcategorization in a more elaborated model within Optimality Theory. In this model, each allomorph is tried out separately; the output of H-EVAL is submitted to morpholexical control (MCONTROL), which filters out the candidate that does not satisfy the subcategorization requirements of the allomorph chosen. Applied to Korean, for instance, the optimal candidate *ki.mul* (which had competed against candidates like *kim.ul* or *kim.ʔul*) satisfies MCONTROL, because *ul* has a preceding consonant in its subcategorization frame; the optimal candidate *kim.lul*, on the other hand, is filtered out, because the subcategorization requirement for *lul* is a preceding vowel. One advantage of this account over Paster's is that reference to prosodic structure is possible without having to assume that it is present underlyingly.

Many of the cases that have been used to argue against approaches to phonologically conditioned allomorphy in which the right choice of allomorph is determined in the phonology (like the multiple input based approach sketched above) can actually be accounted for within the phonology. In one type of case, which, according to Paster (2006, 2009) or Bye (2008), make a subcategorization-based model almost inevitable, one or more of the allomorphs force a phonologically natural configuration while another one is the default allomorph, the preferred one. This situation can be illustrated with the Spanish conjunctions. As we saw above, the conjunction *y* [i] 'and'has the allomorph *e* which is used only when the next word begins with [i]; the conjunction *o* 'or' has the allomorph *u*, which is used only when the next word begins with [o]. See page 21 for examples. In subcategorization models, the approach to these cases would be essentially the same: one allomorph subcategorizes for a specific context while the other subcategorizes for the complementary set.

As for the Korean accusative (34)–(36), however, the disadvantage of such approaches is that they cannot capture a phonologically natural fact, namely that for both conjunctions the preferred allomorph, [i] and [o], is avoided only when it would be homophonous with the following segment. Within Optimality Theory, one of the proposals that has been made to capture this type of cases, argued for by Mascaró (2007) and Bonet, Lloret, and Mascaró (2007), is to consider that, in some instances of multiple inputs, there is a precedence relation, $x > y$, between allomorphs. This is the only extra aspect of the analysis that needs lexical encoding.

In this particular case, the two allomorphs of each conjunction are inserted, but with a precedence relation: [i]>[e]; [o]>[u]. Choosing the dispreferred allomorph is penalized by the universal faithfulness constraint PRIORITY. The tableaux below illustrate how the combination of this faithfulness constraint and the markedness constraint, OCP, account for the distribution of the allomorphs.[15]

(38)

input: {[*o*]>[*u*]} *otro*	OCP	PRIORITY
a. *o otro*	*!	
b. ☞ *u otro*		*

(39)

input: {[*o*]>[*u*]} *alguno*	OCP	PRIORITY
a. ☞ *o alguno*		
b. *u alguno*		*!

In (38), choosing the allomorph [o] violates of OCP; to avoid this, the dispreferred allomorph is selected. In (39), OCP violation is not an issue because the item following the conjunction does not start with [o]; in such cases, the preferred allomorph, the one that does not violate PRIORITY, is chosen.[16]

An account with ordered allomorphs is also possible for the definite article in Haitian Creole, a much cited case of apparently bizarre allomorph selection (a 'perverse' system, as Paster in press puts it). Again ignoring nasalization, the key data is given below, with information about syllable structure:

(40) a. [the.SG] $\Leftrightarrow$ $\begin{cases} a & \text{V}\_\_\_\_ \\ la & \text{C}\_\_\_\_ \end{cases}$

b. [kat.la] (*[ka.ta]) 'the book'
[ka.a] (*[ka.la]) 'the father'

This system is anti-optimizing on the surface, because instead of selecting an allomorph that would give rise to an unmarked CV syllable structure (*[li.va], *[pa.pa.a]), it selects an allomorph that gives rise to more complex syllables (CVC.CV) or to a hiatus (CV.V). However, if the allomorphs are assumed to be ordered, {[a]>[la]}, then an appropriate set of ranked constants (including PRIORITY and a constraint ensuring alignment of morphological with prosodic edges)

[15]For a more detailed analysis, which considers possibilities like diphthongisation or coalescence, see Bonet and Mascaró (2006).

[16]Again, positing ordered allomorphs is not incompatible with Distributed Morphology. The Vocabulary Item for Spanish 'or', for instance, would be [or] $\Leftrightarrow$ {[o]>[u]} and the ordered pair {[o]>[u]} be the input to the phonology.

can account for the distribution of the allomorphs (see Bonet, Lloret, and Mascaró 2007 for a fully fledged analysis).

Wolf and McCarthy (2007) also assume a priority relation between allomorphs but reject a parallel evaluation approach and the constraint PRIORITY. Instead, they argue that the preferred allomorph is tried first and that the candidate set includes the null output, ⊙, which violates a single constraint, MPARSE (see Prince and Smolensky 2004). If the null output is the optimal candidate the next allomorph is tried. In the case of the Spanish conjunctions, for instance, for 'or' plus *otro*, the allomorph *o* is tried first. Since the candidate *o otro* violates OCP (ranked above MPARSE), the null output ⊙ is chosen. Given that the Lexicon contains another allomorph, *u*, the other combination, *u otro*, can be tried out and, as this sequence does not violate OCP, it beats the null output. In favor of their proposal, Wolf and McCarthy (2007) mention cases like the comparative suffix *-er* in English, which has a prosodic requirement: with long adjectives, like *intelligent*, the null output beats the candidate with the suffix (**intelligenter*); no other option is available, given the lack of allomorphy for this suffix.[17]

An important question that arises with respect to phonologically conditioned allomorphy is whether the phonological conditioning is based on the phonological representation of the context or on its surface form. When it is not based on surface form, the conditioning becomes opaque. In many instances of phonologically conditioned allomorphy, there are no crucial differences between the two representations and therefore this question does not arise. Few cases have been discussed in the literature where the surface form, not the underlying form of the context, is relevant. One example is provided by the personal article in Central Catalan:[18]

(41) [the.MASC.SG] $\Leftrightarrow \begin{cases} l' & \text{V}\_\_\_\_ \\ en & \text{C}\_\_\_\_ \end{cases}$

In Catalan, initial *s*C clusters are not tolerated and schwa is inserted before the cluster: [ə]*scàner* 'scanner', [ə]*snifar* 'to sniff', [ə]*spia* 'spy'. Epenthesis also

[17] Wolf and McCarthy (2007) assume that periphrasis like *more intelligent* is obtained through a different input syntactic structure, i.e., periphrasis and *-er* are not "allomorphs".

[18] In relation to the earlier discussion of diachrony, this example is an interesting one. Instead of allomorphy arising as the residue of formerly active phonology (which once derived both forms from a single underlying specification), the two definite article allomorphs here have their origins in distinct words which have gradually semantically and morphosyntactically coalesced (distinguished now only by their phonological contexts of occurrence): *en* derives from Latin *domine* 'master', *l'* from the Latin deictic *ille*.

Table 11: *Phonologically opaque allomorphy in Polish*

	NOM.SG	LOC.SG
'letter'	lis[t]	liś[ć]-e
'leaf'	liś[ć]	liś[ć]-u

affects *s*C-initial proper names, but the allomorph chosen for the personal article is *l'* [l], not *en* [ən], as illustrated in (42).

(42) a. *l'*[ə]*Smolensky*
b. **en* ([ə])*Smolensky*

In Distributed Morphology, this can be accounted for easily if one assumes that Vocabulary insertion as well as the phonology apply cyclically. In order to obtain *l'*[ə]*Smolensky*, the proper name should be introduced first (or should be there from the start, as assumed by Embick 2009), and, crucially, epenthesis should take place before the personal article is inserted. In parallel OT multiple input approaches, the solution is also straightforward because the vocalic context is surface true.

Other cases have been claimed in the literature to be sensitive to the underlying representation of the context, not its surface representation, because a phonological process has rendered the context opaque. In these cases the conditioning is not surface true, and therefore poses problems to parallel models of OT. Several instances of opaque allomorphy in different languages have been reported. Much cited examples are provided by Polish (Łubowicz 2007), Spanish (Lang 1990, Aranovich and Orgun 2006), and Turkish (Aranovich, Inkelas, and Orgun 2005; see also Paster in press). Let us illustrate the phenomenon with a Polish example from Łubowicz.

In Polish the locative singular suffix has the allomorphs [e] and [u]. Even though [u] appears after prepalatal consonants, and [e] after nonprepalatals, the distinction is rendered opaque because of a process of palatalization; on the surface the segments that motivated the choice are identical. Table 11 illustrates this with two examples that constitute a near minimal pair. Obviously, this case cannot be accounted for in the Standard parallel model of Optimality theory. Łubowicz (2007), however, argues for a parallel model within an approach that includes constraints that penalize pairs of inputs that map onto the same output.

Wolf (2008) proposes a revision of Optimality Theory, Optimal Interleaving, designed to account for opacity in allomorph selection (as well as other morphological and phonological phenomena, like non-derived environment blocking). He assumes that all Vocabulary Insertion and all linearization takes place in the phonology; in the syntax all morphemes are abstract. In the phonology, operations like morph insertion, linearization and phonological modifications are interspersed. He further assumes the serial model of Optimality Theory called Candidate Chains (McCarthy 2007): each candidate consists of a sequence of forms that involve a minimal change with respect to the previous one, a change that must be harmonically improving (it has to reduce markedness, given the constraint ranking of the language).

To illustrate, we reproduce from Wolf (2008) three of the candidate chains for the Finnish word [vaativat] 'demand.3PL'. As can be seen in (43a), for instance, the first segment of the chain consists of the abstract morphemes; the second segment contains the morph corresponding to the root; the third segment incorporates the assibilation process that affects /t/ before /i/ (Kiparsky 1973b), and the last one contains the spelled-out suffix. The difference with respect to (43b) lies in the order between affix spell-out and assibilation. Which one of the candidates is selected will be determined by the constraint ranking needed for Finnish. Opacity can be accounted for fairly easily in this model because a conditioning underlying representation is accessible to morpheme realization.[19]

(43) Three candidate chains for Finnish 'demand-3PL' /vaati-vat/ → [vaativat]

a. ⟨ROOT-AF, *vaati*-AF, *vaasi*-AF, *vaasi-vat*⟩
b. ⟨ROOT-AF, *vaati*-AF, *vaati-vat*, *vaasi-vat*⟩
c. ⟨ROOT-AF, *vaati*-AF, *vaati-vat*⟩

For cases of allomorph selection where only the phonology determines which one of the allomorphs is chosen, he assumes, as is done in other work within Optimality Theory, that markedness constraints are the ones forcing the selection of each allomorph. For cases where one of the allomorphs is the preferred one, the other one being selected only when there is some phonological conflict (cases of arbitrary preference), he assumes, and must assume, that the two allomorphs do not express identical morphosyntactic information. For the ergative suffix in Dyirbal, for instance, he claims that one of the allomorphs, *ŋku*, expresses two

[19]For most of his thesis, Wolf assumes that morpheme realization proceeds from the root outwards, but he entertains the idea that it could proceed outwards or inwards, based on some evidence from Italian and Southern Zaria Fulfulde. See section 3.5.1.

Table 12: *Varieties of allomorphic sensitivities*

Direction	Feature type	Locality	Example
inwards	phonological	adjacent	Georgian (44)
inwards	phonological	long distance	*none?*(see p. 41)
inwards	morphosyntactic	adjacent	Latin (p. 46)
inwards	morphosyntactic	long distance	Kiowa? (50)
outwards	phonological	adjacent	*none?*(see note 21)
outwards	phonological	long distance	*none?*(see note 21)
outwards	morphosyntactic	adjacent	Georgian (45)
outwards	morphosyntactic	long distance	Itelmen? (47)

different sets of features, [−free], and other features related to ergative ([−oblique +structural +superior]), while the other allomorph, *ku*, does not express [−free]. Although this account may be feasible for Dyirbal, it is very difficult to imagine what morphosyntactic features may distinguish allomorphs in other cases of arbitrary preference, like the Spanish conjunctions *y*/*e* 'and' and *o*/*u* 'or'.

3.5. Context

The discussion so far has shown that allomorphy can be both morphosyntactically and phonologically conditioned. Moreover, the sensitivities have been both inward (i.e., a higher affix dependent on more deeply embedded information; table 1) and outwards (i.e., a more deeply embedded affix dependent on structurally higher information; table 3). And, in all cases, nothing has intervened between the allomorph and the information on which its choice depends. It is natural to ask which of these conditions are necessary for allomorphic dependencies. That is, one can imagine a set of independent variables which divide up the space of logically possible allomorphic dependencies: inwards versus outwards sensitivity; local versus long distance sensitivity; phonological versus morphosyntactic sensitivity. These possibilities are laid out in table 12 with examples where we believe these can be provided.

As we discuss in passing below (section 3.5.3), one might further refine these questions by asking whether all values for [F] permit the same options (for instance, one can imagine that roots are subject to more local conditioning than affixes). Similarly, one might ask whether the notions of locality are the same for

phonological and morphosyntactic conditioning (for instance, the former might require linear adjacency, the latter structural adjacency).

Theories restricting the range of possibilities have been proposed by, inter alia, Carstairs (1987) and Bobaljik (2000) (see also Carstairs-McCarthy 2001, Adger, Béjar, and Harbour 2003, Carstairs-McCarthy 2003). Below, we explore some of relevant concerns, clarify various methodological points, and present some novel data.

3.5.1. Feature types and directionality

The main focus for our discussion, both here and below, will be Bobaljik's claim that the varieties of attested sensitivities can be derived from the hypotheses that exponence is not an all-at-once operation, targeting all exponence sites within a domain simultaneously, but proceeds from one target to the next starting at the root and cycling outwards, and that exponence is replacive, that is, if [F] $\Leftrightarrow \phi$, then, once ϕ is present, [F] no longer is (cf, Trommer 1999). That is, if we have three targets of exponence, [K [L [M ...]]] and [M] $\Leftrightarrow \mu$, then, when [L] is target for exponence, the structure will be [K [L [μ ...]]], entailing that [L] has access to the μ (but not the morphosyntactic information of which it is the exponent) and [K] (but not the phonological information of its eventual exponent). In its simplest form, this predicts that all and only inwards sensitivities will be phonological and, conversely, that all and only outwards sensitivities will be morphosyntactic.[20, 21]

Georgian datives provide a simple illustration of inwards phonological and

[20] More complex patterns of sensitivities can be derived given other assumptions. For instance, if exponence targets terminal nodes, and if one assumes an X-bar-like syntax, then the morphosyntactic information in category labels (MP in the main text example) remains visible even when exponence has replaced the terminal node itself. Thus, one could have allomorphy tense for aspect, but not for a particular value of aspect, such as perfective or imperfective.

[21] As with the definition of allomorphy itself, one should not be confused into thinking that outwards sensitivity to phonological information is completely impossible: such variation as is derivable by regular phonology is, of course, permitted. For instance, the quality of the root vowel in the declension of Icelandic *fjörð* 'fjord' (Einarsson 1945: 36) is clearly conditioned by the suffixal vowel (not by such heterogeneous sets as {DAT.SG, NOM.PL, ACC.PL}) and can be handled, along with deletion of the glide, by slight, properly circumscribed phonological alternations.

	SG	PL
NOM	*fjörður*	*firðir*
ACC	*fjörð*	*firði*
DAT	*firði*	*fjörðum*
GEN	*fjarðar*	*fjarða*

outward morphosyntactic sensitivities. Some predicates in Georgian may take applicative arguments without any overt applicative head. In such cases, dative agreement is directly preverbal, e.g., *m/g/gv-c'ers* 'writes to me/you/us'. These prefixes are invariant, except for (the numberless) third person agreement. As illustrated below, agreement is *s* before coronals, *h* before velars and uvulars, and zero in most other circumstances:

(44) a. ***s**-txris* 'gauges out from'
***s**-cviva* 'falls from'
***s**-ǰers* 'believes'
b. ***h**-k'mara* 'suffices'
***h**-konda* 'was had by'
***h**-gvris* 'brings'
c. *mo-**Ø**-erbina* 'had run here'
***Ø**-uknia* 'have done'

This sensitivity is, therefore, inward and phonological.

Now, not all datives in Georgian are licensed by null applicatives. Indeed the examples in (44c) involve non-null applicative heads *e* and *u*. The first of these heads is invariant under changes of person and number (witness, e.g., *mo-m/g/gv-e-rbina* 'I/you/we had run here'). However, the second is morphosyntactically sensitive to person, being *i* for all non-third persons:

(45) a. *mo-m/gv-**i**-rbina* 'I/we had run here'
*mo-g-**i**-rbina*(*t*) 'you(.PL) had run here'
*m/gv-**i**-c'ers* 'writes to me/us'
*m/gv-**i**-c'ers* 'writes to me/us'
b. *mo-**Ø**-**u**-rbina*(*t*) '(s)he/they had run here'
***Ø**-**u**-c'ers* 'writes to him/her/them'

No phonological processes of Georgian (to judge by Hewitt 1995) cause alteration between *i* and *u*, and given, moreover, that third versus non-third is a contrast that various other effects in Georgian morphosyntax (including person-case phenomena, plural marking of subjects, aorist suffixes; see Hewitt), this sensitivity is outward and morphosyntactic.

We illustrate and discuss further possibilities from table 12 below, but, while on the topic of Georgian, it is worth illustrating what we mean by non-attestation of inwards, long-distance phonological sensitivity. A superficially satisfactory instance of the phenomenon is presented by the Georgian adjectival suffix *uri*. If

this attaches to a root containing an *r*, then the suffixal *r* dissimilates to *l*. Thus, we find *svan-**u**r**i*** 'Svan' (the 'control' case), ***l**az-**u**r**i*** 'Laz' and ***kol**kh-**u**r**i*** 'Kolkhian' as against ***ka**rt-**u**l**i*** 'Georgian' and ***mig**r**e**-**u**l**i*** 'Migrelian'. The conditioning *r* can be an arbitrary distance away, as in ***r**oma-**u**l**i*** 'Roman', ***r**oman-**u**l**i*** 'Roman, Romance, Romanesque', ***r**omant'i(k')-**u**l**i*** 'romantic'. (In words with both, the right-most is decisive, hence ***r**ustve**l**-**u**r**i*** 'Rustavelian', but ***l**iber**a**l**-u**r**i*** 'liberal'.)

Two facts militate against regarding this as phonologically conditioned allomorphy that is inwards sensitive and long distance. First, the suffixal alternation could be treated as part of the phonology (especially if similar alternations are attested elsewhere in the language); an allomorphic interpretation would also be less controversial if the alternation were between such dissimilar items as *uri* and *glok*. Second, if one believes that liquids are represented on a separate phonological tier, then the [±lateral] specifications may be adjacent even if the segments that they link to are not.[22] It is, of course, exceedingly difficult to claim non-attestation: even robust typological surveys can overlook the crucial example. So, again, we leave the matter open, noting only that many unrelated examples of long-distance dissimilation and other harmony-like systems have failed to yield anything of note.

3.5.2. Distance, directionality and morphosyntactic conditioning

If Bobaljik is correct that outward-sensitive phonological conditioning is impossible, then, in particular, long-distance outwards-sensitive phonological conditioning will be unattested, just as we have (tentatively) found long-distance inwards-sensitive phonological conditioning to be. Therefore, let us turn to long-distance morphosyntactic conditioning. Here we consider two examples, that operate in different directions, one Bobaljik's own, from Itelmen, the other, from Kiowa.

Bobaljik's example concerns phi-feature sensitive. He argues that three parts of the Itelmen verb are sensitive to phi-features of two potential sources of agreement, subject and object, and that these three heads, label A, B, C are hierarchically structured with suffixal C innermost and prefixal A outermost:

[22] For this reason, it is hard to regard as relevant such foot-sensitive allomorphy as the Kalkatungu 'operative', i.e., ergative, where Blake (1969: 33) describes the conditions on *t̪u* versus (*ŋ*)*ku* as requiring, inter alia, more than two versus exactly two syllables. However, at the level of feet, one can distinguish these as contrasting non-word-initial versus word-initial feet. Thus ignoring segments, this seems to involve a simple adjacency sensitivity at the level of feet. Like comments apply to the Tzetzal data of (37).

(46) [A [[verb C] B]]

In a transitive verb, the subject and object phi-features to which these positions are sensitive are, for [A], subject only; for [B], primarily those of the object and, potentially, a subpart of the subject's too; and for [C], both simultaneously, depending on the phi-features in question. Thus, in a maximally rich verb, [A] will reflect properties of the subject, and [B] and [C], of subject and object, as shown below (examples from Volodin are via Jonathan Bobaljik, p.c.; '0S' stands for 'impersonal subject'):

(47) a. t- tɸ- s- ki- čeʔn
[1SGS]$_A$-bring-PRES-[{$^{1S}_{0S}$}+3O]$_C$-[{$^{1S}_{0S}$}+3PLO]$_B$
'I'm bringing them' (Bobaljik 2000: 9, our glossing)

b. χiŋe-ʔn minɬ n- ənk- γ^{w}e- nen
wolf-PL hare [3PLS]$_A$-catch-[3PL+3O]$_C$-[3S+3SGO]$_B$
'The wolves caught the hare' (Volodin 1976: 270, our glossing)

c. minɬ n- ənk- ki- čen χiŋe-ʔn-k
hare [0S]$_A$-catch-[{$^{1S}_{0S}$}+3O]$_C$-[{$^{1S}_{0S}$}+3SGO]$_B$ wolf-PL- LOC
'The wolves caught the hare' (Volodin 1976: 270, our glossing)

On Bobaljik's analysis, [A] is the principal exponent of subject agreement, [B], of object agreement, and [C], of verb class. The sensitivity of [B] to phi-features of the subject in fact represents allomorphy of object agreement, morphosyntactically conditioned by the features present on [A]; likewise, the sensitivity of [C] is allomorphy of the class marker, morphosyntactically conditioned by both [A] and [B]. If so, then the sensitivity of [C] to features on [A] is morphosyntactic and, more importantly, long distance (both linearly and hierarchically) and outwards.

This example in fact requires some further discussion. However, for reasons that will become apparent, we first discuss long-distance morphosyntactic sensitivity in the other direction. Though two separate instances of the phenomenon are to be found in Kiowa, for reasons of space we restrict ourselves to one involving transitivity and modals.

The modal suffix that expresses, inter alia, futurity (see Adger, Harbour, and Watkins 2009 for arguments that this is a modal, not an exponent of tense) is allomorphically sensitive to transitivity:

(48) [MOD] $\Leftrightarrow$ $\begin{cases} t\text{ɔɔ} & \text{TR} \_\_\_\_ \\ t!\text{ɔɔ} & \text{INTR} \_\_\_\_ \end{cases}$

A typical example of their use is shown below, where, for convenience, we have chosen a pair on which transitivity is overtly marked:

(49) a. héíb- e- tɔɔ /*t!ɔɔ
enter-TR-MOD$_{(TR)}$/*MOD$_{(INTR)}$
'will bring in'

b. héíb- é- t!ɔɔ /*tɔɔ
enter-INTR-MOD$_{(INTR)}$/*MOD$_{(TR)}$
'will come in'

In this configuration, the allomorphy is inwards-sensitive to an adjacent morphosyntactic feature.

However, adjacency is not a crucial feature of this allomorphy: by inflecting the verb for distributivity and/or negation, it is possible to separate the modal from the source of transitivity by a morpheme that does not show the same allomorphic sensitivity:

(50) a. héíb- e- gụụ- mɔɔ-tɔɔ /*t!ɔɔ
enter-TR-DISTR-NEG- MOD$_{(TR)}$/*MOD$_{(INTR)}$
'will not bring in at different times/locations'

b. héíb- é- gụụ- mɔɔ-t!ɔɔ /*tɔɔ
enter-INTR-DISTR-NEG- MOD$_{(INTR)}$/*MOD$_{(TR)}$
'will not come in at different times/locations'

Here, the modal suffix continues to show allomorphic sensitivity across two intervening suffixes. Interestingly, in the absence of the distributive, the form of the negative changes and the expression of transitivity is absent from the surface string. Consequently, (in)transitivity is registered only by the long-distance inwards sensitivity of the modal:

(51) a. héíb- ɔ̂ɔ- tɔɔ /*t!ɔɔ
enter-NEG-MOD$_{(TR)}$/*MOD$_{(INTR)}$
'will not bring in'

b. héíb- ɔ̂ɔ- t!ɔɔ /*tɔɔ
enter-NEG-MOD$_{(INTR)}$/*MOD$_{(TR)}$
'will not come in'

Interesting though these Itelmen and Kiowa examples are, they are not unproblematic. Bobaljik's theory rules the latter type out, as, the relevant transitivity features should be absent by the time the modal is targeted for exponence. One

might, as a result, reject just the portion of his proposals that views exponence as replacive. Alternatively, one might maintain this, but claim that the relevant information occurs both low (where it is expressed) and high (where it conditions allomorphy). Such duplication of information is, of course, common in syntax: it is the stuff of agreement relations. So, one can maintain a replacive view of exponence if one is willing to posit an Agree relation between transitivity and modality, and between aspect and evidentiality. This move comes at a price, however, in that there seems to be little grounds, either within Kiowa, or crosslinguistically, for positing the necessary Agree relations.

At the same time, Bobaljik's own example is not immune from reanalysis. Note that [C] comes directly after tense. If subjects in Itelmen move to, or are in an Agree relation, with T, then [C] might be taken to be the pronunciation of (some of) those features. Alternatively, if, contra Bobaljik, [B] is in fact a locus of subject agreement features, just as [A] is, then this would make [C]'s sensitivity to subject features a simple matter of allomorphy for the structurally adjacent head [B]. Supporting this view, Susi Wurmbrand has observed (J. Bobaljik p.c.) that, under nearly all circumstances, the subject features expressed at [C] are a subset of those expressed at [B].

As with all the phenomena discussed in this section, more examples must be sought before firm conclusions can be drawn. Methodologically, we note that the most robust evidence is likely to come from clitics or distinct heads hosting agreement with arguments (as in Itelmen). Using such data precludes the concern, raised regarding Kiowa, that there might be an ad hoc Agree relation between the heads in question: this cannot arise for, say, subject and object agreement, because they are the result of two such relations themselves and, if there were a further such relation between them, their feature content would be identical.

3.5.3. Adjacency-dependent allomorphy

Finally, we wish briefly to consider instances of allomorphy that require adjacency between the conditioning context and the target of exponence. Given that Agree (or similar mechanisms) are capable of copying features between non-adjacent heads, it might be possible to reduce all allomorphy to the adjacency-dependent variety, by claiming that the long-distance element in long-distance allomorphy does not inhere in a special type of conditioning context but relies on prior copying of the relevant features to an adjacent position from which they can condition allomorphy quite locally. The characteristics of adjacency-dependent allomor-

phy are furthermore interesting in their own right. First, both root and affixal allomorphs can be adjacency-dependent. Although we hesitate to suggest generalizations prior to proper typological sampling, we find it interesting that our few instances of long-distance allomorphy involve only affixes and that, complementarily, all our examples of root allomorphy appear to be adjacency-dependent. Second, given that exponence is the heart of the mapping from syntax to phonology, it is interesting to ask whether it is the syntactic notion of structural adjacency or the phonological notion of linear adjacency that is relevant to allomorphic contexts. Again, we suffer from a paucity of examples that militates against general conclusions; however, in at least one potentially relevant case (brought to our attention by Pavel Caha), it is clear that structural adjacency is crucial. That said, as made clear below, we believe that the current state of morphological theory may militate against any firm conclusions being drawn here.

We begin with an illustration of adjacency-dependent affixal allomorphy (which, at the same time, fills another cell from table 12: inwards-sensitive, adjacency-dependent, morphosyntactically conditioned allomorphy). The case in question comes from Latin and concerns the expression of second person singular verbal agreement (Adger, Béjar, and Harbour 2003). In the present perfect indicative 'you have loved', this takes the form *istī*, as in *amā-u-istī* (love-PF-2SG). However, if any other exponent occurs between PF and 2SG, as in the perfect subjunctives *amā-u-eri-s* and *amā-u-issē-s*, then 2SG has the same (default) exponent as in such non-perfect forms as the present and imperfect future indicatives *amā-s* and *amā-bi-s*. These examples therefore show that *istī* is an exponent of 2SG which is inwards-sensitive to a morphosyntactic conditioner, PF, but which crucially requires adjacency with that conditioner.

A similar example for roots is provided by Spanish 'people':

(52) a. *poblar* 'to populate', *poblador* 'resident', *población* 'population', ...
b. *popular* 'popular', *popularizar* 'to popularize', *popularizador* 'popularizer', *popularización* 'popularization', ...

Of particular interest are such forms as 'populate' versus 'popularize'. Both are verbal and, when the verbal affix is adjacent to the root, the latter takes the form *pobl*, which it retains when further suffixes are added (52a). By contrast, if an adjectival affix is adjacent to the root, the latter takes the form *popul*, which it again retains under further suffixation (52b). Thus, when an adjectival affix disrupts adjacency between the root and a verbal affix, the latter cannot condition the allomorph *pobl* (hence, *popul-ar-iz-ar*, **pobl-ar-iz-ar*).

Interesting though the Latin and Spanish examples may be, they do not reveal which variety of adjacency, structural or linear, the allomorphy requires: given that all the affixes are suffixal, structural adjacency obtains if and only if linear adjacency does. The nearest we can find to an example that teases these two conditions apart comes from Korean. In a thorough treatment of negation in that language, Chung (2007) pays particular attention to the verbs 'know' and 'exist', which coalesce with negation (a process which, e.g., Trommer 1999 argues is a form of allomorphy). For instance, *al-ass-ta* (know-PAST-DECL) negates as *moll-ass-ta* (NEG.know-PAST-DECL), rather than as **an*/*ani*/*mos al-ass-ta* (NEG know-PAST-DECL), which would be expected given other verbs in the language (p. 115). Interestingly, though, the negative of causativized 'know' does not use the negative allomorph. Chung argues (p. 132) that the functional hierarchy of such verbs is T > NEG > CAUSE > V (cf, Cinque 1999). This case is, therefore, analogous to Latin: just as the special allomorph of 2SG is blocked when not adjacent to PF, so, here, the special (coalesced or allomorphic) form of 'know' is blocked when not adjacent to NEG. Korean differs from Latin and Spanish, however, in that NEG and CAUSE are both linearly adjacent to V ([[NEG [know CAUSE]] PRES]; p. 132), and shows therefore, that linear adjacency, in the absence of structural adjacency, does not suffice to produce the special negative forms: *an*/*ani*/*mos al-li-ess-ta* (NEG know-CAUS-PAST-DECL), but **mol*(*u*)*liessta* (NEG.know-CAUS-PAST-DECL) (p. 120).

Though this constitutes allomorphy only relative to a certain set of assumptions, the example is nonetheless instructive in showing how one can distinguish structural from linear adjacency as a condition on allomorphy. Naturally, it is possible that morphosyntactically conditioned allomorphy might be sensitive to structural, and phonological conditioned allomorphy, to linear adjacency. However, if Marantz (1984; see also Embick and Noyer 2001) is correct that morphological processes, such as Merger, can establish adjacency relations absent from the syntax, then it is likely to prove extremely difficult to distinguish linear from structural adjacency: any circumstance under which linear adjacency holds might be made into one in which structural adjacency does too, provided the requisite morphological operations may apply.

To make this concrete, consider ordinal allomorph in English and Italian (data from Michele del Vecchio, p.c.). In both, higher ordinals are derived by regular suffixation to the basic numeral, for instance, *venti*/*ventesimo* and *twenty*/*twentieth*, but some lower numerals form their ordinals irregularly, as in *due*/*secondo* (**duesimo*) and *two*/*second* (**twoth*). Moreover, the two languages are string-identical for the number *ventidue*, *twenty-two*. However, they diverge with respect to the corresponding ordinal, with Italian using the otherwise ungrammatical 'twoth',

ventiduesimo (**ventisecondo*) while English retains the special ordinal form of 'two', *twenty-second* (**twenty-twoth*). If we assume that the ordinals are syntactically identical in both languages (which is, of course, debatable), then blocking of **ventisecondo* suggests that the ordinal affix and 'two' are not adjacent; however, this does not mean that English constitutes a case of long-distance root allomorphy, nor of allomorphy without structural adjacency, because English (but not Italian) might be subject to a morphological process that moves the ordinal head to a structurally adjacent position. If Marantz and others are correct, then the formal power of morphological theory may not permit any firm conclusions to be drawn about type of adjacency relevant to allomorphy under all circumstances.

4. Conclusion

In this chapter, we have sought to clarify the empirical grounds on which variation form can be attributed to allomorphy, that is, to the existence of a choice of exponents for a given syntactic structure, as opposed to the operations of phonology, morphology, or syntax. Furthermore, we have adumbrated the many theoretical issues that a full account of allomorphy must address, emphasizing in particular parallels between root and affixal allomorphy, the apparent lack of restrictions on numbers of allomorphs, the role that phonology may play in determining how competition between allomorphs is resolved, and the complex, interrelated set of questions—distance, directionality, adjacency, and feature types—raised by the notion of context. As emphasized at the outset, our aim has not been to develop a theory of all of these factors, but to clarify the facts and factors that such a theory should address. If we have been successful, then hopefully our own observations will be surpassed by such a theory in the near future.

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Contents