2006

Morphology: Optimality Theory

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ENCYCLOPEDIA OF
LANGUAGE & LINGUISTICS

SECOND EDITION

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Morphology: Optimality Theory

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Optimality Theory (OT) is a general approach to modeling human linguistic knowledge (Prince and Smolensky, 2004). OT has had a significant impact on various fields of linguistics, and one of those fields is morphology, the study of word formation. This article discusses how OT provides insight into various morphological phenomena, including affixation, reduplication, and allomorphy. The sections of the article are organized around the several premises of OT that are most directly applicable to morphology: constraint ranking and violability, competition among candidate output forms, faithfulness, and parallelism of evaluation.

Violable Constraints in Morphology

The most important element of OT is constraint violability. Constraints on linguistic forms are ranked in a hierarchy that is specific to each language. A higher-ranking constraint can compel the violation of a lower-ranking one; nonetheless, the violation is always minimal, so no constraint is violated more than is absolute ly necessary to satisfy the constraints that dominate it in the hierarchy. Constraint violability is pervasive in applications of OT, but there are two areas of morphology in which it assumes particular importance: affix location and template morphology.

Affix Location

Alignment constraints demand that the edges of two constituents coincide (McCarthy and Prince, 1993a; Prince and Smolensky, 2004). In particular, a constraint requiring that the left edge of an affix align with the left edge of a word (ALIGN(Afx, L; Wd, L)) or a constraint requiring that the right edge of an affix align with the left edge of a root (ALIGN(Afx, R; Root, L)) will have the effect of declaring this affix to be a prefix. Like all other constraints in OT, alignment constraints are ranked and violable, so an affix's status as a prefix is not absolute it is, rather, contingent on interaction with higher-ranking constraints.

The minimal violation of affix alignment constraints is responsible for several types of infixation. For example, in Timugon Murut (Austronesian, Malaysia), the reduplicative prefix skips over the first syllable if it begins with a vowel (Prentice, 1971), as shown in **Table 1.**

The responsible constraint is ALIGN(RED, L; Wd, L), where RED stands for the underlying form of the reduplicative prefix. This constraint is violated in Timugon Murut because it is dominated by the markedness constraint ONSET (as shown in example 1), which forbids vowel-initial (i.e., onsetless) syllables, as shown in **Table 2.**

(1) ONSET ≫ ALIGN(RED, L; Wd, L)

Table 1 Timugon Murut reduplication

Basic	*Derived*	*Meaning*
bulud	bu-bulud	'hill/ridge'
limo	li-limo	'five/about five'
abalan	a-ba-balan	'bathes/often bathes'
ompodon	om-po-podon	'flatter/always flatter'

Table 2 ONSET ≫ ALIGN(RED, L; Wd, L)

/RED + abalan/	ONSET	ALIGN
a. ☞ a-ba-balan	*	*
b. a-abalan	**!	

The choice here is whether to reduplicate an onsetless syllable or to skip over it in search of something more promising. Because ONSET is ranked higher, the latter option prevails.

This analysis highlights a difference between OT and parametric theories of language. Parameters are all or nothing, but in OT, a constraint that is violated remains potentially active because the violation is always minimal. Although ALIGN(RED, L; Wd, L) is violated by the winning candidate *a-ba-balan*, it is still active: it rules out the even more poorly aligned **aba-la-lan*; and it bars the gratuitously unaligned **bu-lu-lud*. Furthermore, even the higher-ranked markedness constraint ONSET is active but violated in Timugon Murut because there are onsetless syllables both initially (*abalan*) and medially (*ambilu.o* 'soul'). Onsetless syllables are marked in Timugon Murut – they are avoided in reduplicative copying – but they are not categorically prohibited because ONSET is ranked below constraints requiring faithfulness between input and output. (Faithfulness is discussed in greater detail later.)

Constraints on affixal alignment have also been applied to clitic and affix order restrictions (Anderson, 1996; Hargus and Tuttle, 1997; Legendre, 2000). For example, the position-class morphology of the Athapaskan languages lends itself to a description in terms of constraints of the ALIGN(Afx, R; Root, L) variety. The prefix that is preferentially closest to the verb root is governed by the highest-ranking such alignment constraint; the prefix that is next closest is governed by a constraint that is next in the ranking; and so on.

Alignment constraints are relevant to the prosody-morphology interface as well. For example, ALIGN (Stem, L; PWd, L) requires that the left edge of a stem coincide with the left edge of a phonological word. This constraint is arguably responsible for the resistance to resyllabification that is observed at the left edges of stems in languages such as German. For example, *ab-arbeit-en* 'to work off' is pronounced [ʔɑp.ʔɑr.bɑj.tən] and not *[ʔɑ.bɑr.bɑj.tən].

Template Morphology

Template morphology refers to those cases in which a morphological category is expressed by imposing a particular syllabic structure on an affix or stem. Partial reduplication is the best-known type of template morphology (*see* **Prosodic Morphology**).

For example, in Diyari (Dieri; Pama-Nyungan, Australia), the reduplicative prefix is disyllabic (Austin, 1981), as shown in **Table 3**. The reduplicative prefix has its own main stress and always ends in a vowel, as do all phonological words of Diyari. These characteristics show that reduplicated forms have the prosodic structure of compounds, consisting of two separate phonological words, $[t^{j}ilpa]_{PWd}$-$[t^{j}ilparku]_{PWd}$. The analytic problem is to explain why the reduplicative prefix contains exactly two syllables, no fewer and no more.

The reduplicative prefix contains **no fewer** than two syllables because it is a phonological word, and all phonological words of Diyari are minimally disyllabic. Such minimal-word effects follow from independently motivated constraints on prosodic structure: For a phonological word to bear stress, it must contain a metrical foot; and metrical feet are preferentially disyllabic because of the foot-binarity constraint FT-BIN. The reduplicative prefix contains **no more** than two syllables because of other prosodic constraints. PARSE-SYLL is violated by any syllable that is not assigned to a foot, as in trisyllabic $(pína)_{Ft}du$ 'old man.' ALIGN(Ft, L; PWd, L) requires every foot to be initial in a phonological word, so it is violated by noninitial feet, as in $(ŋánda)_{Ft}$ $(wàlka)_{Ft}$ 'to close.' Both PARSE-SYLL and ALIGN(Ft, L; PWd, L) are independently motivated in the stress system of Diyari and other languages.

Neither PARSE-SYLL nor ALIGN(Ft, L; PWd, L) expresses a categorical truth of Diyari. Although these constraints affect the size of the reduplicative prefix, they are ranked in a way that does not allow them to affect the stem or any other unreduplicated word. They dominate the reduplicative identity constraint MAX-BR, which is violated by uncopied segments. But they are themselves dominated by the faithfulness constraint that says every input segment must be preserved in the output (MAX-IO, usually just called MAX). **Table 4** illustrates these rankings for PARSE-SYLL. Total reduplication (as in **Table 4** line b), reproduces the stem's unfooted syllable, thereby

Table 3 Diyari reduplication

Root	*Word*	*Meaning*
ŋama	ŋama-ŋama	'to sit'
kanku	kanku-kanku	'boy'
ku|kuŋa	ku|ku-ku|kuŋa	'to jump'
t^{j}ilparku	t^{j}ilpa-t^{j}ilparku	'bird species'

Table 4 MAX-IO ≫ PARSE-SYLL ≫ MAX-BR

/RED + t^{j}ilparku/	*MAX-IO*	*PARSE-SYLL*	*MAX-BR*
a. ☞ $[(t^{j}ilpa)_{Ft}]_{PWd}$-$[(t^{j}ilpar)_{Ft}ku]_{PWd}$		*	***
b. $[(t^{j}ilpar)_{Ft}ku]_{PWd}$-$[(t^{j}ilpar)_{Ft}ku]_{PWd}$		**!	
c. $[(t^{j}ilpa)_{Ft}]_{PWd}$-$[(t^{j}ilpa)_{Ft}]_{PWd}$	***!		

adding a PARSE-SYLL violation. Shortening the stem (as in Table 4 line c), offers another way of satisfying MAX-BR, but it does so at the expense of deleting input material, thereby violating top-ranked MAX-IO. The best option under this ranking is partial reduplication (as in Table 4 line a): It preserves the input stem and accepts a less than perfect copy as the price of avoiding an unfooted syllable.

Timugon Murut and Diyari illustrate a consequence of OT known as emergence of the unmarked (McCarthy and Prince, 1994). Marked structures, such as onsetless or unfooted syllables, may be present in the language as a whole but systematically avoided under certain conditions, some of which can be characterized morphologically. The emergence of the unmarked follows from OT's basic structure: Through ranking, a markedness constraint can be active in a language even when it is not generally obeyed. ONSET in Timugon Murut and PARSE-SYLL and ALIGN (Ft, L; PWd, L) in Diyari are examples of emergent markedness constraints.

Candidate Competition in Morphology

Because constraints are violable in OT, the output of the grammar need not be, and almost never is, perfect in the sense that it obeys all the constraints. Rather, the output is that member of a set of competing candidates that best satisfies the constraint hierarchy of the language in question. An OT grammar therefore chooses from among a set of competitors. Candidate competition offers new insights into many phenomena, among them allomorphy and haplology.

Allomorphy

In generative phonology, it is standard to assume that a morpheme's surface alternants are derived by regular phonological processes from a single underlying representation. There are cases, however, in which this assumption does not hold up. In Catalan (Catalan-Valencian-Balear), for example, the personal article has two forms, *en* before a consonant and *l* before a vowel: *en Wittgenstein*, *l'Einstein*. The surface alternants *en* and *l* cannot be derived from a single underlying form by regular phonological processes – they are simply too dissimilar. Nonetheless, the distribution of the alternants makes sense phonologically, as shown by comparing candidates: *en Wittgenstein* avoids **l'Wittgenstein*'s initial *lw* cluster, and *l'Einstein* avoids **en Einstein*'s initial onsetless syllable. This phenomenon is called phonologically conditioned allomorphy.

The analytic problem presented by allomorphy is this: how can the unpredictability of the allomorphs be reconciled with the predictability of their distribution? The approach to allomorphy developed in OT combines an old idea with a new one. The old idea is that the allomorphs are lexically listed as suppletive alternants (Hudson, 1974). The Catalan personal article has two underlying forms, /l/ and /en/, or /{en, l}/ for short. The new idea is that the same markedness constraints that are responsible for regular phonological processes also choose among the alternants (see Kager, 1996; Mascaró, 1996; Tranel, 1996; Bresnan, 2001; and additional references cited in McCarthy, 2002: 183). The winning candidate is the one that best satisfies the markedness constraints as ranked in the language in question.

Table 5 *[$_\sigma$*l*C ≫ ONSET

/{en, l} + *Wittgenstgein*/	* [$_\sigma$*l*C	ONSET
a. ☞ en Wittgenstein		*
b. l'Wittgenstein	*!	

The Catalan constraint hierarchy must favor *en Wittgenstein* over **l'Wittgenstein* as output from /{en, l}-Wittgenstein/. This is accomplished if the constraint against syllable-initial *l*C clusters is ranked above ONSET, as shown in Table 5. The prohibition on syllable-initial *lw* is part of a more general limitation on permissible onset clusters, but for our present purposes it is enough to use the *ad hoc* constraint *[$_\sigma$*l*C. With a vowel-initial stem, such as /{en, l}-Einstein/, the constraint *[$_\sigma$*l*C is satisfied by both candidates, so ONSET is decisive, correctly favoring *l'Einstein*.

Rule-based or process theories of phonology and morphology emphasize mechanisms of derivation: A rewrites as B in context C. This perspective is unhelpful in allomorph selection, where the mechanism of derivation is trivial, because the allomorphs must be lexically listed. OT, on the other hand, is inherently comparative, using a constraint hierarchy to select the right output from a range of options. Because outputs are chosen comparatively rather than derived by rule, it is possible through ranking for the same constraint to be responsible for allomorph selection in one language and infixation or epenthesis in another. As we have seen, ONSET is an example of such a constraint.

Haplology

In haplology, an affix is absent in a context that is phonologically identical (or similar) to it, for example, /boy-$_{PL}$-$_{GEN}$/ → *the boys' books*, **boys's*; /Moses-$_{GEN}$/ → *Moses' descent from Mt. Sinai*, **Moses's*. An adequate theory of haplology must answer two questions: what causes haplology, and how can an entire affix go missing?

Haplology is to morphology what dissimilation is to phonology. The contextual conditions that encourage haplology – identical or similar speech sounds in close proximity – are the same as those that trigger dissimilation. The only real difference is in what is affected and how. Haplology affects morphemes, which then disappear, whereas dissimilation affects segments, which then change. An example of dissimilation is Latin /popula:lis/ → [popula:ris] 'of the people' (cf. [re:ga:lis] 'royal').

Work in OT supports the idea that the same constraints are responsible for both processes (Russell, 1997; Plag, 1998; Gouskova, 2003). The juxtaposition of identical or similar segments is a marked structure, actively avoided in many languages. Constraints against such structures can force phonological dissimilation or morphological haplology, depending on how they are ranked. The competition between *Moses'* and **Moses's* is abstractly the same as the competition between *popula:ris* and **popula:lis*; in both cases, a markedness constraint forbidding sequences of nearby identical segments is decisive.

Dissimilatory markedness constraints therefore answer for the 'why' of haplology. As for the 'how,' the key insight is that the final [əz] of *Moses'* is doing double duty, serving as part of the root *Moses* and as the genitive suffix (Russell 1997; de Lacy 1999). Haplology, then, is fusion or overlap of morphemic exponence. In haplologized *Moses,'* both root and suffix are fully present, but they use the same segmental material. The competitor **Moses's* avoids this overlap, but at a cost in segmental markedness. When the dissimilatory markedness constraint is ranked higher than the constraint against overlap, the haplologizing candidate wins.

Allomorphy and haplology illustrate the virtue of OT's inherently comparative nature. OT takes the focus off operations and puts it on outcomes. ONSET is as relevant to allomorph selection in Catalan as it is to determining placement of the reduplicative prefix in Timugon Murut. At the operational level, these phenomena are as different as could be, but at the level of comparing candidates, this similarity emerges. Likewise, haplology and dissimilation are operationally distinct, but both reflect similar markedness pressures that become apparent when candidates are compared.

Faithfulness in Morphology

A unique aspect of OT is the idea of faithfulness: the existence of a set of constraints that require identity between the input and output. Faithfulness constraints are generally antagonistic to markedness constraints; the former support lexical contrasts, whereas the latter resist them. A phonological process, such as final devoicing in German /bund/ → [bʊnt] 'federation,' reflects the crucial ranking of a markedness constraint above a faithfulness constraint, favoring an unmarked output structure over fidelity to the input structure.

There have been several proposals to incorporate morphological notions into faithfulness constraints: root and affix faithfulness, morphological polarity and subtraction as antifaithfulness, and constraints on morpheme realization.

Root and Affix Faithfulness

Distinct faithfulness constraints protect distinct properties of the input. For example, MAX requires every input segment to appear in the output, thereby forbidding deletion. DEP, on the other hand, requires every **output** segment to appear in the **input**, so epenthesis violates DEP. The various IDENT(feature) constraints forbid segments from changing their distinctive feature values in the input-output mapping.

Faithfulness constraints are also distinguished by the type of morpheme to which they apply (McCarthy and Prince, 1995, 1999; Beckman, 1999). MAX_{Root} and $\text{MAX}_{\text{Affix}}$ are separate and therefore separately rankable constraints. MAX_{Root} is violated by the deletion of root material and $\text{MAX}_{\text{Affix}}$ by the deletion of affixal material. There is a similar division of the DEP and IDENT(feature) constraints. Universally, MAX_{Root} is ranked higher than $\text{MAX}_{\text{Affix}}$, so roots will in general be treated at least as faithfully as affixes and sometimes more faithfully.

Two sorts of evidence support the distinction between root and affix faithfulness constraints and the universally fixed ranking between them. Evidence from phonological inventories shows that languages often permit certain marked structures to appear in roots but not in affixes. In Arabic, for example, the marked uvular and pharyngeal consonants /χ, ʁ, ħ, ʕ/ are found in roots but never in affixes, which are limited to less-marked consonants such as /t, n, m/. Similarly, in the Cuzco Quechua language of Peru, consonants that are marked by virtue of glottalization or aspiration are allowed in roots but not affixes (Parker and Weber, 1996). In general, if the segments that violate some markedness constraint M are allowed in roots but not affixes, then the language in question must have the ranking $\text{Faith}_{\text{Root}} \gg \text{M} \gg \text{Faith}_{\text{Affix}}$. In this way, affixes will consistently obey M, but roots need not.

Evidence from phonological alternations also supports the $\text{Faith}_{\text{Root}}/\text{Faith}_{\text{Affix}}$ dichotomy. In Finnish, for example, affix vowels assimilate in backness to a root vowel, but the vowels within a root need not

agree with one another in backness. This means that the markedness constraint that compels vowel assimilation is ranked below IDENT(back)$_{Root}$ and above IDENT(back)$_{Affix}$. Sometimes such effects are preferential rather than absolute. In Emai (Emae; Benue-Congo, Nigeria; Casali, 1998), hiatus is resolved by deleting one of the two adjacent vowels: /... $V_1 + V_2$.../ → [... V_1...] versus [... V_2...]. Whether V_1 or V_2 deletes is determined by the status of the morphemes they belong to: If one is a content morpheme (a root) and the other is a functional morpheme (an affix), then the vowel of the functional morpheme is deleted; otherwise, if the morphemes are of equal status, the morpheme-final vowel V_1 is dropped. The preference for deleting affixal vowels is expressed by the universal ranking MAX$_{Root}$ ≫ MAX$_{Affix}$, although even MAX$_{Root}$ must be violated if a hiatus is produced by the juxtaposition of two roots.

Polarity, Subtraction, and Antifaithfulness

A rather more controversial idea is antifaithfulness, the claim that there is a class of constraints that is obeyed only when a faithfulness constraint is violated (Horwood, 1999; Alderete, 2001a, 2001b). Antifaithfulness constraints have been applied to two of the most thorny problems in morphology, polarity switching and subtraction.

In effect, antifaithfulness constraints say, 'Be different!' and so they are rather well suited to morphological distinctions that involve the reversal of a phonological contrast. For example, in Luo (Nilotic, Kenya), plurality is marked *inter alia* by reversing the voicing of a stem-final obstruent (Gregersen, 1974), as shown in **Table 6**. The antifaithfulness constraint ¬IDENT(voice) is obeyed when a consonant in the plural disagrees in voicing with its counterpart in the singular. If it is ranked above the faithfulness constraint IDENT(voice) and if other analytic details are attended to, then the final consonant of the plural stem will invert the voicing of its counterpart in the singular.

There are two main types of subtractive morphology: templatic and truncating. In templatic subtractive morphology, the amount of the original stem that remains is constant throughout the morphological category. For example, the vocative forms of personal names in Yapese (Austronesian, Micronesia) are formed by dropping everything except the initial consonant–vowel–consonant sequence (Jensen, 1977), as shown in **Table 7**. The templatic target in Yapese is the minimal word of the language, and so subtractive morphology of this type is analyzed in the same way as Diyari reduplication.

In truncating subtractive morphology, on the other hand, the amount of the original stem that is dropped is what remains constant. For example, in Koasati (Muskogean, Louisiana and Texas) a class of verbs pluralize by dropping the rhyme (i.e., everything except the onset) of the last syllable in the stem (Kimball, 1986), as in **Table 8**. In antifaithfulness terms, this type of subtractive morphology is a consequence of the constraint ¬MAX-V, which is satisfied only by candidates in which at least one vowel has been deleted. Additional constraints ensure that truncation occurs at the right edge of the stem and that it also affects a stem-final consonant.

Morpheme Realization Constraints

Occasionally, a language will deviate from its regular phonotactic patterns in a particular morphological category but nowhere else. This phenomenon is usually associated with subsegmental morphology, in which a morpheme consists of one or two distinctive feature values that constitute less than a full segment. Subsegmental morphemes are realized phonologically by autosegmental association with a segment of the stem to which they are affixed (Goldsmith, 1979; Lieber, 1987; Zoll, 1998).

For example, in Javanese (Austronesian, Java and Bali), the morpheme that marks the elative (comparative and superlative) adjective consists of the distinctive feature values [+high, +tense]. This morpheme is associated autosegmentally with the final vowel of the stem (Dudas, 1976), as shown in **Table 9**. The final vowel of the elative combines the rounding

Table 6 Luo voicing reversal

Singular	*Plural*	*Meaning*
bat	bed-e	'arm/arms'
luθ	luð-e	'walking stick/sticks'
tʃogo	tʃok-e	'bone/bones'
owadu	owet-e	'brother/brothers'

Table 7 Yapese templatic subtraction

Personal name	*Vocative*
luʔag	luʔ
baja:d	baj
maŋɛ:fɛ:lʔ	maŋ

Table 8 Koasati truncating subtraction

Singular	*Plural*	*Meaning*
latáf-ka-n	lát-ka-n	'to kick something'
ataká:-li-n	aták-li-n	'to hang something'

feature of the underlying vowel and the [+high, +tense] features of the elative morpheme, so, for example, /a/ becomes [i] and /ɔ/ becomes [u].

The morphology of the elative interacts in an interesting way with the general phonology of Javanese. In the language as a whole, the tense high vowels /i/ and /u/ are regularly replaced by their lax counterparts [ɪ] and [ʊ] in syllables that are closed by a consonant: /tulis/ → [tulɪs] 'write' (cf. [nulis-i] 'write (LOC)'). Elative forms such as *aŋil* and *abut* are remarkable for having a tense high vowel in a closed syllable, thereby breaking this otherwise inviolate phonotactic generalization of this language.

In a theory where constraints are violable under crucial domination, no phonotactic generalization is necessarily inviolate. The phonology of Javanese as a whole shows that the markedness constraint prohibiting tense vowels in closed syllables, *tnsC]$_\sigma$, is ranked above the antagonistic faithfulness constraint IDENT(tense), as shown in (5). This ranking produces alternations such as *tul*ɪs versus *nulis-i*, as shown in **Table 10**. The constraint *tnsC]$_\sigma$ is crucially dominated, however, by a special kind of faithfulness constraint that demands the realization of a morpheme that would otherwise disappear entirely (Samek-Lodovici, 1993; Gnanadesikan, 1997; Kurisu, 2002). This constraint, called MORPH-REAL, forces the appearance of a tense vowel in a closed syllable when the alternative is the total disappearance of the subsegmental [+high, +tense] elative morpheme. The ranking is shown in **Table 11**. Additional constraints rule out other candidates, such as **abt*, where the [+high] and [+tense] features of the elative morpheme are decoupled.

In the emergence of the unmarked, marked structures that are permitted in the language as a whole are forbidden in some limited situations, such as the reduplicative prefixes of Timugon Murut and Diyari. The Javanese elative is, in a sense, the antithesis of that: the marked structure is forbidden in the language as a whole but permitted under specific conditions. The difference follows from the interaction of markedness and faithfulness constraints through ranking. In the emergence of the unmarked, the general faithfulness constraint (e.g., MAX-IO) is ranked above the emergent markedness constraint, thereby limiting its force. In cases such as Javanese, however, the markedness constraint dominates the general faithfulness constraint, but it is overridden only in those circumstances where the more specific faithfulness constraint MORPH-REAL is relevant.

Table 9 Javanese elative

Adjective	*Elative*	*Meaning*
rame	rami	'noisy'
aŋel	aŋil	'hard, difficult'
laraŋ	lariŋ	'high in cost'
alus	alus	'refined, smooth'
rosɔ	rosu	'strong'
abɔt	abut	'heavy, hard'

Table 10 *[+tense]C]$_\sigma$ ≫ IDENT(tense)

/tulis/	*[+tense]C]$_\sigma$	IDENT(tense)
a. ☞ tulɪs		*
b. tulis	*!	

Parallelism in Morphology

OT permits, but does not strictly require, a 'flat' derivation, in which the grammar evaluates fully formed output candidates that show the effects of various phonological and morphological processes simultaneously. This parallel view of OT is distinct from the serial derivation of rule-based theories. In its strongest form, parallel OT maps a morphosyntactic input representation directly to the surface form of an utterance. Some implementations of OT are more weakly parallel, positing separate constraint hierarchies for, say, word phonology and phrase phonology (see, e.g., Roca, 1997; Hermans and van Oostendorp, 1999; and the references in McCarthy, 2002: 185).

In a strictly modular, serial theory, all morphology precedes all phonology. If morphology and phonology occur in parallel rather than sequentially, however, then it is possible for derived phonological structure to influence the morphology. Two phenomena that exhibit this behavior are allomorph selection and reduplication.

Parallelism in Allomorph Selection

When allomorphy is phonologically conditioned, the choice of allomorph can be based on the surface phonology rather than the underlying representation of the stem. English supplies a nearby example. The indefinite article has two allomorphs, *a* and *an*. The allomorph *a* is favored preconsonantally by the constraint NO-CODA, which expresses the universal

Table 11 MORPH-REAL ≫ *[+tense]C]$_\sigma$ ≫ IDENT(tense)

/abɔt+ [+high, +tense]/	MORPH-REAL	*[+tense]C]$_\sigma$	IDENT(tense)
a. ☞ abut		*	*
b. abɔt	*!		

markedness of syllables that end in consonants: **an book*. The allomorph *an* is favored prevocalically by ONSET: **a apple*. Clearly, the choice of *a* versus *an* in English bears a more than passing resemblance to the Catalan example discussed earlier.

The selection of *a* and *an* is determined by the surface form of the following word, not its underlying form. In English, underlying /h/ deletes in an unstressed syllable, leading to [h]~Ø alternations for some speakers: [h'ɪstəɹi:] *history* versus [ɪst'ɔɹɪkəl] *historical*. Those speakers who have an *h*-less pronunciation of *historical* will most naturally use the *an* allomorph with it: *an historical fact*. Allomorph selection is here being determined by the surface rather than the underlying form, as expected if morphology and phonology take place simultaneously. In a strictly modular theory, allomorph selection could not be affected by the surface properties of syllabification because the syllabification would not yet have been determined at the point in the derivation when the allomorph must be chosen. Modular theories may adopt work-arounds for this problem, such as hanging on to both allomorphs until late in the phonological derivation, but such moves seem more to embarrass than support strict modularity.

Parallelism in Reduplication

There is considerable evidence that reduplication requires access to surface phonological representation. This evidence suggests that the contents of the reduplicative copy are determined in parallel with the surface phonology, and an approach to reduplication in OT has been worked out along these lines (McCarthy and Prince, 1995, 1999).

For example, in Malay (Austronesian, Malaysia), a sequence of vowels and glides following a nasal consonant becomes nasalized (Onn, 1976; Kenstowicz, 1981): /mahal/ → [mãhãl] 'expensive'; /mawas/ → [mãwãs] 'a type of monkey.' As shown in **Table 12**, this process interacts in an interesting way with reduplication. For expositional purposes, the [wã] syllables of the first example will be referred to as $\tilde{w}\tilde{a}_1$ and $\tilde{w}\tilde{a}_2$: $\tilde{w}\tilde{a}_1$ŋ̃ī-$\tilde{w}\tilde{a}_2$ŋ̃ī. The syllable $\tilde{w}\tilde{a}_2$ is nasalized for purely phonological reasons, because it is preceded by the nasal consonant [ŋ]. $\tilde{w}\tilde{a}_1$'s nasalization cannot be explained phonologically, however, because nasality never spreads to the left in Malay: /tahan/ → [tahan] 'withstand,' *[tãhãn]. Rather, $\tilde{w}\tilde{a}_1$ is nasalized because it is a copy of $\tilde{w}\tilde{a}_2$, and $\tilde{w}\tilde{a}_2$ is nasalized. In other words, the reduplicative prefix both triggers the nasalization in $\tilde{w}\tilde{a}_2$ and copies that nasalization.

If reduplication and phonological processes such as nasalization take place in parallel, this kind of behavior is fully expected. Let SPREAD-R(nasal) stand for the markedness constraint that, by dominating IDENT-IO(nasal), forces rightward assimilation of nasality. The overapplication of nasalization seen in reduplicated words shows the effect of IDENT-BR(nasal), a member of the family of constraints introduced in the discussion of Diyari. **Table 13** shows how these constraints dispose of the relevant candidates. In keeping with OT's parallel orientation, the output candidates are finished products, showing the results of both nasalization and reduplication. **Table 13**, candidate b, would be expected on purely phonological grounds, but it is ruled out because it has a fatal disparity in nasalization of *wa* between the reduplicative copy and the stem. **Table 13**, candidate c's, problem is the failure to conform with the basic phonology of nasalization in Malay because nasality has not spread as far to the right as it can. The winner, then, is **Table 13**, candidate a, in which the reduplicative prefix both triggers and copies nasalization in the following root.

Table 12 Malay reduplication

Root	*Word*	*Meaning*
waŋī	**w̃ãŋ̃ī**-w̃ãŋ̃ī	'odor/many different odors'
hamə̃	**hãmə̃**-hãmə̃	'germ/pl.'
aŋãn	**ãŋãn**-ãŋãn	'to daydream/id.repeatedly'

Table 13 Overapplication in Malay

/RED + waŋi/	IDENT-BR (nasal)	SPREAD-R (nasal)	IDENT-IO (nasal)
a. ☞ w̃ãŋ̃ī-w̃ãŋ̃ī			***
b. waŋī-w̃ãŋ̃ī	**!		***
c. waŋī-waŋī		**!	*

Conclusion

This article has described various ways in which properties of Optimality Theory can offer new insight into some old morphological problems. Readers should not, however, come away with the view that these are now settled questions. OT is an area of ongoing research and lively debate. Although some aspects of OT are essential to this theory – for example, constraint violability and ranking, candidate competition, and the existence of faithfulness constraints – others are not; and indeed some – such as antifaithfulness and strong parallelism – are quite controversial. For this reason, the main emphasis has been placed on understanding the theory behind OT and the inferences and implications that can be

derived from it. Morphology is one of many areas where OT has offered and will no doubt continue to offer new and surprising insights.

See also: Affixation; Autosegmental Phonology; Dissimilation; Internal Modification; Metrical Phonology; Phonology: Optimality Theory; Prosodic Morphology; Reduplication; Subtraction; Suppletion; Syllable: Phonology; Template Morphology.

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Morphology: Overview

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Morphology is concerned with the relationship between the form of a word and its meaning. For example, if we consider the words *manage, manages, managed, managing, management, manager,* and *managerial* we find that there is a common core of meaning corresponding to the meaning of *manage*, and if we consider the words *managing, obliging, refusing, seeking,* and *teaching*, there is also a common element of meaning (even if it may be quite difficult to specify that meaning precisely) that is reflected in the recurrent *-ing*.

Etymologically, the term *morphology* seems to indicate the study of forms, though it can be seen from the preceding that form alone does not provide an object of study within morphology. Morphologists are not interested in the fact the word *notable* might be considered to contain the orthographic forms *no* and *table* because neither *no* nor *table* as a unit provides any meaning that can be found in *notable*. It is where form and meaning reflect each other directly, either because a certain formal sequence can be seen as being regularly correlated with a particular meaning (as in the examples above) or because there is a regular patterning of semantic relationships, and a particular form can be seen as filling a cell in the pattern. Thus, *worse* is taken to be in the same relationship to *bad* that *bigger* is to *big* or *frailer* is to *frail*, not because of any regularity of form but because of the equivalence of the cells in the pattern or *paradigm*.

Since morphology is concerned with form, it is related to the study of phonology (*see* **Morphophonemics**), and since it is concerned with meaning, it is related to the study of semantics. It is also related to the study of syntax in that many of the meanings that find expression in morphology are related to syntactic function: for example, the comparative, past tense and present participles illustrated above. Morphology is also related to lexis in that morphological patterns can be used in the creation of new lexical items, as illustrated by *manager* and *management* above. This 'cross-road' (Kastovsky, 1977) nature of morphology means that it has been open to influence from phonological and syntactic theories, as well as to changing ideas about the nature of the lexicon. All this is reflected in morphological theorizing.