The Directionality and Locality of Allomorphic Conditioning in Optimal Construction Morphology

Sharon Inkelas

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1 Introduction

This paper explores the conditioning of allomorphy in Optimal Construction Morphology (OCM; Caballero & Inkelas 2013), a highly lexicalist theory of morphology.* OCM differs from other lexicalist theories (e.g. Lexical Morphology and Phonology (LMP;, Kiparsky 1982a,b)) in having both top-down and bottom-up design features. OCM's unique architecture generates novel predictions regarding the directionality and locality of conditioning of morphological operations. In brief, OCM predicts that allomorphy which is conditioned by arbitrary properties of other morphs in the same word will exhibit an inside-out and potentially local character, whereas allomorphy which is conditioned by properties of the meaning of the word is subject neither to directionality nor to locality considerations. These predictions differ in some interesting ways from predictions arising out of Distributed Morphology (DM; see, e.g., Bobaljik 2000, Siddiqi 2006, Embick 2010, Harley & Tubino Blanco 2013, as well as the papers in this volume by Embick; Harley, Tubino Blanco & Haugen; and Gribanova & Harizanov).

Section 2 introduces the basic structure of OCM, illustrating in section 2.3 how OCM derives both morphological blocking and multiple exponence effects. Section 3 reviews suppletive allo-

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morphy in OCM. Section 4 focuses on S-conditioned allomorphy, i.e. allomorphy conditioned by syntactic or semantic features of the target meaning for the word under construction. Section 5 focuses on L-conditioning, i.e. allomorphy conditioned by arbitrary lexical properties of morphemes in the word under construction, examining the role of percolation and its effect on the locality of conditioning. Section 6 summarizes the basic predictions of S-conditioning and L-conditioning in OCM, with a brief comparison to DM, and section 7 addresses the challenge posed by bound (vs. free) roots for the prediction that L-conditioning is always 'inside-out'. Section 8 concludes.

2 Optimal Construction Morphology

There are three main elements to the architecture of OCM, a constraint-based, production-oriented theory of word formation which shares key insights with such varied approaches as A-Morphous Morphology (Anderson 1992), Construction Morphology (e.g. Riehemann 2001, Booij 2010; cf. Sign-Based Morphology (Orgun 1996)), Lexical Morphology and Phonology (Kiparsky 1982a,b), Optimality Theory (Prince & Smolensky 2004) and Harmonic Serialism (McCarthy 2008):

(1)
a. A semantic/syntactic (S) meaning target that drives the formation of a given word.
b. An elaborated lexicon, or Constructicon, containing all monomorphemic roots as well as every individual word-formation construction (affixation, compounding, reduplication, truncation, etc.) in the language
c. A bottom-up cyclic process of choosing a single, optimal layer of morphology from the Construction to bring the word under construction closer to matching the S target.

Property (1c) makes OCM a bottom-up theory. As in LMP or (to some extent) DM, morphemes are inserted cyclically from the bottom of the structure up.

But property (1a) also makes OCM is also a top-down theory. Every cycle of evaluation makes reference to the ever-present S target, against which the meaning of the word under construction is compared.

The remainder of section 2 discusses the elements in (1) in more detail, building up to the discussion of allomorphy and its conditioning in subsequent sections.

2.1 The S target

Like realizational theories of morphology such as Paradigm Function theory (Stump 2001) or Anderson's (1992) A-morphous Morphology, and to some extent Distributed Morphology (DM), OCM assumes that the process of word formation is goal-oriented. In the case of DM, the goal, or target, is a syntactic skeleton. In the case of realizational theories of inflectional morphology, it is a matrix of features and their values. In this paper, the precise contents of the S target are left fairly unspecified, since the exact nature of syntactic and semantic representations does not affect the key concept that those representations exist and must be matched in the course of word formation.[1] The key claim of OCM is that the S TARGET represents (in whatever syntactic or semantic notation the analyst chooses) the meaning of the intended word and is present throughout word formation. It is compared, at each step, against the syntactic and semantic content of the word being constructed. To illustrate, S targets for three words are given below:

(2)

cup	CUP, SYN = N, NUM = SG
write	WRITE, SYN = V, TENSE = NONPAST
wrote	WRITE, SYN = V, TENSE = PAST

The construction of any given word is necessarily an exercise in best fit, working within the lexical and grammatical possibilities afforded by the language. S targets will be notated here in minimal, space-saving, approximate fashion, with just enough detail for the reader to make sense of the morphological choices that are at issue in any given derivation.

[1]This flexibility of OCM makes it compatible with the representational aspects of DM, though of course the word construction process differs.

2.2 The Constructicon

The Constructicon is a list of all roots and morphological constructions (affixes, compounding constructions, reduplication and truncation constructions, etc.) in the language. OCM is a member of the rich family of constructionist approaches to morphology which includes Network Morphology (Hippisley 1997), Construction Morphology (Booij 2010), and a number of very similar relatives; see, e.g., Bochner 1992, Orgun 1996, Croft 2001, Riehemann 2001, Inkelas & Zoll 2005, and Gurevich 2006, among others, and the papers in Hoffman & Trousdale 2013). These are lexicalist theories in the sense that the constituent structure of complex words is emergent and lexicon driven, rather than being driven by independent syntactic principles of the language (or of UG). Constructions are output-oriented schemas that relate form to meaning. These schemas can be related in an inheritance hierarchy, capturing generalizations across them. They combine through a process of unification, wherein prespecified values for the same entity must match, and variables are fleshed out by unifying with prespecified values contributed by another construction in the same complex structure. For example, the word *buyer* is formed in (3b) by combining the Constructicon entries root *buy* and *-er* in (3a) (Booij 2010):

(3) a. [buy $]_V$

[[X $]_V$ er $]_N$ ↔ 'one who Xs'

b. [[buy $]_V$ er $]_N$ ↔ 'one who buys'

2.3 Cyclic optimization: blocking and multiple exponence

The job of the grammar in OCM is to select items from the Constructicon such that the word under construction optimally matches the S target. OCM assumes a cyclic process of evaluation, modeled via chained tableaus in Optimality Theory (OT; Prince & Smolensky 2004) or Harmonic Grammar (HG; Legendre et al. 1990). Each tableau operates on a single input, a word in progress which consists of a pairing between meaning and form. Each candidate is the result of combining that input with a single construction from the Constructicon. In the respect that each candidate is one step away from the input, OCM resembles McCarthy's (2008) Harmonic Serialism, applied to morphological derivations by Wolf (2008).

Only well-formed candidates, namely those in which the selectional requirements of the constructions are satisfied, are considered; this unification-derived 'selectional satisfaction' requirement is presupposed, and is not overtly modeled by constraints in the text below. For example, since affix constructions select for stems, no affix construction on its own would be a viable candidate. Therefore, only (free) roots normally compete in the initial tableau. (For a discussion of bound roots, see section 7.)

To illustrate candidate competition, consider the S target [TALK; SYN=V, TENSE=PAST], which in English is best matched by the verb *talked*. The candidate inputs for the initial tableau are roots; the winning root captures the largest subset of properties in the target. Among the more viable competitors are *talk, chat, speak*. (Note the assumption, standard in the lexicalist literature (e.g. Kiparsky 1982b; see also Pinker & Prince 1992), that irregular forms like *spoke* are lexically listed and treated like monomorphemic roots.) The choice among these is made by S-FAITH[FULNESS], a constraint family that compares the S-properties of the candidates to the S target.

In (4), candidate *talk* best matches the S target. Candidates *chat* and *speak* lack some semantic and inflectional properties of the target (multiply violating MAX-S) and possess semantic properties not in the S target (violating DEP-S).[2]

[2]Open questions include how to quantify Faithfulness violations and whether to split MAX and DEP further into feature-specific constraints. A subdivided MAX-S, in particular, would resemble the family of feature-specific constraints in their Realizational Optimality-theoretic approach to morphology of Aronoff & Xu (2010) and Xu & Aronoff (2011), or the feature-specific spell-out rules of Stump (2001) and Anderson (1992). The possibility of ranking feature-specific members of the MAX-S family to order affixes is discussed, and cautiously rejected, in Inkelas (in prep.). These issues are beyond the scope of this paper. In the following tableaus, the simplicity of the comparisons allow us to make do with MAX-S and DEP-S.

(4)

S target: SEM=TALK, SYN=V, TENSE=PRESENT, SUBJ=3.M.SG				
Input P: Ø Input S: Ø				
Candidate constructions		*Candidates*	MAX-S	DEP-S
→ a.	*talk*	[tak] SEM=TALK SYN=V	∗∗ TENSE=PRES SUBJ=3.M.SG	
b.	*chat*	[tʃaet] SEM=CHAT SYN=V	∗∗∗! SEM=TALK TENSE=PRES SUBJ=3.M.SG	∗ SEM=CHAT
c.	*speak*	[spijk] SEM=SPEAK SYN=V	∗∗∗! SEM=TALK TENSE=PRES SUBJ=3.M.SG	∗ SEM=SPEAK

The output of this initial tableau is then combined on the next assessment cycle with every compatible construction in the lexicon. Full S target matching is achieved in this second tableau, which considers such competitor constructions as *-s, -ed, -ing, -ative*:

(5)

S target: SEM=TALK, SYN=V, TENSE=PRES, AGR=3SG				
Input P: [tak] Input S: [SEM=TALK, SYN=V]				
Candidate constructions		*Candidates*	MAX-S	DEP-S
→ a.	[[ ]$_V$ -s] AGR=3SG TENSE=PRES	P=[tak] SEM=TALK SYN=V AGR=3SG TENSE=PRES		
b.	[[ ]$_V$ -ed] TENSE=PAST	P=[takt] SEM=TALK SYN=V TENSE=PAST	∗∗! AGR=3SG TENSE=PRES	∗ TENSE=PAST
c.	[[ ]$_V$ -ative] SYN=ADJ	P=[takətɪv] SEM=TALK SYN=ADJ	∗∗!∗ SYN=V AGR=3SG TENSE=PRES	∗ SYN=ADJ
d.	ID	P=[tak] SEM=TALK SYN=V	∗∗! AGR=3SG TENSE=PRES	

The last candidate in (5) is the identity candidate (ID), identical to the input stem. As in Harmonic Serialism (McCarthy 2008), the ID candidate is always a contender; it wins when the lexicon contains no construction which could improve on the input. That completes the lexical derivation. Because the ID candidate does not win in (5), another round of evaluation is necessary (in which the ID candidate does win). In this paper, ID candidates are suppressed in root-selecting tableaus like (4), since they are not viable contenders.

Phonological constraints also potentially contribute to allomorph selection; on P $\gg$ M effects, see e.g. McCarthy & Prince 1995, Paster 2006, Wolf 2008, and Yu (this volume), among others. Morphotactic well-formedness constraints on stem shape also play a role, including those which enforce the wordhood scale developed in Caballero & Inkelas (2013). This concept surfaces later in the analysis of Archi.

2.4 Blocking and multiple exponence in OCM

Caballero & Inkelas (2013) argue for OCM based on its ability to derive both blocking and multiple exponence from the natural interaction of the Constructicon and S-Faith.[3] We illustrate the emergence of blocking, below, for the S target [SEM=SPEAK, SYN=V, TENSE=PAST]. Any theory of morphology faces the challenge of ensuring that this target is realized with the portmanteau root *spoke*, instead of the synonymous complex alternative **speak-ed*. The leading candidates for the initial cycle are, as in (4), roots with meanings close to SEM=SPEAK. In this case, however, a candidate is available on the first cycle that matches the S target completely:

[3]On multiple exponence in morphology, see Stump 1991, Müller 2006, Harris 2008, Aronoff & Xu 2010, Xu & Aronoff 2011, among others.

(6)

S target: SEM=SPEAK, TENSE=PAST				
Input P: Ø Input S: Ø				
Candidate constructions		*Candidates*	MAX-S	DEP-S
a.	*talk*	[tak] SEM=TALK	∗!∗ SEM=SPEAK TENSE=PAST	∗ SEM=TALK
b.	*speak*	[spijk] SEM=SPEAK	∗! TENSE=PAST	
→ c.	*spoke*	[spoʊk] SEM=SPEAK TENSE=PAST		

In terms of S-Faith, a candidate harmonically bounds another if the latter is associated with a proper subset of the S properties of the former. Candidate *spoke* (6c) harmonically bounds candidate *speak* (6b). Crucially, its selection prevents hypothetical candidate **speak-ed* from even being considered. In order for **speak-ed* to compete as a candidate in a subsequent table, root *speak* would have to survive the initial round of competition. But it does not. Candidate **speak-ed* never gets a chance to compete. Blocking of **speak-ed* falls out as a natural consequence of the architecture of OCM.

Caballero & Inkelas compare OCM favorably to other approaches to blocking which have to stipulate the Paninian principle, or others like it, to achieve the result that *spoke* blocks **speak-ed*:[4] Examples are listed below

[4] See also Andrews 1990, Anderson 1992, Poser 1992, Hankamer & Mikkelsen 2005, among others.

(7) a. ECONOMY: "Among equally expressive expressions, the simplest is optimal" (Kiparsky 2005:114)

b. ECONOMY: "The fewer affixes, the better" (Noyer 1993:17)

c. MINIMIZE EXPONENCE: "The most economical derivation will be the one that maximally realizes all the formal features of the derivation with the fewest morphemes" (Siddiqi 2006: 14, 162)

The literature cited in (7) achieves the ungrammaticality not only of forms like **speak-ed*, which loses to the suppletive portmanteau **spoke*, but also of forms like the multiply exponed **spoke-d*. The principles in 7 rule out both on the same grounds.

In OCM, however, the situations of **speak-ed* and **spoke-d* are different. While **speak-ed* is never even a contender, thus far nothing in the analysis of *spoke* rules out the possibility of considering candidate **spoke-ed* on a subsequent cycle. On the cycle to which *spoke* is input, **spoke-d* would tie in terms of S-FAITH with the ID candidate. The tie could be broken in favor of the ID candidate by a constraint like *STRUC; this would be the right outcome in English. But other considerations, to be discussed shortly, might favor the redundantly affixed, multiple exponence candidate. This is the right outcome in some cases.

As Caballero & Inkelas (2013) point out, many languages require multiple exponence in their inflectional and even derivational morphology, making it undesirable to ban it with a universal principle like those in 7. One example discussed by Caballero & Inkelas is Archi (North Caucasian; Müller 2006, citing Kibrik 1991), in which an inner suffix encodes number, and an outer suffix in the same word encodes both number and case. Thus number is encoded twice, as illustrated by the ergative plurals in (8):[5]

[5]The allomorphy of the inner suffix is sensitive to noun class, thus to an L-feature of the type discussed in 5.

(8) Archi nouns

	Singular		Plural
a.	gel-li	c.	gel-um-čaj
	cup.SG-ERG.SG		cup-PL-ERG.PL
b.	qIonn-i	d.	qIinn-or-čaj
	bridge.SG-ERG.SG		bridge-PL-ERG.PL

Assessing the word globally, the existence of the inner plural suffix makes no sense and gratuitously violates principles like ECONOMY. Because plurality is sufficiently encoded by *-čaj*, the inner suffix ought to be dispensible, in the same way that the redundant past tense suffix in English is ungrammatical in **spoke-d*.

The analysis of Archi in Inkelas & Caballero (2013) attributes the multiple exponence seen in **??** to the bottom-up nature of word construction in OCM. On each cycle, the winning candidate is the best match for the S target, given the constructions available to attach to the input. Not all affixes can attach to all inputs. Availability is mediated by what Caballero & Inkelas (2013) call the Wordhood scale, i.e. the distinction between Roots, Stems and Words (see Selkirk 1982 and Inkelas 1990); these are related to the levels of LMP and to the rule blocks of A-morphous Morphology and Paradigm Function Morphology).

To see how OCM uses the Wordhood scale to motivate the redundant Archi plural affix in (8), consider the Constructicon fragment proposed by Caballero & Inkelas (2013) for Archi.

(9)

a.	[gel $]_{Root,Sem=CUP}$	Root
b.	[$]_{Root}$ -um $]_{Stem,\ \text{NUM=PL}}$	Converts root to stem, encodes plural
c.	[$]_{Root}$ Ø$]_{Stem}$	Converts root to stem, no associated meaning
d.	[$]_{Stem}$ -li $]_{Word,\ \text{CASE=ERG, NUM=SG}}$	Converts stem to word, encodes ergative singular
e.	[$]_{Stem}$ -čaj $]_{Word,\ \text{CASE=ERG, NUM=PL}}$	Converts stem to word, encodes ergative plural

The tableaus in (10)-(11), from Caballero & Inkelas (2013), show how the Constructicon and S-Faith interact to produce *gel-um-čaj*, whose S target is [SEM=CUP, NUM=PL, CASE=ERG. The first tableau shown assumes the selection of the root gel_{Root} on a previous cycle of evaluation. The relevant competition on this first affixation cycle is between the plural suffix *-um* (9b), and the null construction (9c), both of which convert roots to stems xxxxx.

(10)

<table>
<tr><td colspan="5">S target: [SEM=CUP, NUM=PL, CASE=ERG]</td></tr>
<tr><td colspan="5">Input P: [gel]$_{Root}$
Input S: [SEM=CUP]</td></tr>
<tr><td colspan="2">Candidate constructions</td><td>Candidates</td><td>MAX-S</td><td>DEP-S</td></tr>
<tr><td>→ a.</td><td>[[ ]$_{Root}$ -um]$_{Stem}$
NUM=PL</td><td>[gelum]$_{Stem}$
SEM=CUP
NUM=PL</td><td>*
CASE=ERG</td><td></td></tr>
<tr><td>b.</td><td>[[ ]$_{Root}$ Ø]$_{Stem}$</td><td>[gel]$_{Root}$
SEM=CUP</td><td>**!
NUM=PL
CASE=ERG</td><td></td></tr>
<tr><td>c.</td><td>ID</td><td>[gel]$_{Root}$
SEM=CUP</td><td>**!
NUM=PL
CASE=ERG</td><td></td></tr>
</table>

Because the ergative singular *-li* (9d) and ergative plural *-čaj* (9e) case suffixes select for Stem bases, they cannot combine directly with gel_{Root}, and thus are not possible candidates in (10). The output of (10), $gelum_{Stem}$ is of type Stem, and can combine with case on the subsequent cycle of affixation, seen in (11):

(11)

S target: [SEM=CUP, NUM=PL, CASE=ERG]

Input P: [gelum]$_{Stem}$

Input S: [SEM=CUP, NUM=PL]

	Candidate constructions	*Candidates*	MAX-S	DEP-S
→ a.	[[ ]$_{Stem}$ -čaj]$_{Word}$ NUM=PL CASE=ERG	[gelumčaj]$_{Word}$ SEM=CUP NUM=PL CASE=ERG		
b.	[[ ]$_{Stem}$ -i]$_{Word}$ NUM=SG CASE=ERG	[gelumi]$_{Word}$ SEM=CUP NUM=SG CASE=ERG	$*$! NUM=PL	$*$ NUM=SG
b.	ID	[gelum]$_{Stem}$ SEM=CUP NUM=PL	$*$! CASE=ERG	

In conclusion, OCM can generate multiple exponence through incremental word formation and S target matching. From a global perspective, multiple exponence is not always semantically motivated. From from a local-incremental perspective, it absolutely can be.

3 The conditioning of allomorphy in OCM

With this necessarily brief introduction of OCM, we arrive at the main topic of the paper: the key predictions that OCM makes about the directionality and locality of the conditioning of suppletive allomorphy. The term ‘suppletive allomorphy’ is used here for any allomorphy that is not the result of the application of phonological rules or constraints.[6]

The canonical situation of suppletive allomorphy would be two different entries in the construction—two different roots, or two different affixes—exponing exactly the same S-features, i.e. lexically listed allomorphs of one another. Canonical suppletive allomorphs differ in some phonological or lexical diacritic respect, but not in their meaning or function. The English suffixes *-ity* and *-ness*, as famously discussed by Aronoff (1976), are suppletive allomorphs of this kind. Both form nouns from adjectives, but differ in their etymological origin and hence are in complementary distribution in the English lexicon. *-ity* occurs with Latinate stems and *-ness* is the elsewhere case.

In practice, however, suppletive allomorphy is rarely this strictly defined. Often the term is used to refer to any situation in which a given syntactic or semantic property is exponed, throughout the grammar, by more than one affix. For example, it is common to refer to *mice* as an allomorph of *mouse*, since both expose the meaning MOUSE. The *mice* allomorph happens also to explone plurality. In the discussion of allomorphy that follows, we will use this looser understanding of the term in our discussion of allomorphy which is conditioned by S and L properties.

S allomorphy is sensitive to the syntactic and semantic properties that comprise S targets. The *mouse*∼*mice* allomorphy falls into this category. The *mice* allomorph of MOUSE is selected when the S target contains [num=pl]; *mouse* is selected otherwise. L-allomorphy is sensitive to diacritic (syntactically and semantically empty) features which define classes of morphemes and play a role in the organization of morphological systems.[7]

In the discussion of allomorphy, we will focus on the parameters of directionality and locality, which have been the focus of considerable recent work in the framework of Distributed Morphology (see, e.g., Siddiqi 2006, Embick 2010, Arregi & Nevins 2012, Harley (to appear), and the papers in this volume by Harley, Tubino Blanco & Haugen and by Gribanova and Harizanov).

[6]This definition is not simple to apply, as linguists often differ over whether a given case of allomorphy is suppletive or derived by highly specific phonological rules. In either case, however, similar issues of locality and directionality still pertain; see e.g. recent discussion by Embick (2010, this volume), Harley & Tubino Blanco (2013), and Buckley (this volume). The boundary between suppletion and phonology may ultimately not materially affect the general issues of locality and directionality discussed in this paper.

[7]In addition to these types, P-conditioned allomorphy is sensitive to phonological properties of the input (or output). We will focus in this paper mainly on the S vs. L comparison (though see section 7 for some discussion of P-conditioning).

In brief, OCM predicts L-conditioned allomorphy to be strictly inside-out in nature (a prediction also made in the Distributed Morphology framework by Bobaljik (2000); see section 6). L features are introduced into the representation by root or affix constructions; they are not present in S targets. Since word construction is bottom up, L-conditioned allomorphy will always be exhibited by affixes which are sensitive to L properties of the bases they attach to. L conditioning is strictly local in some cases, and nonlocal in others; the difference has to do with the 'percolation' properties of L features in the particular situation. By contrast, because S targets are ever-present, OCM imposes no such restrictions on the structural proximity of those affixes exposing the same S-feature.

(12) Directionality and locality predictions in OCM

S-conditioned allomorphy	L-conditioned allomorphy
Outside-in and inside out, no linear locality	Inside out only, linear locality required on a case-by-case basis

Section 4 explores S conditioning, while section 5 explores L conditioning. Section 6 compares and contrasts the predictions in (12) with those of DM.

4 S Conditioning

In a theory like DM, S conditioning consists of the sensitivity of inserted vocabulary items to features in the syntactic structure. It is possible to formulate hypotheses about the structural relationship between the conditioning features and the inserted morphemes. Bobaljik (2000) has proposed, for example, that (the equivalent in DM) of S conditioning is always triggered by a node higher in the syntactic structure. Embick (2010) has claimed that the conditioning node must be adjacent, as it is in the examples of irregular past tense and plural allomorph conditioning illustrated below. For Embick, the insertion of the *spoke* allomorph is conditioned by the structurally local (past) tense head, and the insertion of *mice* is conditioned by the structurally local (plural) number head.[8]

(13) a. [speak] SEM=SPEAK, SYN=V
[spoke] SEM=SPEAK, SUN=V, TENSE=PAST
b. [mouse] SEM=MOUSE, SYN=N
[mice] SEM=MOUSE, SYN=N, NUM=PL

In OCM, S conditioning is not accomplished by another morpheme in the structure. It is accomplished by the S target, which is ever-present and accessible throughout the derivation. The syntactic structure of a word is not given beforehand or constrained by universal syntactic principles. It emerges as a result of the cyclic addition of morphological constructions. As in other lexicalist approaches, the hierarchical structure of a word reflects its derivational history. In OCM, therefore, a feature such as NUM=PL or TENSE=PAST is available from start to finish. This differs from Bobaljik's assumption in DM that once a feature is exponed, it is 'rewritten' or erased from structure and cannot condition later allomorphy. It also differs from Embick's assumption that S features which condition allomorphy must be structurally local (adjacent and in the same phase) as the target allomorph.

OCM thus predicts that a given property of the S target can condition allomorph selection through a word, regardless of structural distance from the morphological position which is descriptively associated with the primary exponent of that property (the head associated with those features, in a DM approach).

The elaborate system of S-conditioned suppletive allomorphy in Totonac de Filomena Mata, to which we now turn, illustrates this prediction.

[8] In the lexical entries in (12) for these roots, I have chosen to leave *speak* unspecified for tense, given that it is used in nonfinite forms; similarly I leave mouse unsepecified for number. It would also be possible to specify *speak* and *mouse* with the opposite value for the S property distinguishing its complement allomorph (a practice used e.g. by Siddiqi 2006:75).

4.1 Totonac de Filomena Mata

In the verbal system of Totonac de Filomena Mata (TFM; McFarland 2009), the S property of second person subject conditions suppletive allomorphy in roots and various suffixes.[9] Example (14) illustrates root allomorphs (McFarland 2009:130):

(14)

	2nd person allomorph	'Elsewhere' allomorph
'go'	pin	'an
'come'	tan	min
'hear'	qašpat	qašmat
'lying down'	paa	maa

2nd person subject is also encoded, in the plural, by the dedicated 2nd person plural suffix -*tit̥i* (15a,b). In the singular it is encoded with two suppletive allomorphs that are phonologically distributed: the suffix -*t̥i* on stems whose last vowel is stressed (15c); and glottalization otherwise (15d).

Below are some examples from McFarland 2009:

(15)

a. *qašpátit̥i*
qašpát-tit̥i
hear2-2SUB.PL
'you p. heard it' [34]

b. *kapíntit̥i*
ka-pin-tit̥i
IRR-go2-2SUB.PL
'leave!' [116]

c. *katát*
kan-tan-t̥i
IRR-come2-2SUB.SG
'come!' [[201]

d. *tapaaníit'a*
ta-paa-niita-[cg]
MID-lying2-PFT-2SUB.SG
'you have lain down' [128]

As we will see in section 4.1.2, other suffixes also exhibit 2nd person allomorphs. We will discuss these, as well as intervening nonparticipating suffixes (section 4.1.1), shortly. First, we sketch

[9] TFM (Totonac-Tepehua) is spoken in Filomeno Mata, a village in Veracruz, Mexico. The data cited here come from original fieldwork, reported and analyzed in McFarland 2009.

an analysis within OCM in which both root allomorphy and 2nd person-number suffix selection are both triggered by the same S property, namely SUBJ.PERS = 2.

If the S target contains the specification SUBJ.PERS=2, then given a choice between two otherwise semantically equivalent root allomorphs, S-FAITH mandates the selection of the root allomorph which (also) expones 2nd person.[10] Tableaus (16) and (17) illustrate the derivation of (15a), *qašpátiti̥* 'you p. heard it'. Tableau (16) illustrates root selection:

(16)

S target: [SEM=HEAR, SUBJ.PERS=2, SUBJ.NUM=PL, TENSE=PAST]				
Input P: Ø Input S: Ø				
Candidate constructions		*Candidates*	MAX-S	DEP-S
→ a.	*qašpat*	[qašpat] SEM=HEAR SUBJ.PERS=2	∗ SUBJ.NUM=PL TENSE=PAST	
b.	*qašmat*	[qašmat] SEM=HEAR	∗∗! SUBJ.PERS=2 SUBJ.NUM=PL TENSE=PAST	

Tableau (17) illustrates the addition of the dedicated 2nd person plural suffix, which increases the number of S properties matched by the winning candidate, (17a). For comparison, a 2nd person singular suffix is also shown in candidate (17b):

[10] As mentioned earlier, I am assuming that the 'elsewhere' allomorph is not specified for the S property that conditions the other, here, SUBJ.PERS=2. However, this is entirely negotiable. See Siddiqi (2006) on 'incompatibility' features (e.g. SUBJ.PERS≠2 that could be specified on the 'elsewhere' allomorph if desired. Candidate (b) loses regardless of whether it is unspecified for subject person or specified as being SUBJ.PERS≠2 and so I have gone with the underspecification approach, for notational simplicity.

(17)

S target: [SEM=HEAR, SUBJ.PERS=2, SUBJ.NUM=PL]

Input P: [qašpat]

Input S: [SEM=HEAR, SUBJ.PERS=2]

	Candidate constructions	*Candidates*	MAX-S	DEP-S
→ a.	[[ ] -tit̥i] SUBJ.PERS=2 SUBJ.NUM=PL	[qašpatit̥i] SEM=HEAR SUBJ.PERS=2 SUBJ.NUM=PL		
b.	[[ ] -t̥i] SUBJ.PERS=2 SUBJ.NUM=SG	[qašpat̥i] SEM=HEAR SUBJ.PERS=2 SUBJ.NUM=SG	∗! SUBJ.NUM=PL	∗ SUBJ.NUM=SG
c.	ID	[qašpat] SEM=HEAR SUBJ.PERS=2	∗! SUBJ.NUM=PL	

4.1.1 Intervening transparent suffixes

In examples (15a-c) and the illustrative table in (17), the suppletive root allomorph and the 2nd person suffix are structurally adjacent, as predicted by Embick (2010) for the equivalent of S-conditioned allomorphy in DM. However, a key aspect of the TFM data is that other suffixes can intervene between the root and the 2nd person agreement suffixes without any effect on allomorphy. This is illustrated in (18), where the morphemes participating in 2nd person subject exponence are bolded:

(18) a. *pímpar'ḁ*

pin=para-ti̥

go2-IMPF-**2SUB.SG**

'you went again' [46]

b. *tapaaníit'ḁ*

ta-paa-niita-[cg]

MID-**LYING2**-PFT-**SUBJ.SG**

'you have lain down' [128]

c. *štitamparátiti̥*

š-ti-tan-para-titi̥

PAST-CNTR-**come2**-ITER-**2SUB.PL**

'you pl. should have returned' [129]

d. *štitankutumparátiti̥*

š-ti-tan-kutun-pará-titi̥

PAST-CNTR-**come2**-DES-ITER-**2SUB.PL**

'you pl. should have come again' [145]

The existence of transparent morphology (marking imperfective, perfective and iterative aspect, and desiderative mood, in (18))—intervening between the elements participating in suppletive allomorphy is not surprising in OCM. The force driving the selection of the 2nd person subject root and suffix allomorphs is the S target, which is available throughout the derivation, and able (via S-Faith) to play a role in any or all tableaus. The S target is a constant; it does not change as a word is built up. Unlike in (some versions of) DM, there is no notion of 'discharge' or 'erasure' of features after a cycle of exponence (cf. Bobaljik 2000 or Embick 2010). Therefore the prediction of OCM is that the same S property can trigger allomorphy in any or all layers of the same word. In the examples in (18), both root and distant suffix allomorph are responding to the same S-conditioning.

The tableaus in (19) and (20) illustrate the derivation of one such case /pin-para-t̥i/ '**go2**-IMPF-**2**SUB.SG = you went again' (18a). The tableau in (19) takes as its starting point the output of a tableau comparable to that in (16), which selects the 2nd person allomorph of the root. Tableau (19), with root *pin* 'go' as input, compares three candidates: the addition of the imperfective (19a), the addition of a perfective (19b) (McFarland 2009:42, 57) as a straw man competitor, and the identity candidate (19c):[11]

[11] Another candidate to consider would be the addition of 2nd person subject agreement, as in tableau (17). In TFM (as in most languages), aspect suffixes must precede subject agreement; therefore some independent means of ordering affixes would need to be put in place to ensure that the imperfective is added first. There are multiple ways to accomplish this in OCM, including stem type, as in the earlier analysis of Archi and the upcoming discussion of Breton, in section 7. Affix ordering is not the focus of the present paper, and lack of space prevents further discussion here. See, however, Inkelas (in prep.)

(19)

S target: [SEM=GO, ASP=IMPF, SUBJ.PERS=2, SUBJ.NUM=SG]				
Input P: [pin] Input S: [SEM=GO, SUBJ.PERS=2]				
	Candidate constructions	*Candidates*	MAX-S	DEP-S
→ a.	[[ ]$_V$ -para] ASP=IMPF	[pimpara] SEM=GO SUBJ.PERS=2 ASP=IMPF	∗ SUB.NUM=PL	
b.	[[ ]$_V$ -niit̥a] ASP=PRFT	[piniit̥a] SEM=GO SUBJ.PERS=2 ASP=PRFT	∗∗! ASP=IMPF SUBJ.NUM=PL	∗! ASP=PRFT
c.	ID	[pin] SEM=GO SUBJ.PERS=2	∗∗! ASP=IMPF SUBJ.NUM=PL	

The output of this tableau, *pimpara* (19a), serves as input to a subsequent tableau (20) in which the only remaining S-Faith discrepancy is repaired by adding the 2nd person plural subject agreement suffix:

(20)

S target: [SEM=GO, ASP=IMPF, SUBJ.PERS=2, SUBJ.NUM=SG]				
Input P: [pimpara] Input S: [SEM=GO, ASP=IMPF, SUBJ.PERS=2]				
	Candidate constructions	*Candidates*	MAX-S	DEP-S
→ a.	[[ ] -t̥i] SUBJ.PERS=2 SUBJ.NUM=SG	[pimparat̥i] SEM=GO ASP=IMPF SUBJ.PERS=2 SUBJ.NUM=SG		
b.	ID	P=[pin] SEM=GO ASP=IMPF SUBJ.PERS=2	∗! SUBJ.NUM=SG	

4.1.2 Intervening participating suffixes

We turn next to examples in which other suffixes, occurring between the root and the 2nd person subject suffix, themselves exhibit suppletive allomorphy conditioned by 2nd person subject. Four such suffixes are listed below:

(21)

	2nd person allomorph	Other allomorph
PROG(RESSIVE)	-paa	-maa
DOWN	-pii	-mii
HERE	-čit̥a	-č̥i
THERE	-p̥i	-ča'ḁ

Examples are given in (22). Note that some of these examples also include transparent intervening suffixes (22c,e).

(22)

	PROG2		PROG
a.	*laalaaqtsimpáatit^{h}i̥*	b.	*liičiiwinamáaw*
	laa-laaqtsin-paa-titi̥		lii-čiiwinan-maa-wḁ
	REC-see-**PROG2-2SG.PL**		INST-talk-**PROG**-1SUB.PL
	'you (pl) are looking at each other [57]'		'we are talking about it' [54]
c.	*šwaayampaaqóotots'*	d.	*łkaaknamaapá*
	š-waa-nan-paa-qoo-titi-ts'a		łkaak-nan-maa-para
	PAST-eat-HAB-**PROG2**-TOT-**2SUB.PL**-YA		heat-HAB-**PROG**-ITER
	'you pl. were already finishing eating [122]'		'it's hot again' [46]
	DOWN2		DOWN
e.	*tankaapíiya (kiw'I)*	f.	*'akłkanuumíi*
	tan-kaa-**pii**-aa (kiw'I)		ak-łka-nuu-mii
	REAR-cut-**DOWN2**-IMPF-**2SG.SG** (tree)		HEAD-measure-**DOWN**
	'you cut down the tree' [130]		'he passed him (in weeding)' [191]
	THERE2		THERE
g.	*waayámpi*	h.	*ta'aktayaa(n)čá'a*
	waa-nan-pi-ti̥		ta-akta-aa-ča'ḁ
	eat-HAB-**THERE2-2SUB.SG** (tree)		MV-descend-IMPF-**THERE**
	'you ate over there' [130]		'he lands over there' [49]
	HERE2		HERE
i.	*kiitantliiyaačitátiti̥*	j.	*hkiiwaayánči̥*
	kii-tantlii-aa-čita-titi̥		k-ki-waa-nan-či̥-li̥
	RT-dance-IMPF-**HERE2**-2SUB.PL		1SUB-RT-eat-HAB-**HERE**-PFTV
	'you pl. only come for a moment to dance' [49]		'I came here to eat and returned' [143]

It is even possible for the same verb to exhibit three participating suffixes:

(23) a. *tankaapiipítiti n (kiw'I)*

tan-kaa-**pii-pi-titi̥** (kiw'I)

REAR-cut-**DOWN2-THERE2-2SUB.PL** (tree)

'you cut the tree down over there' [130]

b. *kaa'aktlawapípaaṭi̥*

kaa-ak-tlawa-pii-paa-ṭi̥

OBJ.PL-HEAD-do-**DOWN2-PROG2-2SUB.SG**

'you are mistreating them' [191]

Finally, in (24) we see examples of verbs in which the root and more than one suffix all encode 2nd person subject. These verbs exhibit extreme, or what Harris (2008) has termed 'exuberant', multiple exponence, all driven by faithfulness to the S property SUBJ.PERS=2:

(24) a. *ímpaaṭi̥*

pin-paa-ṭi̥

go2-PROG2-2SUB.SG

'you are going' [44]

b. *tapáaipaaṭ̥*

ta-**paa-paa-ṭi̥**

INC-**lying2-PROG2-2SUB.SG**

'you are (in the process of) lying down' [110]

c. *łaatooqašpátpaaṭi̥*

łaa=tuu=**qašpátp-paa-ṭi̥**

NEG-INT-**hear2-PROG2-2SUB.SG**

'you aren't listening' [130]

d. *šqašpatpáap^{h}ti̥*

š-**qašpat-paa-p^{h}i̥-ti̥**

PAST-**hear2-PROG2-THERE2-2SUB.SG**

'you were listening over there' [54]

All of these examples of suppletive allomorphy yield to the same OCM analysis given above in sections 2.3 and 4.1: each layer of morphology is responding, independently, to the same S target.[12]

For multiple exponence to be possible, a language must have multiple constructions each mentioning the same S property. Multiple exponence occurs when more than one of those constructions is selected in the course of cyclically, incrementally optimizing the match between candidate outputs and the S target. Multiple exponence is therefore an excellent source of information on the

[12]Not explained in this section is why the 'default' allomorph of the suffixes in (15) doesn't attach when the input stem already possesses the 2nd person subject feature. In such cases, it would seem that the 2nd person allomorph or the default allomorph of the suffix would be equally good, since adding [SUBJ.PERS = 2] to a stem already possessing it changes nothing. The solution is either to specify the apparent default affixes with a contradictory feature, as in footnote 9, or to adopt a Paninian principle to the effect that the affix with more specific featural specifications is preferred to the affix with fewer featural specifications, all else being equal. We leave this question open here.

distribution of S-conditioned allomorphy.

5 L Conditioning

Some suppletive allomorphy is conditioned not by S features but by diacritic features, often called lexical features because they distinguish lexical roots or affixes from one another and are not relevant to "post-lexical", or syntactic, distributional generalizations. In this paper we will call them L FEATURES.

To illustrate L feature conditioning with a familiar example, consider plural formation in German. Nouns are partitioned into a number of classes, some phonologically or semantically characterizable but others purely arbitrary, each of which forms plurals in a distinctive way (see e.g. Marcus et al. 1995 for discussion). For example, the masculine count noun *Turm* 'tower' forms its plural through umlaut and -*e* suffixation, while the masculine count noun *Wurm* 'worm' pluralizes using umlaut and -*er*. Many other patterns exist, including just umlaut:

(25)

Umlaut + -*e* plurals	Umlaut + *er* plurals	Umlaut alone
Turm, Türm-e 'tower(s)'	*Wurm, Würm-er* 'worms'	*Mantel, Mäntel* 'coat(s)'

To capture unpredictable distinctions such as these, any theory is obligated either to list the plurals lexically (giving up on any generalization) or to index the roots using an L feature to which one of the competing plural-forming constructions is sensitive. Paradigmatic effects described as conjugation or declension class and many things in the category of 'noun class' or nonsemantic 'gender' must be viewed in the same way.

Another phenomenon of this type is what Hammond (1992) has termed 'potentiation' and others call 'niches of productivity', i.e. affixes which only productively attach to stems formed by specific other affixes. Fabb (1998) collects a number of such examples from English (see also Hay & Plag 2004).

L features are not part of S targets; unlike S properties, they do not define principled syntactic or semantic categories that are part of the meaning or syntactic structural role of words, such as part of speech, semantic gender, animacy, valence, etc. L features are therefore not governed by S-Faith. They exist as properties of individual lexical constructions (roots, affix constructions, etc.), and they enter the derivation with their construction. Whether L features are relevant to subsequent layers of morphology is subject to two conditions: whether the subsequent layers of morphology select for the L feature to begin with, and whether or not L features percolate up through layers of intervening morphology.

In OCM, feature percolation is not automatic; it follows from the way constructions are stated. The schematization below contains all three logically possible relationships for a given feature F between mother (output) and daughter (input) nodes in a bilevel construction. The mother may agree with the F specification of its input ("Percolation'); the mother node may specify its own a constant value for F ("Exocentricity'); or neither, in which case the output is unspecified for the relevant feature:

(26)

	"Percolation/Endocentricity"	"Exocentricity"	Percolation failure
Mother (output)	αF	βF	(ØF)
Daughter (input)	αF	αF	αF

This relationship can be parameterized for each construction, thus permitting language-internal distinctions such as that pointed to by Lieber (1980) for English, which contrasts exocentric part-of-speech-changing derivational affixes such as noun-forming *-ity* (*scarce*$_{Adj}$ $\rightarrow$ *scarcity*$_N$) or verb-forming *en-* (*mesh*$_N$ $\rightarrow$ *enmesh*$_V$) with the endocentric derivational prefix *counter-*, which can go on verbs, nouns, and adjectives and preserves part of speech: *counter-argument*$_N$, *counter-intuitive*$_{Adj}$, *counter-act*$_V$). It can also be parameterized for the language as a whole, by means of a metaconstruction from which each individual construction can inherit (see e.g. Riehemann 1998, 2001).

In the next two sections, we will see that Nimboran (section 5.1) and Nanti (section 5.2) employ different parameter settings for feature percolation. This is relevant for L features, which enter the derivation as part of a root or affix, and condition subsequent allomorphy if and only if they percolate high enough in the structure to be accessible to later layers of affixation. Nanti (ir)realis allomorphy, in section 5.2, shows generalized percolation of the relevant L feature. As a result, L feature conditioning has the appearance of being nonlocal. Nimboran tense allomorphy, in section 5.1, does not exhibit percolation of the relevant L feature, and thus can only be locally triggered. The trigger (lexical possessor of the L feature) and target (allomorph sensitive to its presence in the base) must be strictly adjacent in order for L-conditioning to take place.

While the trigger-target relationships in these two example differ in whether or not intervening affixes are transparent, they share the trait of being 'inside-out' in nature. The allomorphic target will always occupy an outer layer of morphology, relative to the trigger.

5.1 Nimboran L Conditioning

In Nimboran (Irian Jaya, Papuan; Anceaux 1965), a three-way suppletive allomorphic alternation in tense suffixes is conditioned by the presence of certain other suffixes in the verb. The allomorphy is illustrated below. (A fourth tense, Past, marked by the suffix *-k*, does not exhibit allomorphy.)[13]

(27)

	I	II	III
Future:	*-d-*	*-r-*	*-r-*
Present:	*-t-*	*-Ø-*	*ná*
Recent Past:	*-p-*	*-Ø-*	*ná*

Class I (the default), II and III allomorphs are conditioned by the preceding Deictic suffix, if any. A nearly complete affix order template is given below, to illustrate the relative position of Deictic suffixes (the triggers of allomorphy) and Tense suffixes (the targets):[14]

[13] Anceaux distinguishes only Class I and Class II tense suffixes and analyzes the *ná* of Class III as an allomorph of what are here analyzed as the Class III-triggering deictic markers (pp. 76-79).

[14] According to Inkelas (1993), the Durative also occupies Position 2. Missing from the template is the category of particles, which occur in positions 2-6 and possess idiomatic meaning in combination with roots. Particles have no

(28)

0	1	2	3	4	5	6	7	8
root	Plural subject	Dual subject, Plural	Masc. object, Durative	Incl. Dual subject	Deictic	Iterative	Tense	Subject
					Trigger		*Target*	

Nimboran has 14 overt Deictic suffixes which encode portions of the logical space defined by five points (here, there, above, below, far away). Verbs lacking an overt Deictic suffix are interpreted as taking place 'here'; one could, following Anceaux (1965), assume a null suffix.

(29) Deictic suffixes

Class I trigger		Class II trigger		Class III trigger	
-Ø	'here'	*-bá*	'above'	*-bená*	'from below/there/ far away to above'
-be	'from here to above'	*-ŋá*	'below'	*-sená*	'from below to there'
-se	'from here to there'	*-sá*	'there'	*-kené*$_A$	'from above/below/ there to far away'
-se$_A$	'from here to below'	*-ná*	'far away'	*-sené*$_A$	'from there/above/far away to below/there'
-ne	'from here to far away'				
-kaN$_A$	'from above/far away to here'				
-báN	'from below to here'				
-sáN	'from there to here'				

If a Class I-triggering Deictic (Dx) suffix is present (30a,b), or if no overt Deictic suffix is present (30c), tense suffixes assume their Class I forms. If the Deictic slot is occupied by a Class II-triggering Deictic suffix, then tense suffixes of class II are used, as in (31). If, on the other

effect on tense suffix allomorphy. Inkelas (1993) argues for a hierarchical structured template rather than the linearly structured one which is graphically easier to display and appears in (28), but on either templatic analysis, only the iterative intervenes structurally between Deictic and Tense suffixes.

hand, a Class III Deictic suffix is present, as in (32), we find Class III tense suffixes instead. Page numbers refer, here and throughout this section, to Anceaux (1965):

(30) a. [ŋgedóisiedú]

ŋgedói-i-**se-d**-u

draw.pl-PLSUBJ-**DX$_{\mathrm{I}}$-FUT$_{\mathrm{I}}$**-1.SUBJ

‘We (many will draw from here to here’ [A188]

b. [prṕtembetɨ́]

príb-tem-**be-t**-u

throw-DUR-**DX$_{\mathrm{I}}$-PRES$_{\mathrm{I}}$**-1.SUBJ

‘I am throwing (him) from here to above’ [A108]

c. [ŋgedóukedú]

ŋgedóu-k-**d**-u

draw-DUSUBJ-**FUT$_{\mathrm{I}}$**-1.SUBJ

‘We two will draw (here)’ [A186]

(31) a. [ŋgedúobáu]

ŋgedúo-**bá-Ø**-u

draw.sg-**DX$_{\mathrm{II}}$-PRES$_{\mathrm{II}}$**-1.SUBJ

‘I draw above’ [A186]

b. [rekéirebáram]

rekéi-k-re-**bá-r**-am

turn-DUSUBJ-PART-**DX$_{\mathrm{II}}$-FUT$_{\mathrm{II}}$**-3M.SUBJ

‘They two (m.) will turn above’ [A130]

(32) a. [ŋgedúosenanáe]

ŋgedúo-**sená-ná**-e

draw.sg-**DX$_{III}$-PRES$_{III}$**-2.SUBJ

'You (sg) draw from below to there' [A192]

b. [tóuŋkepebananám]

tóuN-k-pe-**bená-ná**-am

rise-DUSUBJ-PART-**DX$_{III}$-PRES$_{III}$**-3M.SUBJ

'they two (m.) rise to the surface from there to above' [A127]

We can represent the Deictic suffixes, which introduce L features, and the Tense suffixes, whose lexical entries select for these L features, as in (33):

(33)

[[ ] Ø]$_{\text{I,HERE}}$	Class I-forming Deictic suffix
[[ ] be]$_{\text{I,FROM HERE TO ABOVE}}$	Class I-forming Deictic suffix
[[ ] bá]$_{\text{II,ABOVE}}$	Class II-forming Deictic suffix
[[ ] sená]$_{\text{III,FROM BELOW TO HERE}}$	Class III-forming Deictic suffix
[[ ]$_{\text{I}}$ be]$_{\text{PRES}}$	Class I present tense suffix allomorph
[[ ]$_{\text{II}}$ Ø]$_{\text{PRES}}$	Class II present tense suffix allomorph
[[ ]$_{\text{III}}$ ná]$_{\text{PRES}}$	Class III present tense suffix allomorph

5.1.1 Intervening suffixes: evidence for strict locality

Exactly one suffix can potentially separate Deictic from Tense suffixes: the Iterative. As shown below, the Iterative prevents the Tense suffixes from sensing the presence of Class II or III L features on the lower stem. Instead, all Iterative stems take the default Class I Tense allomorphs (Anceaux 1965:186-201):[15]

[15]Regular morphophonological alternations result in some additional allomorphy in the Iterative verbs; this can be disregarded.

(34)	a.	[ŋgedúotu]	[ŋgedúokátu]
		ŋgedúo-**t**-u	ŋgedúo-ká-**t**-u
		draw.sg-**PRES**$_{\mathbf{I}}$-1.SUBJ	draw.sg-ITER-**PRES**$_{\mathbf{I}}$-1.SUBJ
		‘I draw (here)’	‘I draw repeatedly (here)’
	b.	[ŋgedúobáu]	[ŋgedúobekátu]
		ŋgedúo-**bá-Ø**-u	ŋgedúo-**bá**-ká-**t**-u
		draw.sg-**DX**$_{\mathbf{II}}$-**PRES**$_{\mathbf{II}}$-1.SUBJ	draw.sg-**DX**$_{\mathbf{II}}$-ITER-**PRES**$_{\mathbf{I}}$-1.SUBJ
		‘I draw above’	‘I draw repeatedly above’
	c.	[ŋgedúosenanáu]	[ŋgedúoseneŋgáte]
		ŋgedúo-**sená-ná**-u	ŋgedúo-**sené**-ká-**t**-u
		draw.sg-**DX**$_{\mathbf{III}}$-**PRES**$_{\mathbf{III}}$-1.SUBJ	draw.sg-**DX**$_{\mathbf{III}}$-ITER-**PRES**$_{\mathbf{I}}$-1.SUBJ
		‘You (two) draw from below to there’	‘You (two) draw repeatedly from below to there’

The opacity introduced by the Iterative suggests that the Iterative fails to allow the L feature to percolate from a lower Class II or Class III Deictic suffix. If we revisit the parameterization options presented in (26), Nimboran Iteratives are either ‘exocentric’ (specified for the Class I L feature) or they simply do not permit percolation of the L feature.

5.1.2 Interim summary

Thus far Nimboran is exhibiting what OCM predicts: an L feature, introduced by a construction selected after one dip into the constructicon, is present in the featural description of the stem formed by that construction, and can influence the selection of the immediately outer layer of morphology. This influence takes place via satisfaction of input selectional restrictions.

L conditioning in Nimboran appears to be strictly local (occurring between linearly adjacent morphemes or hierarchically adjacent layers of morphology). However, Nanti shows that the locality condition on L conditioning does not always obtain. This is because of percolation.

5.2 Nanti L Conditioning

In Nanti (Peru; Arawak, Kampan; Michael 2008), realis and irrealis suffixes exhibit suppletive allomorphy which is triggered by a subset of verb roots as well as by certain affixes which are layered between the root and the (ir)realis morphology. This is classic L conditioning, since the triggers do not form a syntactic or semantic natural class. In Nanti, unlike Nimboran, intervening affixes are transparent to the conditioning.

The suppletive (ir)realis suffix allomorphs in question are listed below (Michael 2008:250). (Note the multiple exponence introduced by the prefixal *N-*; this will not be discussed here.)

(35)

	Realis	Irrealis
A-class	-a	N- -eNpa
I-class	-i	N- -e

A rough Nanti verb template is given in (36), from Michael 2008:248-249. A bird's-eye view of the verb (top row) is followed by a close-up view of the (bolded) inflectional suffix zone:

(36) Subject clitics = irrealis - causative - ROOT - derivation - **inflection** = object clitics

<table>
<tr><th>VERB QUANTIFIER</th><th>ARGUMENT NUMBER</th><th>DIRECTIONAL</th><th>ASPECT</th><th>REALITY STATUS</th></tr>
<tr><td rowspan="2">-uma extreme
-bage durative
-asano complete
-na malefactive
repetitive</td><td rowspan="2">-hig plural
-ge distributive</td><td>-an ablative
-apah adlative
-ab semantic transitivizer</td><td>-ak perfective</td><td rowspan="2">-i/-a realis
-e/-eNpa irrealis</td></tr>
<tr><td colspan="2">-ah regressive (perfective)
-ut returnative (perfective)
-aki translocative (perfective)
-aa translocative (imperfective)</td></tr>
</table>

Michael (2008) explains that A-class and I-class suppletion in the (ir)realis suffixes is conditioned by certain roots and suffixes. Most suffixes are neutral, or transparent, to this distinction, allowing the conditioning effect of a preceding morpheme to pass through them to the following realis suffix. According to Michael, “If a stem includes multiple verb-class altering suffixes, the rightmost suffix determines the ultimate verb class of the stem.”

The following example illustrates the contrast between I-class (37a-b) and A-class (37c-d) verb roots. In these examples the irrealis suffix is adjacent to the root:

(37) a. hirikero

ahirik-e=o

hold.I-IRREAL.I-3nmO

‘Hold it!’ [245]

b.

tera	noNkeme
tera	no-N-**kem-e**
NEG.REAL	1S=IRREAL-**hear.I.IRREAL.I**

‘I did not hear’ [144]

c. geNparo

oog-eNpa=ro

consume-A-IRREAL.A=3mO

‘Eat it!’ [243]

d.

tyani	shiNtaro	magashipogo
tyani	**ashiNt-a**=ro	magashipogo
who	**own.A-REAL.A**=3nmO	mature.garden

‘Who owns this mature/abandoned garden?’ [396]

A formerly productive process, still robust in the closely related language Matsigenka, derived reflexives by converting an I-class verb to A-class, and a few roots in Nanti retain both an I-class and an A-class allomorph (Michael p.c.). However, in Nanti the I-class/A-class distinction is lexicalized and unpredictable; it is a clear L property.

5.2.1 Intervening suffixes: the case for non locality

Many Nanti suffixes are neutral to the L distinction, permitting the root to their left to condition (ir)realis allomorphy to their right. Example (38) illustrates perfective *-ak*. The I-class root *tag* 'burn' conditions I-class (ir)realis allomorphy (38a); the A-class roots *seka* 'eat' (38b), *ashiNti* "own', and *peg* 'get lost' (38c) condition A-class allomorphy. The presence of an intervening perfective does not affect this conditioning:

(38) a. nonehiri

o=N-**tag**-ak=**e**

3nmS=IRREAL-**burn-I**-PERF-**IRREAL.I**

'It will burn' [223]

---

b. nosekataka iNkahara

no=**seka**-ak-**a** iNkahara

1S=**eat.A**-PERF-**REAL.A** earlier

'I ate earlier' [254]

c. pashiNtakeNpa magashipogo

pi=**ashiNt**-ak-**eNpa** magashipogo

2S=**own.A**-PERF-**IRREAL.A** garden

'You will own the garden' [345]

d. ompegaksempa

o=N-**peg**-ak=**eNpa**

3nmS=IRREAL-**burn-I**-PERF-**IRREAL.A**

'She will get lost' [223]

The indirective applicative *-ako* is also transparent. It preserves root-controlled A-class conditioning in (39a) and root-controlled I-class conditioning in (39b-d), where it co-occurs with transparent perfective *-ak*: [16]

(39) a. shintakota[ro] (cf. (37d)

shiNt-ako-**o**=ro

own.A-APPL:INDR-**REAL.A**=3NMO

'owns it' [354]

---

b. maganiro yamutakena

maganiro i=**amu**-ak-**i**=na

all.ANIM emS=**help.I**-PERF-**REAL.I**=1O

'Everyone helped me' [317]

c. Reho **amu**-ako-ak-**i**

persona.name **help.I**-APPL:INDR-PERF-**REAL.I**

'Reho helped out' [345]

d. nokemakotakeri

no=**kem**-ako-ak-**i**=ri

1S=**hear.I**-APPL:INDR-PERF-**REAL.I**=3mO

'I heard about him' [288]

5.2.2 L-triggering suffixes

Some Nanti suffixes themselves bear the L features that condition (ir)realis allomorphy. Frustrative *-be* (40b) and instrumental *-ant* (41b) trigger A-class realis allomorphy, as seen by comparing these examples with those in (40a) and (41a), in which the same verb rootsconditions I-class allomorphy. Note that the conditioning suffixes precede (are layered inside, closer to the root than) the target suffixes, as predicted in OCM:

[16] Michael (2008) classifies *-ako* as an I-class suffix, based on example (6.126): *i=kis-ako-ak-i=ro* '3mS=be.angry-APPLE:INDR-PERF-REAL.I-3NMO'. However, subsequent reanalysis (Michael p.c.) attributed the I-class realis allomorphy in this verb to the I-stem *kis*. This permits *-ako* to be classified as neutral, as supported by the data in (39).

(40) a. nonehakeri

no=**neh**-ak-**i**=ri

1S=**see.I**-PERF-**REAL.I**-3MO

'I saw him' [355]

---

b. nonehabetakari

no=**neh-be**-ak-**a**=ri

1S=**see.I-FRUS.A**-PERF-**REAL.A**=3MO

'I saw him (but without the expected result)' [251]

(41) a. nonseroNkakotakero hetsiki

no=**seroNk**-ako-ak-**i**=ro hetsiki

1S=**slice.I**-APPL:INDIR-PERF-**REAL.I**=3MO fruit. sp.

'I sliced the *hetsiki* fruit off (the branch)' [251]

---

b. yoseroNkaNtakaro

i=**oseroNk-aNt**-ak-**a**=ro

3mS=**slice.I-APPL:INST.A**-PERF-**REAL.A**-3NMO

'He carved with it (a knife)' [285]

Example (42b) illustrates regressive *-ah*, which triggers I-class allomorphy (compare to (42a), in which the A-class root determines realis allomorphy):[17]

[17] Michael (2008) notes (fn. 29) that the addition of the regressive, in (42b), implies that 'the the place in question is one that the subject frequently or habitually returns to, such as a home'.

(42) a. nopigaka

no=**pig**-ak-**a**

1S=**return.A**-PERF-**REAL.A**

'I returned' [257]

b. nopigahi

no=**pig-ah-i**

1S=**return.A-REG.I-REAL.I**

'I returned' [258]

One example illustrates two class-changing suffixes in the same verb. The I-class adlative -*apah* occursoutside of the A-class Instrumental suffix and A-class root in (43) .[18] The realis suffix appears in its I-class form, showing that the nearest (lower) layer of morphology is the one that determines (ir)realis allomorphy. Inner L features are obscured by those in an outer layer.[19]

(43) nokenaNtahigapahi

no=**ken-aNt**-hig-**apah-i**

1S=**head.in.direction.A-INST.A**-PL-**ADL.I-REAL.I**

'We came along it (a path) towards (here)' [285]

The transparency of non-L-marked affixes in Nanti, vs. the opacity observed in Nimboran, can be modelled by assuming that in Nanti, every affixation construction is either of the 'Exocentric' type in (26), i.e. specified with its own unchanging L feature, or the 'Percolation' type, taking on the L specification of its daughter. As a result, every output stem, even if created by an affix with no inherent L features of its own, can potentially bear a specification for the L feature that governs (ir)realis allomorphy. The result is the appearance of nonlocally conditioned allomorphy.

[18] An apparent typo in Michael 2008 is corrected in the gloss of (43), from ABL to ADL.

[19] Evidence that the root *ken* 'head.in.direction' is A-class comes from this example (p. 393): *tya pikena* /tya pi=**ken=a/** 'where 2S=**head.in.direction.A-REAL.A** = Where did you head?'

6 Interim summary

In this section we take a step back to summarize the main predictions of OCM regarding directionality and locality in L-conditioned and S-conditioned allomorphy, comparing them briefly to predictions emerging out of Distributed Morphology.

6.1 Directionality

OCM and DM make the same prediction regarding the inside-out nature of L conditioning (see e.g. Bobaljik 2000; Harley & Tubino Blanco 2013; Harley, Tubino Blanco & Haugen (this volume)). In DM, a vocabulary item bearing the relevant L-feature must be inserted before it can condition the insertion of an allomorph which is conditioned by that L feature; since insertion in DM and word construction in OCM are bottom-up, the inside-out prediction is deeply ingrained in both approaches. Apparent counterexamples pose challenges for both approaches; see section 7 for some discussion of this in OCM, and see Embick (2010) on local dislocation and noncyclic spellout within the phase within DM.

DM and OCM differ, at least conceptually, in the directionality they predict for S-conditioning. Bobaljik (2000) assumes a strong version of DM in which S-conditioned allomorphy is necessarily outside-in; the trigger must be higher than the target. This is for two reasons. One is Bobaljik's assumption that S features are 'rewritten', or expunged from the structure, no longer part of the representation after insertion of the corresponding vocabulary items. Once an S structure has been expunged, it cannot trigger allomorphy on the part of subsequently inserted vocabulary items. Only S features in a higher position in structure, not yet expunged by vocabulary insertion, can trigger allomorphy on items inserted into lower structural positions. (See Gribanova & Harizanov, this volume, for arguments that this position may be too strong.) Also contributing to the 'outside-in' prediction is the distinction, commonly drawn in DM, between what Noyer (1997) calls 'primary' exponents of an S-feature (the head of the projection of that feature) and 'secondary' exponents, i.e. allomorphs which are merely conditioned by the presence of that feature. The DM model also assumes, of course, that inflectional heads occupy fixed cross-linguistic structure positions, and therefore that there should be asymmetries in their possibilities for mutual allomorphy conditioning.

In OCM, there is no corresponding 'outside-in' (or 'inside-out') prediction for S-conditioned allomorphy, mainly because the notions of 'outside' and 'inside' do not apply as they do in DM. In OCM, the unchanging S target conditions all exponents (morphs); it is not the case that than one exponent of an S feature conditions another. There is no inherent directionality to this kind of conditioning in OCM. There is also no distinction in OCM between being a primary and a secondary exponent of an S property. Either a morphological construction (an allomorph) possesses an S property, or it does not; if multiple affixes in the same word all express the same property, they do so equally.[20] In OCM it is not meaningful to say, of examples like those in 24, that one affix expones 2nd person while the others are all conditioned reflexes of that primary exponent. In OCM, all exponents of a given S property are equal in that respect. While OCM itself does not formally make use of the distinction between 'inside-out' and 'outside-in' conditioning, for S conditioning it predicts both the patterns that correspond to those descriptions.

Thus in principle the predictions of DM and OCM differ in regards to the directionality of S-conditioned allomorphy. But in practice this difference is hard to test empirically. Both DM and OCM predict root allomorphy to be able to be conditioned by S features. In TFM, our case study of S-conditioned allomorphy, all of the 2nd person-specific allomorphs could be treated as triggered by subject agreement, which is structurally higher than the root and aspectual and mood suffixes possessing S-conditioned allomorphs. The kind of data that would distinguish the predictions of OCM and DM would be cases in which an affix, which in DM would be the primary exponent of feature S_i, exhibits allomorphy conditioned by a feature S_j, whose primary exponent is structurally *lower*. This is the pattern exhibited by Archi, in which case (structurally higher) case shows sensitivity to (structurally lower) number. It should be ruled out by the 'outside-in'

[20] See Caballero & Inkelas (2013) on the notion of 'exponence strength', whereby some affixes may realize an S property more strongly than others. However, this notion is more closely related to the psycholinguistic dimension of what Hay & Plag (2004), Hay & Baayen (2005), and Plag & Baayen (2009) have termed 'parsability' than it is to the 'primary-secondary' distinction of Noyer, which has to do with syntactic structural position.

condition in DM. Another case of this kind is presented by Gribanova & Harizanov (this volume), in which allomorphy in the Bulgarian definite suffix is conditioned by the gender of the noun stem it combines with.,

As discussed below, strict locality (within the phase), which obtains in the Archi and Bulgarian examples, may also be a sufficient condition in DM for conditioning allomorphy. Thus, while differences in predictions regarding directionality of S-conditioning may obtain between OCM and DM, truly probative examples remain to be teased out.

6.2 Locality

Locality is an area where the predictions of OCM and DM diverge more clearly. In DM, the same locality conditions obtain for both L- and S-conditioned allomorphy. Two different conditions have been proposed, to which different researchers adhere in different degrees (see e.g. Siddiqi 2006, Embick 2010, Arregi & Nevins 2012, and the papers in this volume by Harley, Tubino Blanco & Haugen and by Gribanova & Harizanov):

(44) a. LINEAR LOCALITY: suppletive allomorphy is conditioned only by morphemes to which the allomorph in question is linearly adjacent. (Non-overt morphemes do not count.)

b. STRUCTURAL LOCALITY: suppletive allomorphy is conditioned only with the local cyclic domain (phase)

Embick (2010) provides an instructive example of linear and structural locality from Latin agreement endings. One set of agreement allomorphs occurs in the perfect indicative; the other allomorphs occur elsewhere. A partial paradigm is given below. The special allomorphs in question are bolded:

(45)

	Perfect indicative				Future perfect				Pluperfect indicative			
	Root	-Asp	-T	**Agr**	Root	-Asp	-T	Agr	Root	-Asp	-T	Agr
1sg	amā	-v̄		**ī**	amā	-ve	-r	-ō	amā	-v	-ra	-m
2sg	amā	-v̄		**istī**	amā	-ve	-rĭ	-m	amā	-v	-rā	-m
3sg	amā	-v̄		**t**	amā	-ve	-rĭ	-t	amā	-v	-ra	-t

On Embick's analysis, Agreement allomorphy is conditioned by the aspectual category 'Perfect'. Although perfective suffixes appear in all the verbs in 45, the (bolded) Perfect-triggered Agreement allomorphs appear only in those verbs in which Perfect and Agreement are adjacent because Tense is null. Embick attributes this to the linear locality condition. If an overt morpheme intervenes, Aspect is inaccessible to Agreement.

Altough the LINEAR LOCALITY conditions in (45) work for Latin and would also work for local L conditioning in Nimboran, they are less clearly incompatible with the data from TFM or Nanti, in which numerous overt morphemes intervene, without interfering, between the structural entities participating in S- or L-conditioned allomorphy. The TFM and Nanti cases pose no problem for OCM, which does not impose any a priori universal locality conditions on S- or L-triggered allomorphy.

Since S-conditioned allomorphy is driven by faithfulness to the ever-present S target, OCM imposes no particular expectations about the structural proximity of multiple layers of morphology that expone the same S property. In TFM, the 2nd person subject-sensitive root and suffix allomorph are not necessarily strictly adjacent to one another or to the suffix which is the primary exponent of 2nd person subject, and they occur at various different positions in the inflectional zone (aspect, tense, deixis, mood, person, number). Heidi Harley observes (p.c.) that the four TFM roots exhibiting suppletive 2nd person allomorphs are are experiencers or verbs of motion or position, whose subjects would be base-generated in internal position, adjacent to the root. Thus TFM root suppletion could yield to the same analysis offered fro number-controlled suppletive alternation in verb roots in Hiaki by Harley (to appear) and Harley, Tubino Blanco & Haugen (this volume)). In

Hiaki, certain root allomorphs are conditioned by the number of the closest base-generated argument, namely the subject of intransitives and the object of transitives. This root allomorphy meets the structural locality condition. However, the presence of intervening morphs between the root and some of the other suffixes exhibiting 2^{nd} person allomorphy in TFM would still need to be accounted for.

For L-features, we have seen that OCM can model locality restrictions, though on a language-specific basis. Whether L-conditioned allomorphy is strictly local (Nimboran) or potentially nonlocal (Nanti) depends on whether the L feature percolates through intervening layers of morphology. In OCM, locality is defined hierarchically, not in terms of linear adjacency; this is because L features are properties of stems (mother nodes in constructions) and not of morphs (vocabulary items) per se.

The table in (46) recapitulates the basic predictions made by OCM and DM regarding the conditioning of suppletive allomorphy. In general, OCM is more permissive than DM, in ways emphasized by bolding in (46). We have seen justification for the greater descriptive flexibility of OCM in the form of data from TFM, Nanti and Nimboran.

(46) Relationships predicted between triggers and targets of conditioned allomorphy

	OCM	DM
S	Trigger = feature in S property set; target(s) = morph(s) exposing S **Any relationship among targets is possible**	Trigger = primary exponent; target(s) = secondary exponent(s); **Trigger structurally above target**; **trigger and target are local**
L	Trigger = morpheme lexically specified as L Target = affix selecting for L Trigger structurally lower than target **Locality a language-specific parameter**	Trigger morph lexically specified as L Target affix selects for L Trigger structurally lower than target **Trigger and target are local**

7 Bound roots and the inside-out prediction

Both OCM and DM predict that root allomorphy will not be triggered by L features of an outer affixes. The caveat to this prediction in DM are proposals that phase spell-out is noncyclic, so that all affixes in the same phase are potentially available to one another and to the base of affixation (see e.g. Embick 2010, Gribanova & Harizanov (this volume), Svenonius (this volume), among others).. This proposal is conceptually similar to the noncyclic level of Lexical Morphology and Phonology (see e.g. the paper by Kiparsky, this volume).

OCM offers a different caveat to the strict inside-out nature of L-conditioned allomorphy, namely the possibility that some roots and even some affixes cannot be inserted by themselves because the stems they would create are bound, i.e. incomplete, requiring another affix to be structurally well-formed. This idea was explored for Lexical Morphology and Phonology in Inkelas (1990) and is relevant to OCM as well. In OCM, a candidate must be well-formed to compete in a tableau. This means that bound roots, which require a sister element to be part of a well-formed stem or word, do not qualify on their own as candidates, and therefore cannot be assessed for any kind of faithfulness well-formedness. In just this case, the 'one layer at a time' design feature of OCM must be suspended to allow for the selection of the minimal set of construction layers that will satisfy the subcategorization requirements of all the selected constructions. A bound root (like *-mit*, if words like *permit* or *commit* are considered to be complex) has to be selected together with the prefix that it requires in order to be a well-formed morphological constituent.

This property of OCM accounts for a well-known generalization in the literature, namely that bound roots are not cyclic domains for phonology (e.g. Kiparsky 1982a,b and Inkelas 1990). It also predicts that a bound root can be sensitive to L properties of the immediately adjacent affix, the one with which it must be co-selected in order to be a well-formed candidate. An example close at hand is Hiaki suppletive stems, as discussed by Harley, Tubino Blanco & Haugen (this volume; see also Harley & Tubino Blanco 2013), in which some Hiaki roots have a suppletive allomorph which is selected for by certain suffixes that combine directly with the root. It may also be a useful construct in the analysis of the Nez Perce facts discussed by Deal & Wolf (this volume).

OCM even predicts that a stem formed by an affix which itself is bound, i.e. two-sided, cannot compete as a candidate; it has to combine with another affix in order to enter into a tableau.

With this in mind, let us consider an illustrative example discussed by Svenonius (2012). Participles in Icelandic inflect for case, gender and number. Two different participial suffixes can connect a verb root to the following inflectional layer: *ð* and -*ɪn*. The choice is made on phonological grounds, determined by whether the following inflectional suffix is vowel- or consonant-initial. To make the distribution easier to see, the cells in which the following suffix is underlyingly vowel-initial are italicized. The parenthesized cells are irrelevant since, according to Svenonius, they contain morphosyntactially conditioned portmanteau suffixes and exhibit neither phonologically conditioned participial allomorph in question:

(47)

	M SG	F SG	N Sg	M PL	F PL	N PL
NOM	baːr-ɪn-n	(baːr-ɪn)	(baːr-ɪð)	*baːr-ð-ɪr*	*baːr-ð-ar*	(baːr-ɪn)
ACC	(baːr-ɪnn	*baːr-ð-a)*	(baːr-ɪð)	*baːr-ð-a*	*baːr-ð-ar*	(baːr-ɪn)
DAT	*bɔrð-ʏm*	(baːr-ɪn-nɪ)	*(baɔr-ð-u)*	*bɔr-ð-ʏm*	*bɔr-ð-ʏm*	*bɔr-ð-ʏm*
GEN	bːrɪns	(baːr-ɪn-nar	baːr-ɪn-s	baːr-ɪn-na	baːr-ɪn-na	baːr-ɪn-na

The function of the participial suffixes seems to be to convert the verb root into a stem type that obligatory inflection can attach to. Assuming that this is correct, the the participial suffixes can be treated as bound elements which do not define a well-formed stem but which must also combine with a layer of inflection to produce a stem that a tableau could evaluate. We would expect to see this kind of conditioning on the part of affixes that routinely co-occur with specific other outer affixes and cease to be independent word-formers.

OCM thus predicts that the minimal participial unit that can be presented for evaluation in a tableau will consist of [root-PCP-CASE], or in the case of the participles with portmanteau endings, [root-PCP.CASE]. Therefore two F PL candidates like *baːr-ð-na* and *baːr-ɪn-na* can compete directly, with the former winning on the basis of superior phonotactics.

Whether the correlation between ‘outside-in’ conditioning and bound morphology, and between the phase in DM and the free stem in OCM, will hold up to further scrutiny will be revealed by future research.

8 Conclusion

A sometimes bewildering property of the field of morphological theory is the huge diversity in theories of the same phenomenon—in this case, allomorphy. Some morphological theories are top down 'realizational', others are bottom up 'item-based'. This diversity has existed in part because the competing theories have handled different kinds of data. Realizational theories tend to focus more on inflection, while item-based theories have had more of a purchase on derivational morphology and on the phonology-morphology interface. OCM incorporates elements from both approaches, and in so doing, generates yet another perspective on how we may expect allomorphy to work. The hope of this study is to focus more attention on cases like Totonac de Filomena Mata, Nimboran, and Nanti, whose morphology differs from the canons that standard morphological theories were designed around, and to pay close attention to what those languages are telling us about the relations among the elements of morphologically complex words.

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