Metrical opacity, stratal derivation, and restructuring in Southern Pomo

Abstract. Southern Pomo (Pomoan, California) displays a process of rhythmic vowel deletion (syncope) reflecting two mutually-incompatible metrical structures. This phenomenon, called *metrical incoherence*, can be derived by an ordered sequence of independent subgrammars, i.e., strata. Metrical incoherence is under-attested crosslinguistically, and the stratal models of phonology necessary to generate it have been criticized for predicting counter-typological phenomena. Nevertheless, the Southern Pomo data cannot be generated in more restrictive frameworks. This paper argues that overgeneration is a necessary property of the phonological component, and that metrical incoherence is rare because it is difficult to learn. In Southern Pomo, this difficulty appears to have caused grammatical competition and restructuring: a second pattern of syncope, occurring in only a limited context, suggests that learners have reanalyzed the grammar as having consistent metrical structure across the derivation. This work thus supports the proposal that diachronic change – and therefore typology – is constrained by extragrammatical factors.
Key words: syncope, strata, metrical incoherence, learnability, restructuring, diachronic change

The past is never dead. It's not even past.

– William Faulkner, *Requiem for a Nun*

1. Introduction.

The relationship between synchronic grammar and cross-linguistic typology is a persistent issue for phonological theory. There is considerable debate about whether grammatical or functional factors are (most) responsible for phonological typology, and how phonological theory should reflect this. One view is that many patterns are necessarily ruled out by synchronic grammar (Bermúdez-Otero & Hogg, 2003; de Lacy, 2006), and that apparent counter-typological phenomena should instead be accounted for by other means, such as morphologization (Staroverov, 2020). Another approach suggests that typology is epiphenomenal, with patterns arising diachronically rather than being psychologically active (Hale & Reiss, 2000; Blevins, 2006). A third position posits that synchronic phonology is capable of generating counter-typological patterns (de Lacy & Kingston, 2013), but typology is constrained by extragrammatical factors – such as how the distribution of evidence for a process in the lexicon affect the

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learnability of that process (Jarosz, 2016; Stanton, 2016). Work within each of these theoretical traditions has also investigated how diachronic change reflects intrinsic features of the phonological component (Bermúdez-Otero & Trousdale, 2012), extrinsic influences (Hansson, 2008), or their interactions (Stanton, 2016).

A general approach in phonological theory has been to limit the power of grammatical frameworks to the level necessary to produce only attested, *productive* phenomena.[1] One area of this literature has thus sought to evaluate whether certain phenomena are synchronically active, particularly for phenomena which would require more expansive architectures. Of particular concern has been the synchronic productivity of opaque phenomena – processes whose conditioning environments are not present in surface forms (Kawahara, 2015). One such process is metrically-conditioned syncope: the deletion of vowels in metrically weak positions (McCarthy, 2008). In typical cases of syncope, vowels in weak positions (unstressed or unparsed) are targeted for deletion, as schematized in in (1) below:

(1) Typical environments for syncope [2]

a.	Weak in foot	/(σ́σ̲)/ → [(σ́_)]
b.	Unparsed	/(σσ)σ̲/ → [(σσ)_]

This process poses a well-known problem for parallel constraint-based frameworks such as classic Optimality Theory (OT, Prince & Smolensky, 1993), as deletion must occur after the building of the metrical structure which conditions it. This hidden structure presents a major obstacle for parallelism, as the computation of stress assignment and deletion must be ordered (Kager, 1997; McCarthy, 2008).

Syncope can be called transparent if it is driven by a constraint (or rule) that is surface-satisfied. For example, syncope driven by a constraint penalizing unstressed vowels (*V̌; McCarthy, 2008) is transparent if the output includes only stressed vowels, and all vowels that would be unstressed are deleted. (2) demonstrates this pattern in Macushi (Carib):

(2) Syncope in Macushi (Hawkins, 1950:87; Kager, 1997)

a.	[w_nàː.m_ríː]	b.	[_wàː.n_màː.r_ríː]
	/wa̲.na.ma̲.ri/		/u̲.wa.na̲.ma.ri̲.ri /
	"mirror"		"my mirror"

Deletion in (2) has applied in such a way that there is a clear surface generalization: vowels do not occur in weak (unstressed) positions. In other cases, vowel deletion transparently satisfies

[1] For an overview from a computational perspective, see Meinhardt, Mai, Baković, & McCollum, 2022, and references therein.

[2] Positions targeted for syncope are indicated by underlining in URs; material that has been deleted due to syncope is indicated with underscores in surface forms.

constraints on syllable weight (the Stress-to-Weight and Weight-to-Stress Principles; Prince 1990) or distance from word edge (Prince 1990; see Gouskova, 2003, and Kager, 1997, for implementations). Hidden structure is *still inherent* to this process, however: the conditioning environment is never visible in the output in any of these cases – the vowels in week positions and light stressed syllables are a counterfactual. In that sense, we might think of syncope as inherently opaque.

Additionally, deletion cannot always be explained using surface-oriented means. There are cases when rhythmic deletion does not appear to satisfy a surface generalization related to metrical structure, either underapplying (e.g., unstressed vowels appear in surface forms), or overapplying (occurring in locations that are not explained by surface prominence). These are instances of *metrical opacity*. Metrical opacity seems to provide particularly strong evidence for derivational frameworks, because metrical processes (like deletion and reduction) are conditioned by syntagmatic relations between positions within a hierarchical structure. The structural relations must exist before such deletion can occur. The output of syncope in some cases seems to prioritize faithfulness to strong positions, which must in turn be defined by an earlier derivational stage which builds hierarchical structure. A number of these cases have been analyzed utilizing restrictive derivational models like Harmonic Serialism (HS; Prince & Smolensky, 1993/2004; McCarthy, 2000), which utilize a single ranking of constraints. The nature of deletion, however, may not always be amenable to such restrictions.

The present work investigates syncope in Southern Pomo (Pomoan, N. California; iso: peq). In this language, vowels are deleted in odd, medial syllables (counting from the left word edge). Surface stress, meanwhile, is alternating and penultimate, iterating from the *right* word edge. The result is an *inconsistent relationship between surface stress and the location of syncope*, such that no clear surface-oriented explanation is viable (Walker, 2020; Kaplan, 2020). Instead, this pattern is best captured through the ordered application of multiple metrical structures, as in a multilevel derivational framework like Stratal OT (SOT: Bermúdez-Otero, 1999; Kiparsky, 2000), the constraint-based successor to Lexical Phonology and Morphology (Kiparsky, 1982; Mohanan, 1982). The table below in (3) presents schemata and examples of odd-syllable deletion in forms with four, five, and six underlying syllable nuclei, with the examples cross-referenced to full glosses below.[3]

[3] Note that, in the case of underlying six-syllable strings, syncope may be blocked by phonotactic constraints – on complex onsets and codas, or specific cluster restrictions – in one of the two positions eligible for deletion.

(3) Examples of Southern Pomo vowel-∅ alternation.

<table>
<tr><th></th><th>Underlying</th><th>Surface</th><th>Example URs</th><th>Example SRs (crossref)</th><th></th></tr>
<tr><td rowspan="8">Even parity</td><td rowspan="3">$/\sigma_1\sigma_2\underline{\sigma}_3\sigma_4/$</td><td rowspan="3">$[\sigma_1\acute{\sigma}_2\_\sigma_4]$</td><td>/pʰu(h)t̪opʰut̪ow/</td><td>[pʰuh.t̪óp._.t̪ow]</td><td>(7)a</td></tr>
<tr><td>/ʃi(ː)ba.t̪ʰamʰuʧ/</td><td>[ʃiː.báːt̪ʰ._mʰuj]</td><td>(5)a</td></tr>
<tr><td>/ʔe(h)kʰemaʧin/</td><td>[ʔeh.kʰém._ʧin]</td><td>(5)b</td></tr>
<tr><td rowspan="5">$/\sigma_1\sigma_2\underline{\sigma}_3\sigma_4\underline{\sigma}_5\sigma_6/$</td><td rowspan="2">a. $[\grave{\sigma}_1\sigma_2\_\acute{\sigma}_4\_\sigma_6]$</td><td>/ha(ː)ʧat̪alokoʧʼa/</td><td>[hàː.ʧat̪._lók._.ʧʼa]</td><td>(5)c</td></tr>
<tr><td>/ma(h)kʰem<u>a</u>kʰed<u>e</u>du/</td><td>[mah.kʰem._kʰed._du]</td><td>(7)c</td></tr>
<tr><td rowspan="3">b. $[\sigma_1\grave{\sigma}_2\_\sigma_4\acute{\sigma}_5\sigma_6]$</td><td>/ʔe(ː)kʰet̪alameʧle/</td><td>[ʔeː.kʰèt̪._la.méː.le]</td><td>(5)d</td></tr>
<tr><td>/ʔa(ː)pʰat̪alameʧʼle/</td><td>[ʔaː.pʰàt̪._la.méː.le]</td><td>(5)g</td></tr>
<tr><td>/ʔa(ː)dikajaʧoːkʰe/</td><td>[ʔaː.dìk._ja.ʧóː.kʰe]</td><td>(5)f</td></tr>
<tr><td rowspan="3">Odd Parity</td><td rowspan="3">$/\sigma_1\sigma_2\underline{\sigma}_3\sigma_4\sigma_5/$</td><td rowspan="3">$[\grave{\sigma}_1\sigma_2\_\acute{\sigma}_4\sigma_5]$</td><td>/ʔa(h)t̪im<u>o</u>koʧin/</td><td>[ʔàh.t̪im._kó.ʧin]</td><td>(11)b</td></tr>
<tr><td>/ʔiʧʼ(ː)al<u>a</u>meʧʼin/</td><td>[ʔìʧ.ʧʼal_.mé.ʧʼin]</td><td>(5)h</td></tr>
<tr><td>/ʔa(h)kʰab<u>u</u>(ː)taka/</td><td>[ʔàh.kʰap_tá.ka]</td><td>(9)a</td></tr>
</table>

Rather than optimizing surface outputs, syncope in Southern Pomo reflects the influence of multiple opposed metrical structures. This is what is called a *metrically incoherent* process (Dresher & Lahiri, 1991), where a metrically-conditioned alternation does not appear to refer to surface stress. To see this schematically, (4) below schematizes a process of vowel reduction affecting alternating positions –odd, medial syllables, counting from the left edge. Alternating surface stress falls on odd syllables, as well. However, vowel reduction is tied to *weak* positions cross-linguistically. This reduction process thus seems to have misapplied.

(4) Metrical incoherence in rhythmic processes

Underlying	/ pa.ta.ka.ba.da.ga /
Vowel reduction	| pa.t**ə**.ka.b**ə**.da.ga |
Surface:	[pa.t**ə̀**.ka.b**ə̀.**da.gá]

This pattern is difficult to explain in terms of surface structure, as the reduction process takes place in prominent syllables. This suggests that reduction has occurred at a derivational stage *prior* to the assignment of surface stress. It is mechanically simple to produce this kind of pattern in stratal frameworks. This is accomplished by ordering discrete, independent subgrammars, such that the syllables which undergo vowel reduction are unstressed at the time that process takes place. At a following stage, stress is reparsed and those reduced syllables surface as prominent. In Southern Pomo, the earlier stage involves deletion rather than reduction, and stress is reparsed over the remaining string.

The ability of stratal frameworks to generate these patterns comes at a cost, however, as many predicted phenomena involving metrical incoherence run counter to observed typology. Indeed, the pattern above in (4), where all and only schwa is stressed, are unattested, but Wolf (2012:6) demonstrates that this pattern is predicted by SOT. Another example offered by Wolf (2012:3-4) produces a language in which all and only unstressed syllables start with aspirated stops. In attested languages, though, the distribution of both schwa (or reduced vowels more generally) and aspiration are asymmetrically related to prominence. Schwa can be found in either only in weak syllables or in all syllables, but no language requires it in strong positions. The opposite observation holds for aspiration, which is found either in all positions, or only strong ones, but not exclusively in weak ones. Distributional asymmetries like these have been used by phonologists to motivate universal markedness constraints in CON, but, as Wolf notes, "even given an asymmetric constraint set, Stratal OT predicts a symmetric typology of stress/segmental-phonology correlations," (2012:2). Strata are necessary in order to generate the attested rhythmic phenomena, but multilevel frameworks like SOT readily produce unattested, counter-typological ones, as well.

Additionally, despite their generability within stratal frameworks, metrically incoherent patterns are typologically quite rare (Gordon, 2002; 2016). It is therefore important to determine how to account for attested patterns of this type. This conflict may be resolved by turning to extragrammatical explanations for the rarity of metrical incoherence: while these patterns are generable through strata, their learnability is bounded by the availability of evidence. If the language input is largely consistent with an alternative grammar which is metrically coherent, competition between grammars (that is, between different constraint rankings) may be resolved by a learning bias for transparency (Kiparsky, 1968; Prickett, 2019). As a result, restructuring, in producing a new ranking of grammatical constraints may eliminate metrical incoherence. In the case of Southern Pomo syncope, the data suggests this kind of change may have been in progress due to limited evidence for metrical incoherence, with an alternative surface-optimizing grammar emerging.

In §2, I detail the specifics of syncope in Southern Pomo and its interaction with metrical structure. §2.4 demonstrates how this pattern can be successfully captured using a stratal architecture. Following this, §4 considers alternative analyses from both derivational and parallelist perspectives, ultimately rejecting these alternatives. In §5, I discuss the stratal analysis in relation to cases of syncope in Southern Pomo which target vowels in the fourth syllable, relating this to the learnability of opaque patterns, diachronic change, and restructuring.

2. Southern Pomo.

2.1 The Language.

Southern Pomo is one of seven Pomoan languages of Northern California, which were traditionally spoken in the area around Clear Lake and the Russian River Valley. Kashaya (previously Southwestern Pomo) is genealogically the closest of these to Southern Pomo. Southern Pomo was the largest of the Pomo languages at the time of European contact, spoken by somewhere from two to seven thousand people in the area between modern-day Santa Rosa and Sebastopol, north to Cloverdale (Walker, 2020:8). Colonial genocide of indigenous communities and the suppression of their languages left fewer than one hundred speakers of Southern Pomo by 1900.

Elizabeth Dollar (1895-1971), Annie Burke (1876-1962), and her daughter Elsie Allen (1899-1990) were the primary contributors to Southern Pomo documentation. The majority of linguistic description was done by Abraham Halpern (e.g., 1964), Robert Oswalt (e.g., 1976), and Neil Alexander Walker (2020). The language is recently dormant, but there are active revitalization efforts.[4]

2.2 Syncope in Southern Pomo.

2.2.1 Generalizations.

In Southern Pomo, vowels in odd syllables are deleted when these syllables are not at a word edge (i.e., noninitial and nonfinal; Walker, 93-100). Thus, four and five syllable words undergo deletion in the third syllable, and six syllable words show deletion in the fifth syllable as well. This can be described as targeting odd syllables, with the initial syllable protected by phonotactic constraints (as in (10), below). This pattern can be seen below in (5). In these examples, the first line shows the attested surface form, with an underscore indicating a position where an underlying vowel has been deleted due to syncope. The second line shows underlying forms, decomposed into their constituent morphemes, with bolding and underlining to indicate vowels which are deleted. The segments in parentheses are the "laryngeal increment" (Oswalt, 1976), a semi-predictable feature which appears in all words and has the effect of making all initial syllables heavy.[5] Southern Pomo is a morphophonologically complex language with many alternations (e.g., compensatory lenghthening seen in (5)d and (5)g); examples highlight these processes where necessary. Unless otherwise noted, Southern Pomo examples are from Walker

[4]For information see the Western Institute for Endangered Language Documentation Southern Pomo Project: http://wieldoc.org/wp_temp/?page_id=30

[5] I analyze these segments as a feature of the word-level phonology, rather than as lexically specified or stem-level, on the basis of their behavior in compounds and interaction with postlexical enclitics. I maintain Walker's morphophonemic forms. For discussion, see Halpern (1984) and Walker (2020, 119-122); see also Buckley (1992) and Oswalt (1998) for discussion of this phenomenon in closely-related Kashaya.

(2020), or Oswalt's unpublished dictionary, and are annotated to indicate page.[6,7]

(5) Southern Pomo syncope

SR	a.	[ʃiː.báːt̪ʰ._mʰuj]	b.	[ʔeh.kʰém._ʧin]
UR		/ ʃi(ː).baː.t̪ʰ**a**- mʰuʧ-Ø /		/ ʔe(h)kʰe-m**a**ʧ-in /
		poor-RECIP-PFV		w.body.move-DIR-SG.IMP
		"felt sorry for each other" (W 46)		"move in (speaker outside)" (W 94)
SR	c.	[hàː.ʧat̪_lók._ʧʼa]	d.	[ʔeː.kʰèt̪_la.méː.le]
UR		/ ha(ː)ʧa- t̪- **a**lok**o**ʧʼ- a /		/ʔe(ː)kʰe- t̪- **a**lameʧ- le/[8]
		by.wing.fly-PL.ACT-DIR-EVID		w.body.move-PL.ACT-DIR-PL.IMP
		"they're flying out" (W 210)		"(2) move down from above!" (W 212)
SR	e.	[ʔah.ʧip._kʰaj.wi]	f.	[ʔaː.dìk.ja.ʧóː.kʰe][9]
UR		/ ʔa(h)ʧi- b**a**kʰaʧ =wi /		/ ʔa- (ː)di- k**a**- ja- ʧo- ːkʰe /
		louse-comb-INSTR		1-older.sister-GS-PL-OBL-POSS
		"with a louse comb" (W 136/O 93)		"my older sister's [things]" (W 150)
SR	g.	[ʔa:.pʰàt̪_la.mé:.le]	h.	[ʔìʧ.ʧʼal_.mé.ʧʼin]
UR		/ ʔa(:)pʰa- t̪- alameʧʼ-le /		/ ʔiʧʼ(:)- alameʧʼ-in /
		move.foot-PL.ACT-DIR-PL.IMP		carry.by.handle-DIR-SG.IMP
		"2 carry 1 down 1 each!" (W 211)		"bring down [sack]!" (O 28)

This pattern of deletion targets alternating syllables in both lexical stems and affixes, across morphological and lexical classes. Because stems are typically two syllables (though not always, as above in (5)a), it is usually the first suffix with vocalic material which undergoes syncope due to their string-linear position. These are commonly directional suffixes (glossed as DIR) such as /-alokoʧʼ-/ 'up out of', /-maduʧ-/ 'up to', and /-alameʧʼ-/ 'down off of' (further directional suffixes are discussed in Walker, 197-221). [10] As a result, syncope frequently gives rise to intra-

[6] Oswalt. (Unpublished). *Southern Pomo dictionary*, Sept. 2014 version prepared by Eugene Buckley.
[7] Walker (2020) is the published form of his 2013 dissertation. The original dissertation contained additional reproduction of Halpern's unpublished fieldnote transcriptions, removed in the published edition. These are cited here as Walker (2013).
[8] This form additionally shows consonant deletion and compensatory lengthening, discussed on p. 14.
[9] Syncope of the penultimate vowel in this form seems to be blocked by a surface-true ban on [...ʧk...] sequences.
[10] See appendix A for full list of morphological abbreviations.

paradigmatic vowel-Ø alternations in verbal paradigms:

(6) Intraparadigmatic vowel-Ø alternations in /-alokoʧ-/ “out(ward)” (W 210)

a. [-_lok._ʧ-]
[hà:.ʧat._lók_ʧ'a]
/ha(h)ʧa-t̪-**a**lok**o**ʧ'-a/
by.wing.fly-PL.ACT-DIR-EVID
“they're flying out”

b. [-l._koʧ-]
[hàʧ.ʧa_l_.kó.ʧ'in]
/ha(h)ʧa-al**o**koʧ'-in/
by.wing.fly-DIR-SG.IMP
“fly out!”

c. [-_lo.koj-]
[hà:ʧat̪_ló.koj]
/ha(h)ʧa-t̪-**a**lokoʧ'-Ø/
by.wing.fly-PL.ACT-DIR-PFV
“[3pl] fly out [of s.t.]”

The contrast between the allomorphs seen in (6)a and (6)c hinges solely on the syllable added by the evidential suffix /–a/. The presence of this suffix allows for deletion of the penultimate vowel /o/ in (6)a; this same vowel surfaces in (6)b and c.

Syncope also affects root morphemes, as seen particularly in reduplication (both verbal and adjectival), and usually affects the first syllable of the second root in compounds, exemplified below in (7)-(9), and with polysyllabic verb roots (as above in (5)a):

(7) Syncope in verbal reduplication

a. [pʰuh.t̪óp_ t̪ow]
/pʰu(h)t̪o-pʰ**u**t̪ow/
boil- ITER- PFV
“boils” (W 100)
cf. [pʰoh.t̪o:.t̪oj] “boiling” (O 252)

b. [bah.kʰóp_.kʰow][11]
/ba(h)kʰo-b**a**kʰo-w/
by.poking.contact-ITER-PFV
“to give many little pokes” (W 195)
cf. [baʔ.t̪'aw] “to poke with a stick” (W 177)

c. [mah.kʰem._kʰed._du]
/ma(h)kʰe-m**a**kʰe-d**e**d-u/
by.foot.move.body-ITER-DIR-PFV
“shuffle along” (W 195)

d. [t’uʔ.but’._bu.law]
/t’u(ʔ)bu-t’**u**bu-ala-w/
bend.over-RED-down-PFV
“to run down (bent way over) ” (O 21)[12]

(8) Syncope in adjectival reduplication

a. [bah.tʰép_tʰe]
/ba(h)tʰe- b**a**(h)tʰe/
big.COLL- INT$_{RED}$
“huge” (W 99)
cf. [bah.tʰe] “big” (W 262)

b. [pʰal.lápʰ_.la]
/pʰal(:)a-pʰ**al**(:)a/
each-each
“various” (W 99)
cf. [pʰal.la] “each”, [pʰa:.la] “also” (W 383)

[11] This form, like many that follow, displays regressive voicing assimilation (to [-voice]) applying after syncope.
[12] This form can be analyzed as featuring two sites of syncope, but I analyze the latter vowel deletion as hiatus resolution (see discussion on p. 15)

(9) Syncope in noun-noun compounds

a. [ʔàh.kʰap_tá.ka]
/ʔa(h)kʰa- b**u**(:)taka/
water- bear
"sea lion" (W 99)
cf. [ʔah.kʰa] "water" (O 412) + [bu:.t̪a.ka] "bear" (O 412)

b. [huʔ.ʔúkʰ_be]
/hu(ʔ)ʔuj- kʰ**a**(ʔ)be/
face- rock
"eyes" (W 129)
cf. [huʔ.ʔuj] "face" (O 449) + [kʰaʔ.be] "rock" (O 396)

Syncope is blocked where it would violate phonotactic constraints, including a surface-true ban on complex onsets and codas, even when there appears to be a viable alternative site of deletion. This can be seen in (10):

(10) Syncope blocked by phonotactics

a. [hàː.ʧat̪ʼ.b**í**.ʧa] *[haː.ʧát̪ʼ.b_ʧa]
/ ha(h)ʧa- t̪- biʧ- a/
by.wing.fly-PL.ACT-DIR-EVID
"took off (1 by 1)" (W 95)

b. [ʔa:.tìt̪ʼ.m**o**.kó:.le] *[ʔà:.tit̪ʼ.m_kó:.le]
/ ʔa(h)t̪i-t̪-mokoʧ-le /
put.foot-PL.ACT-DIR-PL.IMP
"put foot several times, [y'all!]" (W 213)

Surface-true generalizations about cluster phonotactics in the language appear to explain this non-application of syncope. Compare (10)b to its minimally-different paradigm mates below in (11), where syncope does occur:

(11) Syncope is not morpheme-specific

a. [ʔà:.tim_.kó:.le]
/ ʔa(h)ti-m**o**koʧ-le /
put.foot-PL.ACT-DIR-PL.IMP
"put foot, y'all" (W 213)

b. [ʔàh.t̪im_kó.ʧin]
/ ʔa(h)t̪i-m**o**koʧ-in /
move.foot-DIR-SG.IMP
"put foot back!" (W 95)

Non-application can be attributed to a constraint like *COMPLEX (roughly "no tautosyllabic obstruent clusters").[13] This phonotactic constraint, which blocks syncope when it would create a complex coda or onset word-medially, also prohibits deletion of the vowel in the initial syllable even though this is in an odd-numbered position. All syllables in Southern Pomo surface with onsets (indicating that ONSET is another undominated constraint), and because of this, deletion in an initial syllable will necessarily result in an illicit onset cluster (e.g., deletion in /c**v̲**.cv/ results in *[c_cv]).

The examples here are demonstrative but by no means exhaustive. Odd-syllable syncope is quite regular across the lexicon, rather than lexically specific. However, we will see in §2.2.2 that this process is in conflict with the language's stress system.

2.2.2 Syncope, stress, and metrical structure.

Main stress in Southern Pomo falls on the penult (in words in isolation), with iterating secondary stresses on every other syllable from right to left (McLendon, 1972; Walker, 2020). That is, the surface metrical structure counts from the right edge of the word in what has been characterized as a trochaic system (Buckley, 2019), though I assume an unbracketed grid-based approach (Prince, 1983). Stress is quantity-insensitive: it falls on both light and heavy syllables, is not attracted to heavy syllables, and is strictly alternating.[14] In strings with an odd number of syllables, syncope targets syllables which would be weak given regular surface stress, in line with the characterization of syncope as targeting vowels in metrically weak positions. However, in underlying strings with *even* syllable parity, syncope targets positions that *would be stressed* if deletion had not occurred – an apparent misapplication. In both cases, there are also unstressed vowels in surface forms, unlike in Macushi. This pattern is schematized above in (3), partially reproduced below in (12):

(12) Syncope is irregular relative to stress

	UR		SR	Example UR	Example SR
Even parity	/$\sigma_1\sigma_2\sigma_3\sigma_4$/		[$\sigma_1\acute{\sigma}_2\_\sigma_4$]	/pʰu(h)t̪opʰut̪ow/	[pʰuh.t̪óp._.t̪ow]
	/$\sigma_1\sigma_2\sigma_3\sigma_4\sigma_5\sigma_6$/	a.	[$\grave{\sigma}_1\sigma_2\_\acute{\sigma}_4\_\sigma_6$]	/ha(ː)ʧat̪alokoʧ'a/	[hàː.ʧat̪_lók._.ʧ'a]
		b.	[$\sigma_1\grave{\sigma}_2\_\sigma_4\acute{\sigma}_5\sigma_6$]	/ʔe(ː)kʰet̪ala.meʧle/	[ʔeː.kʰèt̪_la.méː.le]
Odd Parity	/$\sigma_1\sigma_2\sigma_3\sigma_4\sigma_5$/		[$\grave{\sigma}_1\sigma_2\_\acute{\sigma}_4\sigma_5$]	/ʔa(h)t̪imokoʧin/	[ʔàh.t̪im._kó.ʧin]

[13] Obstruent clusters may occur across syllable boundaries. For further discussion of cluster phonotactics, see Walker, 27-40.

[14] A possible exception to this is in three-syllable monomorphemic nouns, which in isolation reportedly have a secondary stress on the initial syllable in addition to main stress on the adjacent penult syllable. Words of fewer than four syllables never undergo syncope, regardless of lexical category.

Syncope is therefore not predictable based on surface metrical structure. The non-isomorphism between stress and syncope suggests that these two metrical phenomena are calculated based on *separate metrical structures*, which disagree in their direction of application: syncope occurs in the weak positions defined by a *left-to-right* alternating count, while surface stress corresponds to a *right-to-left* alternating count. The Southern Pomo data suggests a derivation, with conflicting metrical structures at sequential stages and syncope taking place at the second stage.

The alternating-syllable deletion seen in these data is a quintessential mark of metrical conditioning, where deletion has occured weak positions. The crosslinguistic evidence for vowel deletion in *strong* positions is only tenuous, and the existence of this phenomenon is disputed (McCarthy, 2008). We can thus conclude that the derivation first builds metrical structure from left to right, only assigning prominence to syllables which are not ultimately targeted for vowel deletion. Next, the weak positions undergo syncope, driven by a constraint against vowels in these positions. Finally, metrical structure must be reparsed from right to left, generating the observed surface stress.

(13) Deriving syncope, by step

	Odd Parity	Even Parity
0. Underlying	/ʔahtim**o**koʧin/ σσ**σ**σσ	/pʰuht̪op**u**t̪ow/ σσσσ
1. Parse left-to-right	|ʔah.tì.m**o**.kó.ʧin| σσ̀**σ**σ́σ	|pʰuh.t̪ò.p**u**.t̪ów| σσ̀**σ**σ́
2. Syncopate	|ʔah.tìm._kó.ʧin| σσ̀_σ́σ	|pʰuh.t̪òp._t̪ów| σσ̀_σ́
3. Reparse right-to-left	[ʔàh.tim._kó.ʧin] σ̀σ_σ́σ	[pʰuh.t̪óp._t̪ow] σσ́_σ

(13) presents a condensed rule-based schematization of this system; In §3, I demonstrate a formal analysis of this pattern using SOT. The mechanics of the constraint-based analysis differ slightly – for instance, the second and third of the steps in (13) (syncope and reparsing) will occur in tandem. The crucial similarity in these accounds is that the metrical structure which conditions syncope must be different from the one responsible for surface stress. *Syncope is metrically opaque, whether this pattern is formalized with rules or constraints.*

2.2.3 Syncope as a phrasal phenomenon

There is strong evidence that the second stage of metrical structure-building occurs at the phrase level: surface stress in both Southern Pomo and Kashaya is assigned in a domain larger than the word, described as the 'phrase' (Walker, 2020:49; Buckley, 2019) or "breath-group" (Halpern, 1984:38).[15] This is evidenced by phrasal stress shift: (14) below shows the expected stress pattern for words in isolation versus when phrased together, with stress shifting rightward (relative to the expected penultimate prominence seen at the word level) to avoid a lapse within a phrase. Here, the location of the shifted stress is underlined:

(14) Phrasal stress shift

	a.	b.
UR	/ts'i(h)ta # min(ː)an-ṯi/	/na(ː)pʰi-jow # ʔa(h).ʧah.ʧej/
Gloss	bird trap-FUT.INTENT [16]	all-? human.beings
	"trapping birds" (W 2013, 487)	"all human beings" (W 2013, 543)[17]
Word-level stress	[ts'íh.ta]ω [min.náːn.ṯi]ω	[naː.pʰí.jow]ω [ʔah.ʧáh.ʧej]ω
Phrase-level stress	[ts'ih.tà # min.náːn.ṯi]φ	[náː.pʰi̲.jow # ʔah.ʧáh.ʧej]ϕ

Additionally, all morphosyntactic enclitics (discussed at greater length below) are also included in this larger stress domain, as seen in (15). These morphemes combine with stems at the phrase level and are prosodically deficient: not licit as independent prosodic words and thus not assigned prominence at the word level (Anderson, 2005; 2011).

(15) Enclitics participate in surface stress

[hùw.waŋʰ.kʰè.ṯʰoṯ'.wáʔ.ja]

/hu(ː)w	-ad	-kʰːe	=ṯʰoṯ'	=ʔwa	=ʔja/
go	-DIR	-FUT	-NEG	=COP.EVID	=1PL.AGT

"We will not come" (W 75)

The syntactic behavior of these morphemes demonstrates that they are morphosyntactic enclitics. Below we see enclisis onto constituents larger than the word, such as case-marking clitics follow modifiers in postmodified NPs: [18]

[15] See also Buckley & Gluckman (2012) for discussion of the stress domain in Kashaya.

[16] This verb is not glossed in the source; the morphemic breakdown is the author's own. /-ṯi-/ is analyzed by Walker (2020) as the future intentive and the homophonous inchoative enclitic.

[17] Halpern's transcription of this sentence, reproduced in Walker (2013:543), marks only one stress for most words, but the location of the transcribed stress suggests another alternating stress should occur on the ultima in [náːpʰijow], "all," rather than an extended three-syllable lapse.

[18] For further discussion of morphosyntactic diagnostics, see Walker (2020:60-78).

(16) Phrasal enclitic after postmodified NP [19]

a. [mák:ats’ ʃiːbaːʈʰaw máʈʰ:i mit.tíː**ʧon**]
/[ma-k(:)a-ts’-∅ ʃiːbaːʈʰaw maʈʰ:i mit.ti]$_{\text{NP}}$ **=:ʧon** /
3C-mother’s.mother-GS-AGT poor blind one.lie=**PAT**
“their poor blind grandmother who was lying (there)” (W 74)

b. ʈʰa:na ʔak.kʰo**wi** da:tʰow
/ [ʈʰa:na ʔak.kʰo]$_{\text{NP}}$ **=wi** da:tʰo-w/
hand two**=INSTR** scrape-PFV
“scrapes it off with both hands” (W 74)

The above morphosyntactic evidence indicates that enclitics are introduced into the derivation at the postlexical (phrasal) level and are not assigned stress in the word-level stratum.

We thus see converging evidence that surface metrical structure must be assigned *no earlier* than the derivational level at which syncope occurs, i.e., it is phrasal. However, the site of deletion is determined by the word-level stress of the input to the phrase level, not the syllable’s context in a larger phrase-level unit. The derivation in (17) below shows that the predicted syncope pattern is seen even when surface stress has shifted:

(17) Syncope is insensitive to position in a phrase

UR	/ mij(:)a-d**a̲**kʰad-∅ # biʔdu # ʧohʃin-∅ /	
Gloss	3-spouse-AGT acorn pound-PFV	
	“His wife was pounding acorns” (W 268)	
Word-level stress	[mij.jà.d**a̲**.kʰán]$_\omega$ [bíʔ.du]$_\omega$ [ʧóh.ʃin]$_\omega$	
Syncope	|mij.jàtʰ_.kʰàn # bìʔ.du # ʧóh.ʃin|	
Phrase-level stress	[mij.jàtʰ_.kʰan # bìʔ.du # ʧóh.ʃin]$_\phi$	*[mìj.ja.d**à̲**.kʰan # bìʔ.du # ʧóh.ʃin]$_\phi$

Even when the deleted syllable would be prominent due to phrasal stress shift, the location of syncope does not change. The pair of examples below in (18) demonstrates that the same pattern of syncope maintains in /maʔ-dakad-en/ → [maʔ.dak_.den] when the position of phrasal stress varies. These examples feature an allomorph of the same root seen in (17), /dakʰad/ ‘spouse’, with a different locus of deletion – conditioned by word-level metrical position. This root is realized

[19] (17)a presents the stress transcription original to Halpern’s fieldnotes (reproduced in Walker, 2020:74), which is inconsistent with any clear generalization about stress domain. This may represent a syntax-prosody mismatch. (17)b is presented in Walker (2020:74) without stress transcribed.

as [-tʰ_kʰan-] in (17) (with regressive voicing assimilation and word-final neutralization of /d/ to [n]) following a two-syllable prefix, but surfaces as [-dakʰ_d-] in (18), following a monosyllabic prefix. The difference in syllable parity leads to a difference in which syllable is weak in the output of the word stratum.

(18) Syncope is insensitive to variation in stress

a. [maʔ.dàkʰ_.den # dàh.te.tém.huj]
/ma(ʔ)-dakʰ**a**d-en # da-(h)te-te-mhuʧ/
3.own-spouse-OBJ w.hand-PAT-RED-RECIP
"[He and his wife] pat each other" (O 385) [20]

b. [máʔdakʰ_dén # muʔ.t'á.waj]
/maʔ-dakʰ**a̲**d-en # mu-ʔt'a-waʧ/
3.own-spouse-OBJ ?-attach-DIR
"He sticks to his wife, is always with her" (O 306)

Phrasal clitics also participate in some – but not all – non-metrical sandhi processes that occur at morpheme boundaries, providing some evidence that they are not present at all points in the phonological derivation. First, there is a process of word-final ejectivization in Southern Pomo which does not occur under suffixation. The dental, alveolar, and velar plosives become ejectives word-finally, and these stops are always ejectivized before clitics. [21] Compare the plain-vs.-ejective alternation, which occurs word-finally in (19) and before enclitics in (20), to the non-alternating ejectives in (21):

(19) Plain stops ejectivize word-finally (W 101)

a. [kahsá**k**a]	b. [káhsa**k'**]
/ ka(h)sak-a /	/ ka(h)sak-∅ /
desert-EVID	desert-PFV
"deserted"	"deserting"

(20) Plain stops ejectivize before enclitics (W 33)

a. [hùʧʾ:a:**k**ájdu] [22]	b. [huʔʧʾà**k'**waʔáto]
/ hu(ʔ)ʧʾak-kaʧ-waʔdu /	/ hu(ʔ)ʧʾak=wa=ʔto /
to.be.stingy-DIR-HAB	to.be.stingy=COP.EVID=1SG.PAT
"always stingy"	"I'm stingy with it"

[20] Oswalt. (Unpublished). *Southern Pomo dictionary*, Sept. 2014 version prepared by Eugene Buckley.
[21] That is, /t tʰ/ become [t'], /t̪ t̪ʰ/ become [t̪'], and /k kʰ/ become [k']; /p pʰ/ do not occur word-finally.
[22] This form additionally shows a process of (ostensibly word-final) /ʧ/ ~ [j] alternation in the habitual suffix *-waʔdu*. This might suggest that the suffix is actually enclitic; this does not pose any difficulties for the present account.

(21) Underlying ejectives surface word-medially (W 101)

a. [him.mó.**k'**o]
/ him(:)ok'-o /
fall-EVID
"fell down"

b. [hím.mo**k'**]
/ him(:)ok'-Ø /
fall-PFV
"to fall over"

The ejectivization before enclitics seen in (20)b suggests that clitics are outside the domain of computation for some word-level processes, providing more evidence for the existence of multiple morphologically conditioned levels of phonological operations, and specifically a word level stratum where suffixes are counted, but enclitics are not.

Clitics in Southern Pomo do however participate in other sandhi processes at the phrase level, such as compensatory lengthening: heterorganic obstruent clusters at morpheme boundaries undergo deletion of the first segment, with compensatory lengthening of the preceding vowel. (Homorganic obstruent clusters typically undergo fusion.) This process is particularly instructive because compensatory lengthening has been said to require a derivational approach: predictable moraic structure must be defined prior to deletion for mora preservation to occur (Kiparsky, 2011; Samko, 2011). An example of this process applying word-internally is shown in (22)a. As (22)b demonstrates, this process also occurs in clusters formed between stems and enclitics:

(22) Compensatory lengthening

a. [ʔèk.kʰe._dú:̲.le]
/ʔekʰ(:)e- aduʧ̲- le/
w.body.move-DIR-PL.IMP
"2 move away! (sitting or lying)" (W 216)

b. [kahsá:̲t̪̲on]
/ kahsak̲=t̪on /
desert =LOC
"leaving [gerund]" (W 66)

These forms suggest that a constraint preserving moraic structure (MAX-μ) is active at the phrase-level, where deletion is promoted by phonotactic pressures.

A number of forms in Southern Pomo demonstrate an additional process of *hiatus resolution* that bolsters a derivational account of syncope. In contexts where two vowels are adjacent across a morpheme boundary, the second vowel does not surface, and is also not counted in the computation of syncope. This is shown below in (23):

(23) Hiatus resolution precedes syncope

a. [ʔek.kʰé_ʧ_.ʧin]
*[ʔèk.kʰe._d**ú̲**.ʧin]
/ʔekʰ(:)e- **a̲**d**u̲**ʧ- in/
w.body.move- DIR- SG.IMP
"move over!" (W 217)

b. [pʰej.jé_d_.du]
*[pʰèj.je._d**é̲**.du]
/pʰej(:)e- **a̲**d**e̲**d- u/
look.for- DIR- PFV
"looking for" (W 104)

The fact that this vowel is not counted by syncope indicates that it is not present at the phrase level, where syncope takes place, and instead it must be deleted prior, at the level of the word, such that the vowel is not counted in the initial computation of metrical structure.[23] There are no vowel-initial clitics which would allow this process to be seen occurring between stems and enclitics (such that we could ascertain whether this process is active in the phrasal stratum as well). In a rule-based derivation (elaborating on that in (13) above), this would simply precede the initial metrical parse, as seen below in (24).

(24) Rule-based derivation with hiatus resolution preceding syncope

0. Underlying	/pʰej(ː)e-aded-u/
1. Hiatus Resolution	|pʰej.je_.de.du|
2. Parse L-to-R	|pʰej.jè_.de.dú|
3. Syncope	|pʰej.jè_d_.dú|
4. Reparse R-to-L	[pʰej.jé_d._du]

These phenomena provide convergent evidence for a stratal derivation, and this analysis finds further justification from diachrony. While Southern Pomo has alternating stress assigned from right to left, stress in all other Pomo languages is left-aligned (McLendon, 1973), and Buckley (2019) analyzes Proto-Pomo metrical structure as trochaic with initial-syllable extrametricality and peninitial primary stress. If these trochees yielded alternating secondary stresses in even syllables assigned right-to-left, this is mechanically identical to the output stress of the word-level stratum in this account. Buckley proposes that the right-aligned prominence in contemporary Southern Pomo reflects contact-induced change influenced by the Bodega variety of Coast Miwok (Miwokan; California), a language with overwhelmingly penultimate stress (89%; Buckley, 2019; Callaghan, 1970). It could thus be that bilingual learners of Southern Pomo imposed this pattern of metrical organization from Miwok at the phrase level. This would mean that, in addition to being mechanically necessary to produce this type of metrical opacity, these strata may also directly represent historical change in the layered structure of the synchronic grammar ("amphichronic explanation", Bermúdez-Otero, 2015; Kiparsky, 2015; Gordon, 2016). Sound change has been shown to develop along a trajectory, with processes phonologized at the phrase level and generalized to smaller domains over time via *domain narrowing* (i.e., the *phonological life-cycle*; Bermúdez-Otero & Trousdale, 2012; see also *domain generalization*; Myers & Padgett, 2014). The development of Southern Pomo appears to present exactly this pattern, with Proto-Pomoan stress still synchronically active at the word level and the later-introduced

[23] This can be achieved by the straightforward ranking of *HIATUS over MAX-V at the word level, i.e., stratum I.

penultimate stress pattern at the phrase level.

To summarize: rhythmic deletion in Southern Pomo targets alternating vowels in odd syllables, when these syllables are non-final and deletion is allowed by phonotactics (i.e., when it does not result in a complex onset or coda). The location of deletion is not consistent relative to surface stress: primary stress is penultimate and alternates leftward, such that odd syllables may be stressed or unstressed on the surface. Additionally, the domain of stress is the phrase rather than the word, which means that stress does not fall consistently even within the same word, based on its position within a multi-word phrase or when it is encliticized (as clitics are also included in this phrasal domain, and bear stress). Regardless, the location of syncope remains the same. Taken together, this evidence suggests that the metrical structure conditioning syncope is distinct from and derivationally prior to that seen in surface forms.

§2.4 presents a Stratal Optimality Theory analysis of this pattern. Prior to this analysis, however, we introduce a significant wrinkle: a small portion of the lexicon which exhibits syncope in the fourth syllable, rather than the third. While these may seem at first to represent a hole in the account described above, it may be that these forms are instead a key to understanding the diachronic stability of highly opaque systems like metrical incoherence.

2.3 Fourth-syllable syncope

The derivation in (24) identifies the location of syncope in the vast majority of Southern Pomo forms. However, a number of words instead exhibit deletion of what would be a penultimate fourth syllable, rather than deletion of the third underlying vowel (in what would be the antepenult). Several of these are shown in (25), alongside paradigmatically-related words showing third-syllable deletion.

(25) Fourth-syllable syncope and paradigmatically-related third-syllable forms

Fourth-syllable forms	Third-syllable forms
a. [hàt̪.t̪a.lók_.ʧʼin] *expected:* *[hàt̪.t̪al_.kó.ʧʼin] /hat̪(ː)-alok**o**ʧ-in/ move.foot-DIR-SG.IMP “[move foot] up out of[!]” (W 95)	a′. [hat̪.t̪ák.ʧʼin] /hat̪(ː)-akoʧʼ-in/ move.foot-dir-sg.imp “Put your foot up once!” (O 250)
b. [bèː.ne.m^{h}út^{h}_.le] *expected:* *[bèː.nem^{h}_.t^{h}ú.le] /beː-ne-m^{h}uʧʼ-t^{h}**u**-le/ with.arms.grasp-RECIP-PROH-PL.IMP “(2) don’t hug each other!” (W 226)	*No other recorded forms of this stem eligible for syncope, due to phonotactics.*

c. [ʧàn.ho.démʔ_.ʧin]
expected: *[ʧan.hòd_.m^{h}ú.ʧin]
/ʧan(h)u-aded-m^{h}**u**ʧ-in/
speak-DIR-RECIP-SG.IMP
“speak!” (W 225)

c′. [ʧan.hó_d_.du]
/ʧan(h)o- **a**d**e**d- u/
Speak-DIR-PFV
“To be talking here and there” (O 188)

d. [dàk.k’aʈ̪’.máʧ_.ʧ’in]
expected: *[dak.k’àʈ̪’.m**a**.dú.ʧ’in]
/dak’(:)aʈ̪-mad**u**ʧ-in/
lead.several-DIR-SG.IMP
“bring several here!” (W 202)

d′. [dak.k’áʈ̪^{h}_.kon]
/dak’(:)aʈ̪-**o**k-in/
lead.several-DIR-SG.IMP
“1 bring out sev.[!]” (W 206)

The examples in (25)a-c show deletion in the fourth syllable when syncope in the third syllable would produce a licit form. (25)d shows fourth syllable syncope occurring in a string where deletion of the vowel in the third syllable would produce an illicit cluster *[-ʈ̪’md-], so syncope is not expected. This pattern does not appear to be related to the identity of the lexical root, as paradigmatically-related words have syncope in the third position, nor is it explained by the specific suffixal morphology, as these morphemes appear in other words with the third-syllable pattern of deletion. Because the pattern of deletion varies within paradigms, it cannot be attributed to an item-specific process indexed to particular lexical roots, morphemes, or morphosyntactic phases. Syncope also does not seem to “compromise” by deleting in a position that produces a phonotactically licit form, as evidenced by the forms in (10) where syncope is blocked. Additionally, these forms show an implicational asymmetry: for any paradigm where fourth-syllable syncope occurs, there are also forms with third-syllable syncope, but the reverse does not hold. Further, as discussed below in §2.4, the regularity of third-syllable deletion in likely low-frequency contexts suggests that this process is productive. Deletion in the fourth syllable thus appears to be an exception to the descriptive generalization that syncope targets vowels in the third syllable, which holds in all but a handful of words across the language.

However, we will see later in §4.3 that the grammar which produces these exceptional fourth-syllable forms also makes correct predictions for most (but not all) Southern Pomo words. Specifically, this grammar only generates the fourth-syllable syncope pattern in strings that *would*, without syncope, surface with five syllables and a light penult. §4.2 evaluates a parallel OT analysis where syncope is driven by the Stress-to-Weight Principle (SWP) and shows that it differs from the predictions of the stratal derivation for exactly these forms. To explain the variability between this SWP syncope grammar and the stratal syncope grammar, §5 approaches this conflict as a matter of grammar competition in the ranking of constraints (in particular, SWP) propelled of the scarcity of disambiguating evidence. First, I lay out a stratal analysis in §2.4 which accounts for the third-syllable syncope pattern.

2.4 SYNCOPE AS A PRODUCTIVE PROCESS

Recent work has suggested that rhythmic syncope may be particularly prone to restructuring because of the computational complexity induced by alternating deletion (Hao & Bowers, 2019; Bowers & Hao, 2020). Rhythmic syncope systems in other languages such as Nishnaabemwin (Bowers, 2019) and Eastern Slavic (Isačenko, 1970:95-6) are reported to have quickly collapsed. In Southern Pomo, syncope is further complicated by the imposition of a different structure (surface stress) which could, in theory, condition further deletion. As a result, there is no surface-true generalization about weak positions which explains the process. In addition, Gordon (2016:43) notes that phonological systems with competing iterative parses are not only rare but also unstable, with one metrical system typically fossilizing in exceptions and morphologization.

Given this, we must address whether rhythmic deletion was a synchronic process. Learning syncope requires robust evidence for vowel-zero alternations across the paradigm – evidence that is clearly present in Southern Pomo, as discussed in §2.2.2 and §2.4. There are robust vowel alternations in syncope with reduplication (shown in (7)-(9)), as the base of reduplication surfaces with the vowel that is absent in the reduplicant and most of these reduplicative bases also surface elsewhere as non-reduplicated forms. This strongly suggests that speakers are aware of the underlying phonological shape of the roots which undergo syncope. (5) and (6) show a number of intra-paradigm vowel-∅ alternations in highly productive functional morphemes, as well. It seems likely that learners are able to learn accurate underlying representations, with vowels still in place. That is, they have evidence that syncope is a synchronically active process.

However, as we will see, the question is not simply whether deletion *per se* was synchronically active, but which mechanism was responsible. This requires an analysis of the systems underlying both the third- and fourth-syllable patterns of deletion. In §5, I return to this question, and propose that Southern Pomo at the time of observation was undergoing a change in progress, with ongoing grammar competition between these two systems.

3. A stratal analysis.

3.1 Stratal Optimality Theory

Stratal OT is a derivational variant of classic Optimality Theory that recasts Lexical Phonology and Morphology in a constraint-based system. Phonological operations are driven by the interaction of constraints on input-output faithfulness and surface-oriented markedness, and candidate forms are evaluated on their satisfaction of all of these constraints in parallel. SOT differs from classic OT in that, while there is fully parallel evaluation, there are also multiple ordered stages, corresponding to morphological domains – typically the stem, word, and post-lexical phrase. The constraint ranking of each subgrammar is fully independent of the others, such that marked structure may be preserved from an earlier stage by the promotion of a faithfulness constraint.

Stratal analyses of metrical opacity have been proposed to describe similar asymmetries between stress and metrically conditioned phenomena, including pre-pausal stress shift in Tiberian Hebrew (Churchyard, 1999), vowel lengthening and stress interactions in Tübatulabal

(Uto-Aztecan, California; Benz, 2018; similarly suggested in Heath, 1981), and stress freezing in Washo (isolate, California; Benz, 2018). The use of strata in these accounts is predicated on the observation that the relevant process cannot be predicted from surface structure and is thus metrically opaque.

Because syncope is dependent on the existence of metrical structure, the first stratum (the word level) must be responsible for assigning the prominences which then condition rhythmic vowel deletion. (This analysis will not account for stem-level phonological patterns.) The second stratum (the phrase) is then able to reference existing structure, and because of this it can accomplish both syncope and stress realignment in parallel. In the remainder of §2.4, I demonstrate a SOT analysis of Southern Pomo syncope and several other phonological processes. This is certainly not the only set of constraint interactions which successfully derives syncope in SOT – rather, this is merely a mechanical illustration using widely-adopted constraints. What is essential is that this analysis is able to generate the third-syllable deletion pattern in all cases, in contrast to the counter-analyses seen in §4.

3.2 STRATUM I – WORD LEVEL.

As described above, the first 'task' of the derivation must be to generate a metrical structure which defines the correct weak positions for syncope. Though this account is amenable to a foot-based treatment, I use an unbracketed grid representation (Prince, 1983) instead: it is prominence *per se* that appears to matter, rather than the locations of foot boundaries or hierarchical relationship between feet. This account also collapses across primary and secondary stress, as this distinction does not affect any phonological processes, and assumes stress alignment constraints produce the correct edge alignment of main stress. The surface regularity of rhythmic stress is accomplished by *CLASH ("no consecutive stressed syllables") and *LAPSE ("no consecutive unstressed syllables"), which are undominated throughout (Gordon, 2002). These are ranked over the faithfulness constraint IDENT(STRESS) –i.e., "don't change the stressedness of a syllable," henceforth ID(STR) – in motivating the building of metrical structure. The undominated ranking of *CLASH and *LAPSE is assumed throughout for presentational simplicity. For this reason, candidates with stress clashes or lapses are not shown.

To define the correct weak positions that syncope acts on in the second stratum, the essential ranking is that between two TROUGH constraints:

(26) Definition: TROUGH-{LEFT/RIGHT}:
Assign one violation just in case there is a prominent syllable at the {left/right} edge of the stress assignment domain.

In the word stratum, TROUGH-L dominates TROUGH-R, which has the effect of assigning stress from left to right, with an initial weak syllable. The first stratum thus outputs left-to-right alternating stress, and the syllables which will be targeted for syncope in the phrase stratum are unstressed. In addition, assuming a ranking of MAX-V ("don't delete vowels") over *V̆ guarantees that deletion does not occur at the word level. The third syllable (ultimately, the site of deletion at the phrase level) is underlined.

σσσ̲σ	Trough-L	Max-V	Trough-R	*V̆	Id(str)
a. ☞ σσ̀σ̲σ́			*	**	**
b. σ̀σσ̲́σ	*!W		L	**	**
c. σσ́_σ		*!W	L	**	*L
d. σσ́_ _		*!*W	*	*L	*L

Tableau 1. Word stratum, even parity.

σσσ̲σσ	Trough-L	Max-V	Trough-R	*V̆	Id(str)
a. ☞ σσ̀σ̲σ́σ				***	**
b. σ̀σσ̲̀σσ́	*!W		*W	**L	***W
c. σσ̀_σσ́		*!W	*W	**L	**
d. σσ̀_ _σ		*!*W		**L	*L

Tableau 2. Word stratum, odd parity.

Tableau 1 and Tableau 2 demonstrate that Max-V must also outrank Trough-R – ruling out candidate (c) in the first tableau – and Id(str), ruling out both (d) candidates. Candidates (e) in both tableaux demonstrate that Trough-L must outrank Id(str). A definitive ranking of Trough-L and *V̆ cannot be established. This gives us the ranking we see in the Hasse diagram in Figure 1:

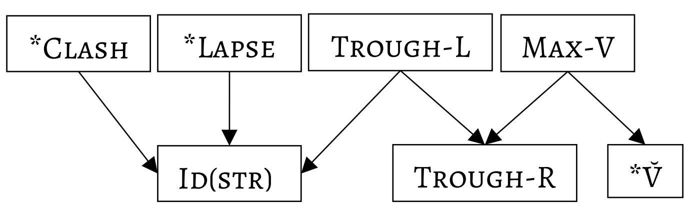

Figure 1. Hasse diagram of constraint rankings for Stratum I.

Tableau 3 and Tableau 4 demonstrate this ranking using attested Southern Pomo forms.

/pʰuht̪opu̲t̪ow/	Trough-L	Max-V	Trough-R	*V̆

a. ☞ |pʰuh.t̪ò.pu̲.t̪ów|			*	**
b. |pʰùh.t̪o.pú̲.t̪ow|	*!W		L	**
c. |pʰuh.t̪óp._t̪ow|		*!W	L	**

Tableau 3. Word stratum for /pʰuh-t̪o-pu-t̪o-w/ (even parity).

/ʔahtim**o̲**kotʃin/	TROUGH-L	MAX-V	TROUGH-R	*V̆
a. ☞ |ʔah.tì.m**o̲**.kó.tʃ in|				***
b. |ʔàh.ti.m**ó̲**.ko.tʃ ín|	*!W		*W	**L
c. |ʔah.tìm_.ko.tʃ ín|		*!W	*W	**L

Tableau 4. Word stratum for /ʔah-ti-mokotʃ-in/ *(odd parity).*

The crucial aspect of these outputs is that the syllables targeted for syncope – odd syllables counting from the left word edge – are unstressed. In the phrasal stratum, these syllables are deleted by reranking *V̆, which penalizes vowels in weak syllables, above the faithfulness constraint MAX-V which had preserved these positions at the word level.

3.3 STRATUM II – PHRASE LEVEL.

The second stratum inherits the metrical structure assigned by the first stratum as its input. With this, it must both propel deletion in the weak positions defined by that structure, as well as reassign prominences from the right edge leftward, beginning with an unstressed syllable. The second of these effects is accomplished by inverting the ranking between the trough constraints, such that TROUGH-R is re-ranked above TROUGH-L.

To generate syncope, *V̆ is re-ranked above MAX-V. However, the targets of deletion are motivated not by surface stress, but by the metrical structure from the first stratum. This entails a constraint demanding faithfulness to stressed syllables in the input, MAX-V́ ("don't delete vowels which are stressed in the input"), which has the effect of protecting those vowels from deletion regardless of whether they remain stressed in the output of the second stratum.

(27) Definition: MAX-V́ [24]

For any stressed vowel α in the input, assign one violation if that vowel has no correspondent β in the output.

This constraint is undominated at the phrase level and may be considered undominated at the word level as well; there, it is vacuously satisfied, irrespective of the input, because deletion is

[24] This is similar to MAX-σ́ (Beckman, 1998) and HEAD-MAX(BASE/OUTPUT) (Kager, 1999) but specifically concerns vocalic material rather than all segments. Similar formulations, prioritizing input-output correspondence for phonologically strong underlying forms, have also been shown to account for segmental phenomena like chain shifts in vowel reduction (e.g., MAX(V:); Gouskova, 2007, 2003; McCarthy, 2007).

prevented by the high ranking of MAX-V. As a more specific constraint, MAX-V́ is less stringent than MAX-V – it is violated by only a proper subset of the deletions which would violate MAX-V. Thus vowels which are unstressed in the input may be deleted, while deletion of their stressed counterparts is barred. The crucial phrase-level ranking to motivate syncope in the appropriate syllables is therefore MAX-V́ >> *V̌ >> MAX-V. This ranking ensures that only syllables which are unstressed at the word level are deleted at the phrase level. Tableau 5 and Tableau 6 below demonstrate this result for even and odd syllable parities, again with undominated *CLASH and *LAPSE, and the assumption that phonotactic constraints bar the deletion of vowels in the initial syllable or consecutive syllables:

$\sigma_1\grave{\sigma}_2\underline{\sigma}_3\acute{\sigma}_4$	MAX-V́	TROUGH-R	*V̌	TROUGH-L	MAX-V	ID(STR)
a. ☞ $\sigma_1\acute{\sigma}_2\_\sigma_4$			**		*	*
b. $\sigma_1\grave{\sigma}_2\underline{\sigma}_3\acute{\sigma}_4$		*!W	**		L	L
c. $\grave{\sigma}_1\sigma_2\underline{\acute{\sigma}}_3\sigma_4$			**	*!W	L	****W
d. $\sigma_1\_\acute{\sigma}_3\sigma_4$	*!W		**		*	***W
e. $\grave{\sigma}_1\sigma_2\_\acute{\sigma}_4$		*!W	*L	*W	*	**W

Tableau 5. Phrasal stratum syncope and stress realignment, even parity.

$\sigma_1\grave{\sigma}_2\underline{\sigma}_3\acute{\sigma}_4\sigma_5$	MAX-V́	TROUGH-R	*V̌	TROUGH-L	MAX-V	ID(STR)
a. ☞ $\grave{\sigma}_1\sigma_2\_\acute{\sigma}_4\sigma_5$			**	*	*	**
b. $\sigma_1\grave{\sigma}_2\underline{\sigma}_3\acute{\sigma}_4\sigma_5$			***!W	L	L	L
c. $\grave{\sigma}_1\sigma_2\underline{\grave{\sigma}}_3\sigma_4\acute{\sigma}_5$		*!W	**	*	L	*****W
d. $\grave{\sigma}_1\_\underline{\sigma}_3\acute{\sigma}_4\sigma_5$	*!W		**	*	*	**
e. $\sigma_1\grave{\sigma}_2\_\sigma_4\acute{\sigma}_5$		*!W	**	L	*	**

Tableau 6. Phrasal stratum syncope and stress realignment, odd parity.

In these tableaux, we can see that higher-ranked TROUGH-R successfully reverses the direction in which metrical structure is built, *V̌ propels deletion in weak syllables, and MAX-V́ prevents deletion from occurring in syllables which were stressed in the input. Tableau 5 demonstrates several rankings: candidate (b) eliminated by the ranking of TROUGH-R over both MAX-V and ID(STR), and (e) similarly shows that TROUGH-R outranks *V̌. Further, we see that TROUGH-L is still active at the phrase level stratum and must be ranked above MAX-V to eliminate candidates without deletion like (c). Interestingly, it is this alignment constraint, rather than *V̌, which motivates syncope for even-parity forms. This can be thought of as a peculiarity of this OT implementation, rather than an important feature of the system; as we've seen, this can instead be rendered in terms of rule-based processes.

Tableau 6 demonstrates two further critical rankings: *V̆, which motivates deletion by dominating MAX-V, must also dominate TROUGH-L and ID(STR) in order to rule out candidate (b), which violates neither TROUGH constraint. The full ranking is shown in the Hasse diagram in Figure 2.

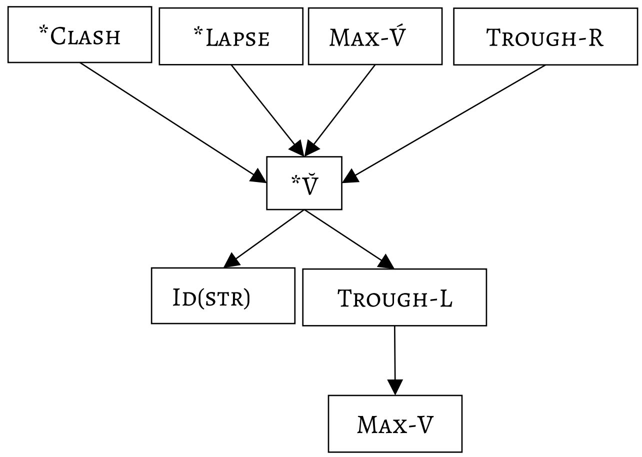

Figure 2. Hasse diagram of constraint rankings, Stratum II.

These constraint rankings demonstrate that TROUGH-R and *V̆ have been re-ranked above TROUGH-L and MAX-V, and further articulate the ranking between these constraints. This propels both deletion and the reconfiguration of the metrical structure in a way which must satisfy *CLASH by shifting stress away from derived clashes (e.g., in forms like *[ʔah.tı̀m._**kó**.ʧin]). Because TROUGH-R now outranks TROUGH-L, stress appears to be 'shifted' leftward onto the initial syllable (in odd-parity inputs); in even-parity inputs, this results in one less stressed syllable. We thus see deletion (in the odd medial syllables) and alternating stress shifted to the penult, iterating leftward. The tableaux below show that this results in the desired outputs for our two example words from §3.2:

|pʰuh.t̪ò.pu̲.t̪ów|	MAX-V́	TROUGH-R	*V̆	TROUGH-L	MAX-V	ID(STR)
a. ☞ [pʰuh.t̪óp._t̪ow]			**		*	*
b. [pʰuh.t̪ó.pu̲.t̪ów]		*!W	**		L	L
c. [pʰùh.t̪o.pú̲.t̪ow]			**	*!W	L	****W
d. [pʰùh.t̪op._t̪ów]	*!W		**		*	**W

Tableau 7. Phrasal stratum for /pʰuht̪oput̪ow/.

|ʔah.tí.m**o̲**.kó.ʧin|	MAX-V́	TROUGH-R	*V̆	TROUGH-L	MAX-V	ID(STR)
a. ☞ [ʔàh.tim_.kó.ʧin]			**	*	*	**

b.	[ʔah.tì.m**o**.kó.ʧ in]			***!W	L	L	L
c.	[ʔàh.ti.m**ò**.ko.ʧ ín]		*!W	***W	L	L	L
d.	[ʔah.tìm_.ko.ʧ ín]		*!W	**	*	*	***W
e.	[ʔàh.ti.m**ó**k_.ʧ in]	*!W		**	*	*	****W

Tableau 8. Phrasal stratum for /ʔahtimokoʧin/.

We have now seen that the Southern Pomo data are generable using a two-stage derivation in SOT. The first of these strata, corresponding to the word level, defines weak positions from the left edge, and the second stratum (phrase level) deletes vowels in these positions and re-assigns prominence from the right edge. The positions where syncope occurs are determined by word-level metrical structure assigned in the first stratum, but deletion itself is applied at the phrase level. This seems at odds, however, with the observation that the location of syncope is insensitive to a word's position within a larger prosodic constituent. Syncope occurs in the same syllable regardless. This outcome is in fact consistent with the strata above. Vowel deletion is determined by an output-oriented markedness constraint against unstressed vowels (*V̆), but the targets and extent of deletion are governed by higher-ranked faithfulness constraints. Max-V́ ensures that deletion occurs in positions determined by word-level metrical structure, *even though deletion takes place in the phrase-level phonology*. Recall the form presented above in (18)b (reproduced here) showing that syncope is not affected by the placement of phrasal stress:

(28) Syncope is insensitive to stress shift
[máʔdak^{h}_dén # muʔ.t'á.waj]
/maʔ-dak^{h}**a**d-en # mu-ʔt'a-waʧ/
3.own-spouse-obj ?-attach-dir
"He sticks to his wife, is always with her" (Oswalt, 306)

Compare the prediction for the morpheme string /maʔ-dakad-en/ in isolation (in Tableau 9) to the form predicted when this is followed by three syllables, as in (28), shifting stress to the ultima (Tableau 10). The tableaux below demonstrate that the locus of deletion does not change, and the outputs are both [maʔ.dak_.den]:

| maʔ.dá.k^{h}**a**.dén |	Clash/ Lapse	Max-V́	Tr.-R	*V̆	Tr.-L	Max-V	Id(str)
a. ☞ [maʔ.dák^{h}_.den]				**		*	*
b. [maʔ.dà.k^{h}**a**.dén]			*!W	**		L	L
c. [maʔd_.k^{h}á.den]		*!W		**		L	***W
d. [màʔ.da.k^{h}**á**.den]				**	*!W	L	****W

Tableau 9. Phrase level, showing syncope for /maʔ-dakad-en/ *in isolation.*

[maʔ.dá.k^h<u>a</u>.dén]$_\omega$ [σόσ]$_\omega$	Clash/ Lapse	Max-V́	Tr.-R	*V̆	Tr.-L	Max-V	Id(str)
a. ☞ [[màʔ.dak^h_.dén]$_\omega$ [σόσ]$_\omega$]$_\varphi$				***	*	*	**
b. [[maʔ.dà.k^h<u>a</u>.dén]$_\omega$ [σόσ]$_\omega$]$_\varphi$				****!W	L	L	L
c. [[maʔ.dàk^h_.den]$_\omega$ [σόσ]$_\omega$]$_\varphi$	*!W		*!W	****W	L	L	*L

Tableau 10. Phrase level, showing syncope for /maʔ-dakad-en/ *within a multiword phrase.*

These tableaux demonstrate that this account predicts the observed invariance in what syllables are targeted for deletion.

We have also seen that word-final syllables do not undergo syncope even when they do not receive word-level stress in Stratum I, e.g., the word-final syllable in [ts’íh.ta] ‘birds’ in (14) above, reproduced here in (29).

(29) Final vowels are not deleted

[ts’íh.ta]$_\omega$ [min.náːn.t̪i̯]$_\omega$
→ [ts’ih.t<u>à</u> # min.náːn.t̪i̯]$_\phi$ “trapping birds" (Walker, 2013, 487)

This suggests the activity of an independent constraint which protects positions at word edges from deletion. To this end, I propose an Anchor constraint, Anchor-Right-Edge-Word, which assigns violations for deletion of vowels occurring word-finally in the input:

(30) Anchor-R-Edge-Wd (adapted from McCarthy & Prince, 1995)
Assign one violation for each segment in the input, just in case that vowel is word-final, and has no correspondent in the output.

This constraint is undominated, with the result that vowels in initial or final syllables in the word domain are not eligible for deletion in the phrasal domain.[25]

The discussion of enclitics above indicated that these are introduced into the derivation at the phrase level and are not assigned stress in the word-level stratum. This means that, in the latter stratum, Max-V́ (which causes deletion to be rhythmic elsewhere) will be vacuously satisfied no matter the pattern of deletion in the clitic field. Syncope in these morphemes is therefore free to occur anywhere – *any vowel in the clitic field is liable to be deleted*. Combined with the activity of *Clash, *Lapse, and the syncope-driving constraint *V, this predicts that *the clitic field will undergo as much deletion as is allowed by phonotactics*. This deletion is predicted to occur

[25] Syllables which are final in some domain are not always immune to deletion – for example, we see root-final deletion in (7)a [ʃiː.báːt̪^{h}._m^{h}uj]. This is not contradictory to the model proposed here: bracket erasure is a prediction of this model – “phonology applying within higher-order stems in a word does not make reference to deeply embedded morphological structure,” (Inkelas & Zoll, 2007:145; see also Bermúdez-Otero, 2012:82). Bracketing at the root level in noun-noun compounds is not visible at the phrasal level (two stages later) where syncope occurs.

regardless of the position of encliticized material relative to either word- or phrase-level stress. That is, clitics should not show rhythmic vowel deletion, nor the vowel-∅ alternations that word-internal suffixal morphemes do. Clitics should instead surface with the minimal amount of phonological material allowed by phonotactics. This prediction is illustrated in Tableau 11:

	[cv$_1$c.cv́$_2$.cv$_3$] =cvcv	Anchor-Edge	Max-V́	Tr-R	*V̆	Tr-L	Max-V
a.	☞ cv̀$_1$c.cv$_2$.cv́$_3$=c._cv				**	*	*
b.	cv$_1$c.cv̀$_2$.cv$_3$ =cv́.cv				***!W	L	L
c.	cv$_1$c.cv̀$_2$.c_ =cv́.cv	*!W			**	L	*
d.	cv̀$_1$c.cv$_2$.cv́$_3$=cvc_	*!W			**	*	*

Tableau 11. Maximal deletion is predicted in the clitic field.[26]

This prediction cannot be tested because the clitics of Southern Pomo are predominantly monosyllabic and appear to be irreducible: any further vowel deletion results in phonotactically illicit sequences. There are thus no synchronic vowel-∅ alternations in the clitics themselves, and the tableau above represents an earlier stage in the language's development. However, some evidence emerges from comparison to the patientive pronominal clitics [=ʔt̪o] '1.sg.pat' and [=mt̪o] '2.sg.pat', both of which have unreduced forms (and cognates in other Pomo languages) that appear as independent words, [ʔaːt̪o] and [miːt̪o]; I analyze the underlying realizations of these morphemes as /ʔat̪o/ and /mit̪o/, respectively (that is, I attribute vowel length and thus syllable weight in the initial syllables of these two forms to the laryngeal increment). When encliticized, these pronouns are always reduced, irrespective of the position of surface stress. Similarly, Walker proposes that "regular syncope" is responsible for the synchronic forms of many clitics which were historically multimorphemic (380), though this did not apparently rely on the rhythmic properties of the host word like syncope elsewhere in the language.

This suggests that the clitic field was once subject to deletion of unstressed vowels, but that this was a non-rhythmic process, as predicted by this stratal analysis. Deletion has seemingly occurred wherever possible and is non-alternating. It therefore appears that the lexicon has undergone diachronic restructuring, what has been called *lexical* or *input optimization* (Prince & Smolensky, 1993). The learner, as a default, assumes that the surface form of a word violates as few Faithfulness constraints as possible – i.e., that the surface form and underlying representation are maximally similar. Without alternations providing evidence for the presence of underlying vowels, learners acquire the reduced forms of these morphemes, the only observed surface forms, as underlying representations (Bermúdez-Otero & Hogg, 2003). The synchronic forms of these clitics represent historically frozen patterns of deletion.

I have now shown how SOT accounts for the third-syllable pattern of syncope in Southern

[26] Here, I assume any candidate [=c_c_] with two deletions in the enclitic will be blocked by phonotactics, as this results in a complex coda.

Pomo. The theoretical consequences of this analysis are significant: with the stratal framework needed to account for metrically incoherent syncope in Southern Pomo, we allow for counter-typological overgeneration. We should thus consider whether this syncope pattern can also be achieved in parallel, without a derivation, or in a more restrictive framework with a static constraint ranking, like Harmonic Serialism (HS) OT with Candidate Chains (OT-CC; McCarthy, 2006), or Transderivational Faithfulness (Benua, 1997). §4 considers such analyses, which are ultimately unsuccessful at generating this pattern. However, we will also see that the parallelist analysis utilizing the Stress-to-Weight Principle (Prince, 1990) generates fourth-syllable deletion.

4. Alternatives to strata

4.1. NON-STRATAL DERIVATION

In HS and OT-CC architectures, opacity arises from satisfying constraints sequentially, from highest- to lowest-ranked, rather than in parallel. This system does not allow those constraints to be violated in later stages of the derivation; there is only one constraint ranking in the derivation, and constraints are not re-ranked (unlike SOT). Metrical structure in an HS or OT-CC account is determined by highly ranked constraints, and no candidate can harmonically improve if it is not fully compatible with these constraints (McCarthy, 2008; Pruitt, 2010; Elfner, 2016; Calamaro, 2017). HS is thus unable to produce metrical reversals due to inherent features of its architecture. In syncope processes, HS enforces an *inherent ordering* of metrical parsing before the deletion that it conditions. This captures rhythmic vowel deletion like that seen in Awajún (Aguaruna) and Tonkawa (McCarthy, 2008), but by design is unable to produce the Southern Pomo pattern: even in the absence of syncope, surface stress in Southern Pomo must be realigned to the right edge of a postlexical phrase, which necessitates metrical reparsing. These factors militate for an account in Stratal OT, with free re-ranking of constraints between strata.

Another set of analyses, utilizing base-output correspondence (i.e., Transderivational Faithfulness; TF), have been put forward for the Tripoli and Palestinian dialects of Levantine Arabic (Kager, 1999). These analyses derive opacity in morphologically complex forms by enforcing faithfulness to their less-complex stems. TF was devised to handle opacity arising from morphologically-conditioned opaque inheritance, such that transparent phonological alternations from base forms appear in more morphologically complex forms as over- or underapplication of a phonological process. In Southern Pomo, there is no form in the paradigm with transparent application of deletion that can serve as such a base, and as such there is not a clear way to discuss this pattern of opaque deletion in terms of faithfulness to such a base.

Derivational frameworks which depend on a single ranking are not able to realign stress without making a candidate less harmonic. However, these frameworks may be able to generate the attested pattern using *disjoint metrical tiers* (also called *disjoint footing*; Rappaport, 1984; Halle &

Vergnaud, 1987; Parker, 1998; Aion, 2003; González, 2007; Vaysman, 2008). Such analyses utilize multiple tiers of distinct metrical structure that coexist within a word, each conditioning the application of one of the two rhythmic phenomena in question.

(31) Disjoint footing for stress and syncope

Stress	R→L	σ (σ́ σ)(σ́ σ)
Deletion	L→R	(σ̲ σ}{σ̲ σ} σ

Here, unlike in analyses incoherent surface prominence (e.g., Gordon, 2016), one metrical structure corresponds to prominence, and the other to a rhythmic segmental process (e.g., vowel deletion). However, because surface stress in Southern Pomo is alternating and postlexical, it must be calculated based on the syllable string *after* deletion. Therefore, disjoint footing processes must still be derivationally ordered, syncope followed by stress assigment. Though similar analyses have been proposed for stress and syncope in Tiberian Hebrew (Rappaport, 1984; *cf.* Dresher, 2009), the interaction of vowel lengthening and stress in Tübatulabal (Heath, 1981; Aion, 2003; *cf.* Benz, 2018), and alternating epenthesis and stress in Huariapano (González, 2007; Parker, 1998a; *cf.* Bennett, 2013a), the necessity of sequential derivation makes this analysis qualitatively different from other uses of disjoint footing. This approach thus appears to merely recapitulate the predictions of SOT, including the same set of counter-typological rhythmic processes criticized by Wolf (2012). In addition, Disjoint footing is unable to account for non-rhythmic derivational phenomena such as compensatory lengthening. For further argumentation against this approach, I direct the reader to Bennett (2013), Churchyard (1999), and references therein.

4.2. Parallelist approaches

A number of successful analyses of syncope – such as those for Southeastern Tepehuán (Kager, 1997; Gouskova, 2003), Tonkawa, Hopi (Gouskova, 2003; *cf.* Blumenfeld 2006), Bedouin Hijazi Arabic, and Central Alaskan Yupik (Gordon, 2001) – rely only on surface-oriented constraint interactions and are generable in parallel OT. Some of these analyses utilize Foot- or Stress-to-Edge Alignment constraints, which penalize intervening syllables between a word edge and foot edge or stressed syllable. Others make use of the Stress-to-Weight Principle (SWP, which penalizes stress on light syllables; Prince 1990), or other quantity-sensitive constraints on stress. All of these constraints maximize the wellformedness of surface metrical structure and can promote deletion to either minimize the number of syllables between a prominence and word edge (Alignment) or ensure that stress only falls on syllables containing enough phonological material (SWP).

As I demonstrate below, parallel OT and surface-oriented constraints – those that militate for stress to fall on certain types of syllables, and those that militate for reducing phonological material – cannot generate the observed third-syllable deletion pattern, precisely because third-syllable deletion is not surface-optimizing. Instead, this syncope pattern requires reference to metrical positions defined at an earlier derivational stage. While syncope in the stratal account is conditioned by a surface-oriented markedness constraint (*V̌), it is faithfulness to metrically strong positions in the input that determine where deletion occurs.

Given that surface metrical structure in Southern Pomo is aligned to the right edge of the word, we might hypothesize that syncope can be explained by the ranking of ALIGN-RIGHT($\acute{\sigma}$,ω) (McCarthy & Prince, 1993) over MAX-V. This ranking would have the effect of promoting deletion when this results in a prominence closer to the right word edge. As a result, this constraint, and its sibling ALIGN-LEFT, suffer from the same shortcoming: deletion in *any* syllable can improve harmony by reducing word length, and worse yet, this promotes deletion of as many syllables as possible (to the extent allowed by other constraints). Perhaps SWP will fare better?

Syncope appears to always result in fewer stressed light syllables, due to the phonotactic restrictions of the language and to the fact that initial syllables in the language are always heavy due to laryngeal incrementation (discussed above in §2.2.1). Deletion of the vowel in a given syllable results in the re-syllabification of that syllable's onset as a coda consonant in the preceding syllable. That is, /-cv_2.c$\underline{\mathbf{v}}_3$.cv_4-/ becomes [-cv_2c._cv_4-]. Therefore, deletion in the third syllable creates a heavy peninitial syllable, and deletion in the fifth syllable creates a heavy fourth syllable:

(32) Syncope results in fewer light stresses

a. / $\sigma_H\sigma_L\sigma_L\sigma_L\sigma_L$ / → [$\acute{\sigma}_H\sigma_H$_$\acute{\sigma}_L\sigma_L$] one $\acute{\sigma}_L$ * [$\sigma_H\acute{\sigma}_L\sigma_L\acute{\sigma}_L\sigma_L$] two $\acute{\sigma}_L$

b. / $\sigma_H\sigma_L\sigma_L\sigma_L$ / → [$\sigma_H\acute{\sigma}_H$_σ_L] zero $\acute{\sigma}_L$ * [$\acute{\sigma}_H\sigma_L\acute{\sigma}_L\sigma_L$] one $\acute{\sigma}_L$

SWP, which assigns violations to stressed light syllables, is thus a plausible constraint to motivate syncope, and maximally well-formed words will avoid light stressed syllables. Impressionistically, this appears to reflect the data. Syncope is blocked in closed syllables by phonotactic constraints, and so words which have undergone syncope invariably have one less light syllable. The resulting heavy syllable is frequently stressed. As the tableaux below show, the syncopated candidates are in fact more harmonic than their faithful competitors:

	σ_H.cv_2.c$\underline{\text{v}}_3$.σ	SWP	MAX-V
a. ☞	σ_H.c$\acute{\text{v}}_2$c._σ		*
b.	$\acute{\sigma}_H$.cv_2.c$\acute{\text{v}}$.σ	*!W	L

Tableau 12. Syncope increases harmony for SWP (even-parity).

	σ_H.cv_2.c$\underline{\text{v}}_3$.cv_4.σ	SWP	MAX-V
a. ☞	$\acute{\sigma}_H$.cv_2c._c$\acute{\text{v}}_4$.σ	*	**
b.	σ_H.c$\acute{\text{v}}_2$.c$\underline{\text{v}}_3$.c$\acute{\text{v}}_4$.σ	**!W	L

Tableau 13. Syncope increases harmony for SWP (odd-parity).

Forms that have undergone syncope are more harmonic for SWP than candidates without deletion. As previously mentioned, this is typically because deletion shifts stress leftward: in words with an odd parity of underlying syllables, this results in the heavy initial syllable receiving a secondary stress; in even-parity words, this results in one less stressed syllable overall, and stress falls on a now-heavy peninitial syllable. The resulting wellformedness is not necessarily local, as can be seen in (33), where the derived heavy syllable is not stressed:

(33) Syncope increases global SWP harmony

a. |ʔah.t̪ɨ̀.m**o̲**.kó.ʧin| (2 SWP violations) → [ʔàh.t̪ɨm_.kó.ʧin] (1 SWP violation)
/ ʔa(h)t̪ɨ-m**o̲**koʧ-in /
move.foot-DIR-SG.IMP
"put foot back!" (W 95)

b. |ʔah.kʰà.b**u̲**.tá.ka| (2 SWP violations) → [ʔàh.kʰap_.tá.ka] (1 SWP violation)
/ʔa(h)kʰa- b**u̲**(:)taka/
water- bear
"sea lion" (W 99)

Here, main stress remains on a light syllable, and the heavy syllable formed by vowel deletion is itself unstressed. The word, however, is globally more harmonic with respect to SWP, because stress is shifted leftward onto the heavy initial syllable. Syncope does not result in a heavy stressed syllable locally, but there is one less light stressed syllable. This is an example of how parallelist approaches to syncope have generally resolved apparent opacity: a process may seem unmotivated or opaque locally, but results in a more harmonic form under global evaluation (Gouskova, 2003; Blumenfeld, 2006).

Syncope always increases global harmony with respect to SWP, and SWP accurately predicts the majority of Southern Pomo surface forms. But we cannot conclude that syncope is transparent: like the alignment constraints, SWP is not able to correctly predict the location of syncope in every case. The optimal candidate for SWP is always one where all stressed syllables are heavy. As shown in Tableau 14 below, deletion in the fourth syllable, rather than the third, would result in a maximally harmonic candidate for SWP:

σ_H.cv$_2$.c$\underline{v}_3$.cv$_4$.σ /ʔah.kʰa.bu.ta.ka/	SWP	MAX-V
a. ☹ $\grave{\sigma}_H$.cv$_2$c._c$\acute{v}_4$.σ [ʔàh.kʰap._tá.ka]	*	*
b. σ_H.c$\grave{v}_2$.c$\underline{v}_3$.c$\acute{v}_4$.σ *[ʔah.kʰà.bu̲.tá.ka]	**!W	L

c. ☠ $\grave{\sigma}_H$.cv$_2$.c$\acute{\underline{v}}_3$c._.σ *[ʔàh.kʰa.bút._ka]	L	*

Tableau 14. SWP predicts the incorrect location for syncope.

As this tableau shows, the attested form (a) is indeed harmonically bounded by a competitor (c) in which V_4 has deleted, resulting in a candidate without light stressed syllables. When V_4 is light, deletion of V_4 shifts stress leftward to σ_3, which is then heavy, having resyllabified the onset of σ_4 as a coda. The optimal location for deletion in these cases is V_4, the vowel in the even penult, but syncope instead targets vowels in the odd (third and fifth) syllables of the word. The only forms where we observe this are four-syllable words like those in (33), derived from underlying five-syllable strings:

(34) Example forms sub-optimal for SWP

a.	[ʔàh.kʰap_tá.ka]	1 SWP violation
	*[ʔàh.kʰa.bút._ka]	0 SWP violations
b.	[ʔàh.t̪im._k'ó.ʧin]	1 SWP violation
	*[ʔàh.t̪i.mók._ʧin]	0 SWP violations

The predictions of an SWP-driven system are *usually* in line with the observed Southern Pomo data, but SWP cannot be responsible for driving the third-syllable pattern of rhythmic deletion because a subset of forms is not surface-optimizing.

These forms – surface strings bearing stress on odd, light penults –provide crucial evidence for opacity, but are only a small portion of the language. How heavily do learners weigh this evidence when most of the input is equivocal? Tellingly, the subpattern of fourth-syllable syncope discussed in §2.3 appears to delete in exactly these surface-optimizing positions, and these forms resist analysis by stratal derivation. I propose that this reflects restructuring of the synchronic grammar, due to the limited learnability of the opaque stratal pattern.

4.3. PARALLELISM & FOURTH-SYLLABLE SYNCOPE

Examples of these forms are given again in (35) below, along with the expected forms (basedon the SOT account) that do not appear.

(35) Surface optimizing and non-optimizing syncope in /σσσσ_Lσ/ strings

	UNDERLYING FORM	OPTIMIZING	NON-OPTIMIZING
	/σσσσ_Lσ/	[σ̀σ$\acute{\sigma}_H$_σ]	[σ̀σ_$\acute{\sigma}_L$σ]
a.	/hat̪(:)-al**o**k**o**ʧ-in/ "[move foot] up out of[!]" (W 95)	☞ [hàt̪.t̪a.ló̲k_.ʧʼin]	* [hàt̪.t̪al_.kó.ʧʼin]

b. /be(ː)ne-mʰ**u̲**ʧʼ-tʰ**u**-le/ "(2) don't hug each other!" (W 226) ☞ [bèː.ne.mʰ**ú̲**tʰ_.le] * [bèː.nemʰ_.tʰú.le]

---

c. /ʔa(h)kʰa-b**u̲**taka/ "sea lion" (W 99) * [ʔàh.kʰa.bút_.ka] ☞ [ʔàh.kʰap_.tá.ka]

d. /ʔa(h)t̪i̪-mokoʧ-in/ "put foot back!" (W 95) * [ʔàh.t̪i̪.mók_.ʧin] ☞ [ʔàh.t̪i̪m_.kó.ʧin]

Compare the forms above in (35)a-b, where syncope results in forms without light stressed syllables, to those in (35)c-d, where syncope is not surface-optimizing for SWP. The pattern of syncope in third-syllable forms is not surface-optimizing because they have *light* stressed penultimate syllables on the surface. In contrast, the fourth-syllable forms have syncope of the underlying fourth vowel, resulting in a *heavy* stress-bearing penult, and thus transparent surface optimization relative to the Stress-to-Weight (as no stresses fall on light syllables). These forms cannot be morpheme-specific, as shown in (25). They instead suggest a re-analysis of the grammar, where syncope and metrical parsing occur in parallel, such that *syncope is metrically coherent* (in the sense that the language makes use of a consistent metrical structure across derivational stages; Dresher & Lahiri, 1991; see also Bennett, 2013a). The constraints driving syncope here are output-oriented, unlike the third-syllable deletion pattern seen in similar forms.

This analysis still requires strata because of phrasal stress shift, and two separate computations of stress are thus necessary to produce the observed structure.[27] However, under this analysis, syncope does not involve inter-stratal dependencies, and instead takes place at the word level, alongside word level stress. It is only in larger prosodic constituents that metrical opacity is introduced by shifts in stress. An example derivation is presented below; Tableau 15–Tableau 17 show word-level Stratum 1b, and Tableau 18 shows a sample derivation of phrasal stress (Stratum 2b). *Clash, *Lapse, and phonotactic constraints are again assumed to be undominated and are not shown.

$\sigma_H.cv_2.cv_3.cv_4$	Tr-R	SWP	MAX-V
a. ☞ $\sigma_H.c\acute{v}_2c\_.cv_4$			*
b. $\grave{\sigma}_H.cv_2.c\acute{v}_3.cv_4$		*!W	L

Tableau 15. Word Stratum 1b, alternative SWP-driven account (4 syllables).

$\sigma_H.cv_2.cv_3.cv_4.cv_5$	Tr-R	SWP	MAX-V

[27] For this reason, the analysis of Southern Pomo syncope remains intractable in Harmonic Serialism.

a. ☞	$\grave{\sigma}_{H}.cv_{2}.c\acute{v}_{3}c\_.cv_{5}$			*
b.	$\sigma_{H}.c\grave{v}_{2}.cv_{3}.c\acute{v}_{4}.cv_{5}$		**!W	L
c.	$\grave{\sigma}_{H}.cv_{2}c\_.c\acute{v}_{4}.cv_{5}$		*!W	*

Tableau 16. Word Stratum 1b, alternative SWP-driven account (5 syllables).

	$\sigma_{H}.cv_{2}.cv_{3}.cv_{4}.cv_{5}.cv_{6}$	TR-R	SWP	MAX-V
a. ☞	$\grave{\sigma}_{H}.cv_{2}c\_.c\acute{v}_{4}c\_.cv_{6}$			**
b.	$\grave{\sigma}_{H}.cv_{2}.c\grave{v}_{3}.cv_{4}.c\acute{v}_{5}.cv_{6}$		*!*W	L
c.	$\sigma_{H}.c\grave{v}_{2}.cv_{3}.c\acute{v}_{4}c\_.cv_{6}$		*!W	*L
d.	$\sigma_{H}.c\grave{v}_{2}c\_.cv_{4}c\acute{v}_{5}.cv_{6}$		*!W	*L

Tableau 17. Word Stratum 1b, alternative SWP-driven account (6 syllables).

The word stratum outputs the isolation forms; in most cases these look identical to those derived by the derivation outlined in §3. The notable exception is the winning candidate in Tableau 16, which has no light stressed syllables, whereas the opaque derivation results in candidate (c) (with a light penult that is not surface-optimizing). Tableau 17, showing six syllable forms, demonstrates how SWP optimizes globally, rather than locally. Deletion in the winning candidate seems to "over-apply," in that the second syllable is heavy because of deletion, but stress does not actually fall on it. Instead, deletion causes stress to fall on the obligatorily-heavy initial syllable, reducing the overall number of light stressed syllables.

The second stratum in this alternative derivation maintains the same ranking; the key difference is the size of the input. Further deletion in the stem is prevented by phonotactics – because deleting any medial syllables would result in illicit onset or coda clusters. Tableau 18 below demonstrates this with a (derived) four-syllable word, followed by a three-syllable word.

	$\acute{\sigma}_{H}\sigma_{L}\_\acute{\sigma}_{H}\sigma_{L} + \sigma_{H}\acute{\sigma}_{L}\sigma_{L}$	*LAPSE	TROUGH-R	SWP	MAX-V
a. ☞	$\sigma_{H}\grave{\sigma}_{L}\_\sigma_{H}\grave{\sigma}_{L}$ + $\sigma_{H}\acute{\sigma}_{L}\sigma$			***	
b.	$\grave{\sigma}_{H}\sigma_{L}\_\grave{\sigma}_{H}\sigma_{L}$ + $\sigma_{H}\acute{\sigma}_{L}\sigma_{L}$	*!W		*L	
c.	$\grave{\sigma}_{H}\sigma_{L}\_\grave{\sigma}_{H}\sigma_{L}$ + $\grave{\sigma}_{H}\sigma_{L}\acute{\sigma}_{L}$		*!W	*L	

Tableau 18. Phrasal Stratum 2b, alternative SWP-driven account (5 underlying syllables)

This second stratum outputs the shifted stress in phrases without necessitating a reranking, with further syncope nevertheless prevented by phonotactic constraints. That is, the language requires a single uniform parsing algorithm across strata, making it metrically coherent.[28]

5. Learnability, grammar competition, & diachronic change

In the preceding section, we saw that the most promising grammatical competitor to a metrically-incoherent stratal account is one in which deletion is instead driven by avoidance of stress falling on light syllables (the Stress-to-Weight Principle, SWP). This can nearly account for the Southern Pomo pattern of third-syllable vowel deletion, but SWP is unable to produce light stressed syllables in attested forms like (9)a *ʔàhkʰaptáka* 'sea lion'. However, there are some forms where deletion of a vowel in the fourth syllable prevents a light stressed penult from arising, precisely as predicted by SWP – e.g., (25)d *dàkk'at̪'mátʃtʃ'in* 'bring several here!'.

The exact historical trajectory of these patterns cannot be confirmed; there is not diachronic data to prove that Southern Pomo went through contact-induced change, rather than an endogenous stress restructuring due to syncope itself. In the latter case, the possibility is that, beginning with a left-aligned peninitial stress system (as in Proto Pomo), deletion might have rendered surface stress ambiguous (for three-syllable forms) between peninitial and a right-aligned, penultimate system. Learners might then have settled upon a penultimate interpretation. This seems to be unlikely, as the language features a large number of words that, due to enclisis, are quite long and have multiple stresses. There are also no shortage of disyllables (not remarked upon here because they never display vowel-zero alternations), where stress would remain final. The majority of input would thus be unambiguous. For this reason, the proposal that contact with Bodega Miwok spurred the development of right-aligned phrasal stress is more plausible. The later development of a word-level SWP grammar therefore represents restructuring, flattening the metrically-incoherent system.

If fourth-syllable syncope is due to restructuring of the grammar, what promoted this reanalysis? Prior work has suggested that there is a diachronic bias towards more transparent systems (e.g., Kiparsky, 1968; Prickett, 2019). This bias is hypothesized to arise from the relative ease of learning how processes (or constraints) interact. The difficulty associated with learning opaque interactions is at least partially due to the *hidden structure* problem: learners have access to underlying representations (morphemes or concatenations of morphemes from the lexicon) and surface realizations, but do not see direct evidence of the intermediate representations involved in the mapping between them (Jarosz, 2016). The learner must accumulate sufficient evidence to infer how the map works and rule out alternative hypotheses. Multilevel grammars in particular are only learnable given robust evidence for the stratal affiliation of a process

[28] Notably, this may be amenable to a non-stratal analysis using output-output faithfulness, though Harmonic Serialism may fail to derive syncope for the same reasons described in §4.1– namely, deletion may not be compatible with the gradualness condition. If we assume that HS is able to produce syncope in the appropriate position, it must still concede that there are strata because of phrasal stress shift. (Combined Stratal HS approaches have been proposed; see Calamaro, 2017.)

(Nazarov & Pater, 2017).

From the learner's perspective, both the surface-optimizing and stratal analyses of syncope are possible analyses of the same data in almost all cases. The predictions of these analyses appear to diverge exclusively in forms with underlyingly light fourth syllables. The circumscribed set of forms in which the predictions of these models do not overlap is suggestive: *because there is minimal evidence from the input to the learner that could clearly support one account over the other, learners are likely to converge on whichever generalization is easier to extract.* Thus, opaque patterns may prompt restructuring by learners, who acquire a different constraint ranking – or induce *ad hoc* constraints – to transparently account for diachronic opacity in the input (e.g., Hayes, 1999). Fourth-syllable syncope provides evidence that Southern Pomo was in the midst of such a restructuring.

We must note that the synchronic status of metrical opacity in Southern Pomo is clear, regardless of whether the language remained metrically incoherent. As demonstrated in §2.2.3, the loci of deletion and surface stress are independent. This means that *any* analysis of metrically conditioned vowel deletion – whether derivationally or output-oriented – must be able to generate surface structures where deletion is opaque. The locus of difference between the *V̆ and SWP grammars is at the word level, specifically in the relative ranking of SWP and MAX-V. The word-level SWP grammar presented in §4.3 requires a phrase-level grammar to realign surface stress, and the phrase-level grammar presented in §3.3 accomplishes exactly this: despite nominally encouraging deletion (via promotion of *V̆ over MAX-V), cluster restrictions prevent any further deletions from occurring. A diachronic shift towards fourth-syllable deletion can therefore be thought of as *domain narrowing* of syncope from the phrase to word level, in line with the theorized trajectory of the *phonological life-cycle* (Bermúdez-Otero & Trousdale, 2012).

What, then, do learners hypothesize about the conditioning of syncope? We must ask whether and how they come to learn that this process is opaque. What assumptions do learners begin with? In this case, there are two possibilities: either the learner expects opacity, and finds it, or they expect transparency and are met with opacity. Let us suppose that the learner begins with the assumption that any given process is transparent until they have positive evidence to the contrary. This is a conservative assumption, and the opposite approach would encounter a familiar problem. Much like error-driven constraint demotion (Tesar & Smolensky, 1993, 2000), starting with the most permissive option – an assumption that a derivation, and specifically stratal architecture, is necessary – will prevent the learner from finding positive evidence for a more restrictive system. In this way, the "stratal-first" learner is akin, by analogy, to a starting ranking of Faithfulness over Markedness. To successfully converge on a grammar, they must instead start from a more conservative system – one which is parallel until necessary.

The learner might then approach this syncope pattern in parallel, as above in §4.2, and will successfully derive syncope transparently in the great majority of cases by using SWP – except in words like [ʔàh.t̪ʰim._kó.ʧin], with stress on light penults. These forms exhibit deletion that is non-optimizing, and thus present the learner with counterevidence for the SWP hypothesis. If too few of these cases are encountered, however, the learner is then able to settle on this transparent derivation of syncope rather than posit a derivational metrical structure to condition it. It is important to note that the "transparency" of this reanalysis is, in fact, still rendered opaque in the surface phonology when phrasal stress shift occurs – that is, in an estimated half of all tokens for any given form, whenever an odd number of syllables follow it within the phrasal domain. There is no evidence of an asymmetry in the syllable parity of words following syncopated forms, so we may assume that learners of Southern Pomo received roughly equal amounts of input with and without phrasal stress shift. That is, syncope could not be conditioned by surface stress in roughly half of learners' input. Allomorphs of the suffixes are conditioned by word-level metrical structure; however, this conditioning may be rendered opaque by phrasal stress. For any given allomorph, phrasal stress shift will ensure that there are two distinct surface realizations:

(36) Phrasal stress interacts with syncope

a. Preceding even parity within phrase	b. Preceding odd parity within phrase
[hàː.ʧat._lók_ʧʼa # όσ]	[haː.ʧàt._lok_ʧʼà # σόσ]
[hàʧ.ʧ_al.kó.ʧʼin # όσ]	[haʧ.ʧ_àl.ko.ʧʼìn # σόσ]
[hàːʧat̪._ló.koj # όσ]	[haːʧàt̪._lo.kòj # σόσ]

Given this, the learner is inevitably faced with a ranking paradox if they attempt to proceed in parallel; two instantiations of the same lexical item would require different grammars to generate this pattern, in the forms where it is possible at all. The interaction of phrasal stress shift with deletion thus demonstrates that the metrical structure which conditions syncope *cannot* be built at the phrasal level, whether or not syncope itself is a phrase-level process. This is supported by the data: speakers did not demonstrate transparent alternations in the location of syncope based on phrasal surface stress, regardless of whether the word produced had deletion in the third or fourth syllable (Walker, p.c.). The issue is then whether syncope is computed subsequent to the building of this word-level structure, or in parallel with it.

In addition to providing converging evidence for the stratal account, the behavior of the clitic field and the boundary between word-level stems and enclitics (described in §2.2.2) is evidence for the learner about opaque structure. Domain-final phonological alternations demonstrate the existence of these domains. For example, the stem-final ejectivization process shows alternations when there is following word-internal material, but not when the following material is enclitic – showing phonological operations applying to the word-level, exclusive of enclitics. In contrast to this, the participation of enclitics in phrase-level stress assignment and compensatory lengthening demonstrates the existence of a postlexical stratum. Thus, the learner receives a significant amount of evidence that multiple levels of phonology are active in the synchronic grammar.

However, with respect to the learnability of the interactions between these strata that result in opaque syncope, the data is largely equivocal or even biasing towards a "simplified" grammar in which syncope is driven by surface optimization and is not influenced by positional faithfulness. The evidence in the input comes only from four-syllable words of the form [$\sigma\sigma\sigma_L\sigma$] that also have related forms in which an additional vowel appears. In one of the few transcribed Southern Pomo narratives, *Rock Man and Grey Squirrel* (Walker, 2020, 345-361), comprising 71 sentences, there are only eight [$\sigma\sigma\sigma_L\sigma$] forms, none of which have intraparadigmatic vowel-∅ alternations. Such words likely did not comprise a large portion of the input. When these words do occur, deletion is dictated by word-level faithfulness constraints. This patterning could lead the learner to suppose that syncope is a word-level process, for lack of sufficient positive evidence to the contrary. The clitic field meanwhile features exclusively heavy syllables, and thus heavy stressed syllables when those bear stress, satisfying SWP while providing no evidence in support of the stratal grammar. The paucity of evidence is not the only challenge for the learner: even when provided with surface alternations, learners may fail to extract the necessary grammatical generalization (Bowers, 2019; Morley, 2018).

This is thus an instantiation of the *credit problem* (Stanton, 2016): most of the Southern Pomo surface forms are equally consistent with deletion driven by *V̆ or by SWP, such that both markedness constraints are promoted. SWP is just as good of a fit for the majority of the data. Stanton (2016) demonstrates that this problem prevents artificial learners from acquiring typologically-predicted grammars despite being provided with the necessary constraints in CON. Limited learnability, rather than non-generability, is sufficient to curtail the observed typology of stress. Gordon (2002) suggests that many unattested metrical patterns should be considered accidental gaps rather representing the bounds of the grammar itself, and these gaps have been attributed to learnability (Heinz, 2009) and its interplay with patterns of phonologization (Hyman, 1977). The evidence for stratal opacity in Southern Pomo was limited, with most of the vowel-∅ alternations in the input being interpretable as a transparent deletion process driven by surface-optimizing constraints (specifically SWP). It is likely that this led to reinterpretation by learners acquiring the language, resulting in innovative forms (Hayes, 1999).

We must therefore ask whether the stratal vowel deletion pattern was a synchronically active process at the time of observation. The alternative is that this process was fully superseded by monostratal, surface-oriented deletion, and that the vestiges of the older pattern are simply memorized exceptions (see, for example, discussion of Mojeño Trinitario in Rose, 2019:21). This interpretation is, to a degree, a mirror of the discussion about learnability; if speakers encounter very few forms which can disambiguate between these two grammars, the forms contrary to their hypothesis might simply be stored as exceptions. Furthermore, some of the forms which might disambiguate are noun-noun compounds with idiosyncratic interpretations, e.g., (9)a *ʔàhkaptáka* 'sea lion' (lit. 'water bear'). This idiosyncrasy suggests the forms must be memorized rather than generated on the fly. On the other hand, there is not clear evidence to suggest that all 3rd-syllable forms are listed irregulars. Many forms displaying the third-syllable syncope pattern are low-likelihood collocations with highly specific, compositional meanings. (6)c *hà:ʧat̪l̪ókoj* "[they] fly out [of something]" and (11)b *ʔàht̪imkóťʃin* "put foot back!" are unlikely to have been high frequency forms, which militates against the argument that these were memorized. We see this in verbal reduplication, as well, where third-syllable syncope forms can be transparently compositional – e.g., (7)d *t'uʔbut'bulaw* 'to run down[wards] (bent way over)'. These metrically opaque forms appear to have equally compositional interpretations when compared to the 4th-syllable forms. This seems to be strong evidence that the third-syllable syncope process, driven by stratal interaction, was still synchronically active. While an appeal to memorized irregulars is possible, it is not clearly motivated by these data.

The next question, then, is how both third- and fourth-syllable deletion can be synchronically real processes in Southern Pomo. §2.3 demonstrates that the distribution of these forms cannot be tied to particular morphemes, roots, or lexical categories, which seems to rule out analyses relying on indexed constraints or cophonologies. This leaves grammar competition (Kroch, 1989; Anttila & Cho, 1998; Fruehwald, Gress-Wright, & Wallenberg, 2009) as the most plausible explanation. Specifically, there appears to have been a degree of stochasticity in the relative ranking (or weighting) of SWP (propelling surface-optimizing deletion) and MAX-V (preventing said deletion) in the word-level grammar. Figure 3 shows Hasse diagrams for these partial rankings.

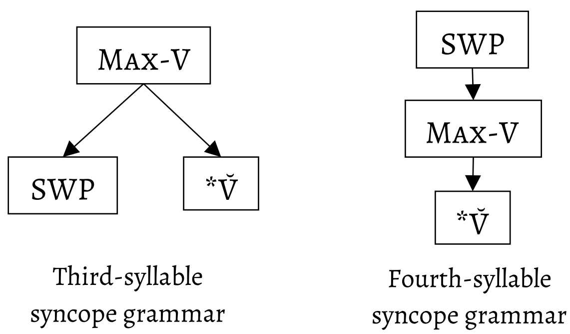

Figure 3. Hasse diagram of partial word-level rankings.

The two partial rankings are only appreciably different in their effect on underlying five-syllable strings. We might think of this as instantiating the credit problem at the level of partial rankings, rather than individual constraints. A grammatical computation would be necessary only when encountering a novel string of this type – it is reasonable to imagine that, given the small number of such forms, these could then be stored, explaining the lack of variation in the site of deletion for any single string.

Altogether, the picture emerges that this metrically-opaque grammar was unstable. The phonological component is capable of representing complex stratal derivations and does not impose restrictions on how strata may differ with respect to metrical structure. That is, the mechanisms that constrain the typology and frequency of these processes are *not grammar-internal*: typologically rare patterns like metrical opacity – and perhaps other unusual patterns predicted by the ranking independence of strata – are within the generative capacities of phonology (de Lacy, 2006; de Lacy & Kingston, 2013). Learners, however, are limited by the quality and consistency of the input data they receive, and the ability of these data to (dis)confirm hypotheses about the grammar. Successful acquisition of stratal syncope requires consistent evidence which differentiates this pattern from one in which syncope is a surface-oriented process. It is apparently the case that learners received too little input of this sort, and instead settled on the grammar which maximizes transparency and metrical coherence.

Another point to consider is the ontogenesis of these patterns. If indeed the Southern Pomo stress shift originated in a context of Miwok-Pomo bilingualism as Buckley (2019) suggests, this is an *unnatural change* (in the terminology of evolutionary phonology) that emerged from language contact rather than phonetic principles (Blevins, 2004; Hansson, 2007). One might theorize that it is only such 'unnatural' processes that can lead to metrical incoherence in sound change, and that languages otherwise hold to the principle of metrical coherence in derivational layering. Under this interpretation, language contact may give rise to unnatural changes that push the limits of the phonological system (Hansson, 2007; 2008). This would further constrain the likelihood of such systems being widely documented in the phonological typology. Southern Pomo demonstrates that metrical incoherence must be representable and transmissible in the synchronic grammar, though we are left with open questions about what diachronic pathways allow for patterns of this nature to arise.

The fact that the opaque pattern arose at all, as well as Southern Pomo's pattern of phrasal stress shift, are evidence that the phonological component must be able to generate strata and learn stratal patterns. Further, it demonstrates that these strata have a degree of independence with respect to their constraint rankings (or component rules) which goes beyond the promotion of faithfulness constraints (*cf.* Koontz-Garboden, 2001). With respect to the existence of metrical incoherence across derivational stages, this case presents strong evidence that such patterns are both real and, at least to some degree, transmissible. However, metrically opaque processes are likely to be unstable if there are possible transparent analyses with a high degree of empirical coverage – even if these are imperfect. Syncope in Southern Pomo thus demonstrates that the typology of these patterns is limited by grammar-external factors, in particular their learnability.

6. Conclusion

In this paper, I have shown that Southern Pomo demonstrates a pattern of rhythmic vowel deletion which is not predictable from the surface metrical structure. Syncope and stress assignment are evaluated over different rhythmic structures, with syncope aligned with the left edge, and stress with the right edge. This poses a significant problem for both parallelist and non-stratal derivational frameworks. I analyze this pattern in a SOT framework involving two strata: the word level defines the weak positions targeted for deletion, while the phrasal stratum enacts both deletion and reassignment of prominence. Independent evidence for the proposed strata is found in phrasal stress shift and several non-rhythmic phrasal processes, as well as the diachronic development of this pattern (Buckley, 2019). While stratal architectures have been criticized for counter-typological overgeneration, this work suggests that such overgeneration is necessary to analyze metrical opacity, in particular given the contact context in which this pattern arose. Southern Pomo also provides evidence that these counter-typological systems may be unstable due to extragrammatical factors. The language features a pattern of fourth-syllable syncope in a small set of forms, which appears to show grammatical restructuring as the result of limited learnability and ambiguous input. Based on the data presented, I conclude that grammar competition between this and the older system resulted in inconsistencies where they conflicted. The full picture suggests that the phonological component must be capable of generating complex stratal interactions that result in opacity, even in the syntagmatic relations of hierarchical metrical structure. It is the limits of learnability, rather than of the grammar itself, which constrain the attested patterns and result in systematic asymmetries in language typology.

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Appendix A: Morphological abbreviations

Abbreviations from Walker (2020)

Ø	zero allomorph
1	first person
2	second person
3	third person
3C	third person coreferential
A	transitive subject
ABL	ablative
AGT	agentive
ALL	allative
AUX	auxiliary
C	consonant
CAUS	causative
COLL	collective
COM	comitative
COND	conditional
COP	copula
COP.EVID	Copula evidential
DEFOC	defocus
DENOM	denominalizer
DEM	demonstrative
DET	determiner
DIR	directional
D.IRR	different subject irrealis
DISTR	distributive
D.SEQ	different subject sequential
D.SIM	different subject simultaneous
EMPH	emphatic
EVID	evidential
F	feminine
FUT	future
GOAL	goal
GS	generational suffix
H	laryngeal increment
HAB	habitual
IMP	imperative
INCH	inchoative
INSTR	instrumental
INTENT	future intentive
INTER	interrogative
IPFV	imperfective
ITER	iterative
LOC	locative
M	masculine
NEG	negative
NP	noun phrase
O	direct object of verb
OBJ	object
OBL	oblique
PAT	patient
PFV	perfective
PL	plural
PL.ACT	plural act
POSS	possessive
PROH	prohibitive
QUOT	quotative
RECIP	reciprocal
SG	singular
S.IRR	same subject irrealis
S.SEQ	same subject sequential
S.SIM	same subject simultaneous
SUBJ	subject
VOC	vocative