Syncope Induced Metrical Opacity as a Weight Effect

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1. Introduction

In many languages, loss of an underlying vowel results in stress patterns which are atypical for the language as a whole. For example, in Bedouin Hijazi Arabic (Al-Mozainy 1981, Al-Mozainy et al. 1985, McCarthy 1999), syncope of /a/ in an open antepenult creates words with stress on a light (CV) penult rather than the antepenult, the typical pattern for words with a light penult: underlying /ʔinkasarat/ is realized as [ʔinksárat] rather than *ʔ́inksarat, cf. [jáʃrɨbin] 'they (f.) drink' with a light penult. Cases of stress opacity triggered by syncope are readily handled in derivational frameworks by assuming an initial metrical parse followed by syncope and then migration of the stress stranded by syncope. Thus, following Al-Mozainy (1981) and Al-Mozainy et al. (1985), a word is initially parsed into trochaic feet in Bedouin Hijazi Arabic with final syllable extrametricality: [ʔin(kása)rat]. Syncope then applies, stranding the stress which subsequently docks on the remaining syllable of the original foot, thereby preserving foot integrity (Halle and Vergnaud's 1987 Faithfulness Condition): ʔin(k´sa)rat (syncope) → [ʔin(ksá)rat] (stress shift).

The analysis of syncope-induced metrical opacity is not straightforward in a constraint-based paradigm like Optimality Theory (Prince and Smolensky 1993) which assumes a direct mapping between underlying and surface forms. Thus, the same constraint rankings which predict antepenultimate stress in non-syncope words with a light penult are expected to produce antepenultimate stress in syncope words with a light penult as well. Opacity cases such as Bedouin Hijazi Arabic appear to require additional formal devices in Optimality Theory (OT), e.g. output-output correspondence constraints (McCarthy and Prince 1995, Steriade 1996, Kager 1996, etc.) or empty nuclei left behind by the syncopated vowel (McCarthy 1999).

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This paper explores an alternative approach to apparent cases of syncope-induced metrical opacity within OT. Focusing on two case studies, Central Alaskan Yupik and Bedouin Hijazi Arabic, it is claimed that many cases of metrical opacity turn out not to be opaque after all, but rather involve weight distinctions that are otherwise covert in non-syncope contexts where the syllable types necessary to diagnose these distinctions do not occur. A feature of the proposed analysis is that it relies directly on weight-sensitive stress constraints rather than foot structure to predict the location of stress in syncope contexts.

2. Central Alaskan Yupik

In Central Alaskan Yupik, stress regularly falls on heavy syllables (CVV and initial CVC, and, in certain varieties CVC before non-final CV) and on the second in a sequence of light syllables (Reed et al. 1977, Woodbury 1981, 1985, 1987, Jacobson 1985, Leer 1985a,b, Miyaoka 1985), as illustrated in (1) (all examples below and throughout text from these sources, unless otherwise indicated).[1] The last two forms illustrate a process of rhythmic lengthening affecting stressed non-final vowels in open syllables.

(1)	kúiɣúːq	‘it is a river’
	áŋjáː	‘his boat’
	əɣánɣuq	‘she begins to cook’
	ɨ́ʁnɨ́aŋuk	‘she acquires a child’
	akútamə́k → akúːtamə́k	(kind of food) (abl.sg.)
	nunakaː → nunáːkáː	‘his land’

Although most short vowels falling in metrically strong non-final open syllables lengthen, schwa instead deletes in these contexts provided the consonants immediately preceding and immediately following the schwa are not identical.[2] (If they are identical, the consonant following the schwa instead geminates, except in the Hooper Bay-Chevak dialect which also deletes schwa between identical consonants.) Interestingly, the syllable immediately preceding the lost schwa receives stress, triggering in non-initial contexts an unexpected stress clash with the preceding syllable: qánʁutə́káː → [qánʁútkáː] ‘he’s talking about her’, rather than the predicted *qánʁutkáː given the light CVC penult. Crucially, schwa

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1. Note that this discussion abstracts away from asymmetries between phrase-medial and phrase-final stress patterns (see Miyaoka 1985 and Woodbury 1987) and between primary and secondary stress (see Miyaoka 1985).

2. Syncope of schwa does not apply in the Unaliq subdialect of Norton Sound Central Alaskan Yupik (nor in Siberian Yupik). In Norton Sound-Unaliq the consonant following the stressed schwa geminates (Jacobson 1985).

syncope applies in neither metrically strong closed syllables nor in weak open syllables: [taŋə́ɬʁúa] 'they saw it', [jaqúːləcúaχ] 'small bird'.

A standard derivational foot-based analysis of Yupik syncope (e.g. Leer (1985a), Hayes (1995); see also Woodbury (1987) for a slightly different analysis of footing and syncope), assumes an initial parse of the word into iambic feet (consisting of either a single heavy syllable or two light syllables) followed by syncope of schwa in metrically strong positions and then migration of the stranded stress onto the remaining syllable in the foot: (qán)(ʁutə́)(káː) → (qán)(ʁut´)(káː) → (qán)(ʁút)(káː).

Before considering an OT account of the syncope data, it is necessary to first analyze the stress patterns found in non-syncope contexts. I will now briefly sketch such an analysis (see Gordon in preparation for more in-depth discussion) which relies on grid-based rather than foot-based representations of stress, following Prince (1983) and Selkirk (1984). I assume the following constraints, most of which are familiar from the OT literature. First, Alignment constraints (McCarthy and Prince 1993) require that stressed syllables be aligned with a word edge, either the right or the left edge depending on the constraint (2).

(2) ALIGN (σ́, {L, R}, PrWd): Stressed syllables are aligned with the {left, right} edge of the prosodic word (violations cumulative).

Two rhythmic constraints ensure an alternating sequence of stressed and stressless syllables (3). *LAPSE ensures that there not be consecutive stressless syllables (cf. Prince (1983) and Selkirk (1984)), while *CLASH bans sequences of stressed syllables (cf. Prince and Selkirk).

(3) *LAPSE: No sequences of adjacent stressless syllables may occur.[3]
*CLASH: No sequences of adjacent stressed syllables may occur.

The next crucial constraints are ones which ensure that heavy syllables are stressed, cf. Prince and Smolensky's (1993) Weight-to-Stress constraints, drawing on Prince (1990). Abstracting away from syncope cases for the time being, there are two highly ranked Weight-to-Stress constraints in Central Alaskan Yupik (see Gordon in preparation for fuller discussion). The first constraint requires that long vowels/diphthongs be stressed, while the second constraint requires that initial closed syllables be stressed. These constraints are formulated in maximally transparent fashion in (4), though they could easily be reformulated in terms of moraic theory.

3. See Elenbaas and Kager (1999) for a slightly different grid-based formulation of *LAPSE.

(4) STRESS CVV: Syllables with long vowels/diphthongs are stressed.
STRESS $_{\text{PRWD}}$[CVC: Initial closed syllables are stressed.

Another type of weight-sensitive constraint bans stress on light stressed syllables, i.e. those containing short vowels in open syllables (cf. Kenstowicz 1994 for similar negatively stated prominence constraints). This constraint plays a crucial role in driving lengthening of stressed vowels in open syllables and is defined in (5).[4]

(5) *CV́]$_{\sigma}$: Open syllables containing a short vowel are not stressed.

A lower ranked faithfulness constraint mandates that underlying long vowels surface as long, i.e. in moraic terms, that output moras have correspondents in the input (6) (McCarthy and Prince 1995).

(6) DEP-IO (V-μ): Moras linked to vowels in the output have correspondents in the input.

We may now consider the pairwise rankings and the forms which demonstrate the rankings in non-syncope contexts in (7).

(7) STRESS CVV >> *CLASH: kúiɣúːq not *kuiɣúːq
STRESS $_{\text{PRWD}}$[CVC >> *CLASH: áŋjáː not *aŋjáː
ALIGN (σ́, R, PrWd) >> ALIGN (σ́, L, PrWd): akúːtamə́k not *áːkutáːmək
*LAPSE >> ALIGN (σ́, R, PrWd): əɣánɣuq not *əɣanɣúq
STRESS CVV >> ALIGN (σ́, R, PrWd): ı́ʁnı́aŋuk not *ı́ʁniaŋúk
*CV́]$_{\sigma}$ >> DEP-IO (V-μ): nunáːkáː not *nunákáː (/nunakaː/)
ALIGN (σ́, R, PrWd) >> *CLASH: nunáːkáː not *núːnakáː (/nunakaː/)

Turning to the syncope facts, the constraint driving syncope is one which bans long schwa (8).

(8) *əː: No long schwa

In conjunction with the highly ranked constraint banning stressed open syllables containing short vowels (*CV́]$_{\sigma}$), *əː has the effect of triggering

4. The constraint against stressed short vowels in open syllables is outranked by another constraint (not formulated here) banning long vowels in final syllables, which in turn is outranked by faithfulness to underlying moras.

schwa syncope as a strategy for avoiding stressed CV.[5] *əː is ranked above the faithfulness constraint requiring that segments surface (9).

(9) MAX-IO [ə]: Input schwa has a correspondent in the output (McCarthy and Prince 1995)

The ranking *ə́ː, *CV́]$_\sigma$ >> MAX-IO [ə] ensures that schwas in stressed positions delete (10).

(10)

/qanʁutəkaː/	*ə́ː	*CV́]$_\sigma$	MAX-IO [ə]
☞ qánʁútkáː			*
qánʁutə́káː		*!	
qánʁutə́ːkáː	*!		

The second candidate is eliminated by virtue of its short stressed vowel in an open syllable, while the third candidate runs afoul of the constraint banning long schwa. This leaves the form without the schwa as the winner.[6]

We must now explain the docking of the "stranded" stress on the syllable immediately preceding the one originally containing schwa, even though the resulting stressed syllable is CVC and thus typically light in non-initial position. We would thus predict *qánʁutkáː rather than the actual form [qánʁútkáː].[7] Phonetic observations, however, offer insight into the unexpected stress-attracting abilities of CVC stemming from syncope. A number of phonetic properties carefully described by the aforementioned sources suggest that CVC resulting from syncope has greater phonetic "strength" than underlying CVC. This strength manifests itself in different

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5. *əː also accounts for the absence of word-final schwa in certain languages, Yupik included (e.g. /qimuɣtə-/ root for 'dog' → [qimuɣta] in isolation), under the assumption that word final vowels are phonetically lengthened (Wightman et al. 1992). Interestingly, rhythmic lengthening in Yupik is suppressed word-finally, suggesting that the articulatory gestures associated with final lengthening take precedence over gestures linked to prominential lengthening (cf. Beckman et al. 1992 for the distinction between these gesture types).

6. Note that the Norton Sound dialect geminates the consonant following stressed schwa: a highly ranked anti-geminate constraint blocks this in the dialects discussed here.

7. As it turns out, certain varieties of Central Alaskan Yupik do in fact assign stress as if the original schwa were never there, thereby giving forms like [qánʁutkáː] (see Jacobson 1985 and Miyaoka 1985 for discussion of this dialect/idiolect difference).

ways. First, consonants which become codas through syncope resist, in certain dialects, regressive devoicing which normally targets codas before voiceless onsets. Thus, the voiced fricative in [kúvciqúq] 'it will spill' which surfaces in coda position[8] due to syncope (underlying /kuvəciquq/) fails to devoice, unlike the fricative in /ajaʁtuq/ 'he leaves' which surfaces voiceless: [ajáχtuq]. The failure of devoicing to affect codas resulting from syncope is plausibly attributed to a stronger voicing gesture and/or additional length which reduces the percentage of coda overlapped by laryngeal gesture associated with following consonant. The result would be a weaker percept of voicing assimilation in the coda.

A second way in which codas resulting from syncope differ from other codas manifests itself in the Hooper Bay-Chevak dialect which displays schwa syncope even when the consonants flanking schwa are identical. In this dialect, codas resulting from syncope are released even when the immediately following onset consonant is identical. This contrasts with the normal realization of geminates with a single closing and opening articulatory gesture without an intermediate release. The release characteristic of codas resulting from syncope is consistent with an interpretation of greater phonetic prominence, which may also include greater duration.

Given these phonetic observations, we may hypothesize that CVC resulting from syncope is heavier than other CVC for phonetic prominence reasons, just as initial CVC is heavier than non-initial CVC. The claim is thus that syncope provides evidence for a further division between different types of CVC in their weight properties. A constraint is thus needed which differentiates between CVC resulting from syncope which behaves as a heavy syllable and normal non-initial CVC not resulting from syncope which does not have any special stress-attracting ability. The relevant constraint can be formulated simply as STRESS CVCˑ, where the half-length symbol stands for a phonetically strong coda, i.e. one resulting from syncope, whose precise phonetic properties which contribute strength are not yet known.[9] This constraint is crucially ranked above *CLASH, as the stressing of CVCˑ resulting from syncope regularly creates stress clashes otherwise not found in the language due to the ranking of *CLASH above STRESS CVC. The ranking of STRESS CVCˑ above *CLASH is demonstrated in (11).

8. Jacobson (1985:34) does say, however, that this form is realized with a voiceless fricative in the Kuskokwim-Bristol Bay subdialect of General Central Yupik.

9. I leave the reformulation of this constraint in representational terms for future research. It seems clear, however, that the necessary representations would have to allow for finer weight distinctions than those based on phonemic contrasts which standard weight theories, such as moraic theory, are designed to handle.

(11)

/qanʁutəkaː/	STRESS CVCˑ	*CLASH
☞ qánʁútˑkáː		**
qánʁutˑkáː	*!	

It is interesting to note that syncope is not the only context in which heavy CVC arises non-initially. Before syllables containing an underlying long vowel, coda consonants also undergo fortition and attract stress even though this creates a stress clash: ákŋ̊iχtáːtŋ̊a → [ákŋ̊íχˑtáːtŋ̊a] 'they hurt me'. (Single intervocalic consonants lengthen in the same context.) Thus, parallel to CVCˑ resulting from syncope, CVC in pre-long vowel contexts also behaves as heavier than non-initial CVC. Interestingly, CVC before long vowels attracts stress even for those dialects/speakers which do not stress CVCˑ resulting from syncope; this suggests a further division between "extra-strong" CVC (indicated here as CVCː) before long vowels and "strong" CVC arising through syncope. The net result is the weight hierarchy in (12), where the bracketed division between CVCː and CVCˑ is found only in certain varieties.

(12) CVV, Initial CVC, {CVCː > CVCˑ}> Non-initial CVC[10], CV > Cə

Stressed (CVV, Initial CVC, CVCː) — Stressed in some dialects (CVCˑ) — Unstressed (Non-initial CVC, CV) — Deletes (Cə)

2.1. Predicting the correct target of syncope in OT

There is still an unresolved issue faced by the proposed OT analysis. This concerns the selection of the "correct" schwa for deletion in words with multiple schwas. In a derivational framework, the initial metrical parse allows all and only the schwas falling in metrically strong open syllables to be targeted for deletion. This capacity for selecting the proper schwas for deletion is a feature of a derivational paradigm and is independent of issues concerning the role of the metrical foot in predicting the docking site for stress in syncope environments, since a grid-based theory of stress presented in a rule-based framework would also target only selected schwas for deletion.

In OT, there is no simple way of ensuring that only schwas falling in metrically strong syllables are deleted, since there is no intermediate stage prior to deletion at which schwas can be separated into those falling in

10. Another division in the hierarchy is evidenced by the heavy status of non-initial CVC before non-final CV in the General Central Yupik dialects of Central Alaskan Yupik.

strong positions and those falling in weak positions. This point is made clear in forms with two underlying schwas: e.g. [aŋúːtə́ŋˑciqúq] 's/he will acquire a man' from /aŋutə(ʁ)-ŋə-ciq-uq/ (the parenthesized uvular fricative is lost in contact with the following velar nasal) and [nunáːnə́tˑɬiníːluní][11] 's/he apparently being in the village' from /nuna-nətə-ɬini-luni/. In these forms, deleting either of the schwas will avoid an ill-formed configuration involving a stressed schwa in an open syllable; thus, either the attested forms with the second schwa deleted or the unattested candidates *aŋútˑŋəcíːquq and *nunánˑtəɬíːnilúːni with the first schwa deleted appear to be viable in an OT analysis. In fact, the unattested forms are predicted to emerge victorious given the rankings of the metrical constraints in Yupik, since they incur a subset of violations suffered by the actual surface forms. For example, [aŋúːtə́ŋˑciqúq] incurs 5 violations of highly ranked ALIGN (σ́, R, PrWd) compared to 4 suffered by *aŋútˑŋəcíːquq. In addition, [aŋúːtə́ŋˑciqúq] violates *CLASH, whereas *aŋútˑŋəcíːquq does not.

Other constraints are thus needed to ensure that the candidates with loss of the second schwa are victorious. Two types of faithfulness constraints are necessary. The first type (13) is sensitive to morphology (cf. Alderete 1999) and accounts for the preservation of the schwa in the root (/aŋutə/) over the affixal schwa in /aŋutə(ʁ)-ŋə-ciq-uq/ (surface [aŋúːtə́ŋˑciqúq]), in keeping with a cross-linguistic tendency for roots to resist changes and deletions targeting affixes.

(13) MAX-I$_{[ROOT]}$O[ə]: A schwa belonging to the root in the input has a correspondent in the output.

This specific faithfulness constraint is ranked above both ALIGN (σ́, R, PrWd) and *CLASH, which in turn are ranked above the more general faithfulness constraint MAX-IO [ə]. This ranking ensures that the winning candidate is the one preserving the schwa belonging to the root, as shown in (14).

(14)

/aŋutə-ŋə-ciq-uq/ Root= aŋutə	MAX-I$_{[ROOT]}$O[ə]	ALIGN (σ́, R, PrWd)	*CLSH	MAX-IO [ə]
☞ aŋúːtə́ŋˑciqúq Root= aŋúːtə́		*****	*	*
aŋútˑŋəcíːquq Root= aŋútˑ	*!	****		*

11. Thanks to Tony Woodbury for providing this form.

Crucially, the root faithfulness constraint is ranked below both of the constraints driving schwa syncope, *ə́: and *CV́]$_σ$, since a schwa in an open syllable is never preserved if metrical constraints would require that it be stressed: thus, [kúvciqúq] not *kuvə́ciquq or *kuvə́:ciqúq 'It will spill'.

The second faithfulness constraint, a positional one (Beckman 1997), accounts for words in which both schwas occur in a single morpheme, as in the underlying form /nuna-nətə-łini-luni/ (surface [nuná:nə́tˈłiní:luní]). It requires that vowels in morpheme-initial syllables, i.e. in initial CV sequences, be preserved; however, not just in word-initial position, but also in morpheme-initial position (15).

(15) MAX-IO $_{Morph}$[(C)V: Morpheme-initial (C)V in the input has a correspondent in the output.

The following ranking obtains in Yupik: MAX-IO $_{Morph}$[(C)V >> ALIGN (σ́, R, PrWd) >> *CLASH >> MAX-IO [ə]. As (16) shows, this ranking ensures that the second rather than the first schwa in /nuna-nətə-łini-luni/ is deleted.

(16)

/nuna-nətə-łini-luni/	MAX-IO $_{Mrph}$[(C)V	ALIGN (σ́, R, PrWd),	*CLSH	MAX-IO [ə]
☞ nuná:nə́tˈłiní:luni		11	*	*
nunánˈtəłí:nilú:ni	*!	9		*

In forms in which one schwa is in morpheme-initial position but in an affix while the other schwa is in morpheme-final position of the root, the affixal schwa is deleted, indicating that MAX-I$_{[ROOT]}$O[ə] (and thus *ə́: and *CV́]$_σ$ by transitivity) is ranked above MAX-IO $_{Morph}$[(C)V: [aŋú:tə́ŋˈciqúq] not *aŋútˈŋəcí:quq from /aŋutə-ŋə-ciq-uq/.[12]

12. This covers the cases I have been able to locate. One potential case not yet accounted for would involve tetrasyllabic roots of the shape CVCVCəCə. Based on phonological descriptions of schwa syncope in primary sources, one would expect the second schwa to be deleted. The proposed account does not make this prediction, however, since neither the morphological nor the positional faithfulness constraints would save the first schwa from deletion. Depending on whether such roots occur and, if so, how they treat schwa, it might be necessary to introduce another positional faithfulness requiring faithfulness to non-final segments in addition to the one requiring faithfulness to initial segments introduced earlier.

It is worth noting that the proposed relevance of morphology for schwa syncope is not the only instance of morphology being relevant in the prosodic system of Yupik. Certain suffixes are lexically marked as triggering deletion of a preceding schwa (Miyaoka 1985). Furthermore, related Siberian Yupik has a process of vowel lengthening affecting root vowels which ensures root stress. For example, the root /atəɣ-ani/ is realized as [áːtɣanı́] 'in his name' with a lengthened initial vowel and loss of the schwa triggered by the vowel-initial suffix (Jacobson 1985).[13] If the initial vowel were not lengthened, stress would fall on an affixal vowel, since initial CVC is not stress-attracting in Siberian Yupik, unlike in Central Alaskan Yupik.

In summary, we have seen how a combination of positional faithfulness constraints and faithfulness constraints sensitive to morphology ensure the correct syncope site in words with more than one eligible syncope target. Admittedly, a derivational approach which predicts the syncope target through an initial metrical parse would appear to be simpler than the constraint-based alternative. However, given that the types of faithfulness constraints argued to drive the Yupik analysis, i.e. morphological and positional faithfulness, find independent justification in other languages, it is also plausible that they play a role in Yupik. The constraint-based analysis would ultimately find even stronger support if future research demonstrated the existence of a heavier morphological component in Yupik syncope (manifesting itself in words with multiple schwas) than published descriptions would suggest exists. I leave this topic for future research.

3. Bedouin Hijazi Arabic

Like Central Alaskan Yupik, Bedouin Hijazi Arabic (Al-Mozainy 1981, Al-Mozainy et al. 1985, McCarthy 1999) also displays stress shift in syncope contexts; however, the direction of the shift is rightward rather than leftward in Bedouin Hijazi Arabic. The basic stress facts (in non-syncope contexts) are as follows. Final superheavy syllables (CVVC, CVCC) are stressed: [maktúːb] 'written', [ðˤarˤábt] 'I hit'. In words without a superheavy ultima, stress falls on a heavy penult (CVV, CVC):[14] [maktúːfah] 'tied (f.sg.)', [gaːbı́lna] 'meet us (m. sg.)', [saħábna] 'we

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13. Note that schwa loss in Siberian Yupik is morphologically governed to a much greater extent than in Central Alaskan Yupik (see Jacobson 1985 and Leer 1985b for historical discussion).

14. Note that a light penult attracts stress if preceded by light antepenult: [ʔakálat] 'she ate', [ʔaxádat] 'she took' (see Al-Mozainy 1981 and McCarthy 1999 for more on these cases which are exceptions to syncope).

pulled'. Otherwise, if neither of these conditions are met, stress falls on the antepenult: [máːlana] 'our property', [arábtukum] 'I hit you (m. pl.)', [jáʃrɨbin] 'they (f.) drink'. I also assume that secondary stress falls on heavy syllables lacking primary stress, though this is a controversial issue in Arabic, with some but not other authors reporting secondary stress.

Most of the constraints relevant for these data have already been introduced with a few exceptions. First, NONFINALITY (Prince and Smolensky 1993) blocks final syllables from carrying stress. Another constraint ensures that the rightmost stress is the primary one in words with multiple stresses: the constraint based equivalent to Prince's (1983) End Rule. Finally, the two highly ranked weight constraints are STRESS CVX, which requires that syllables with branching rimes (CVV, CVC) be stressed, and STRESS CVXX which requires that superheavy syllables (CVVC and CVCC) be stressed. These constraints are ranked as in (17).

(17) STRESS CVX >> *CLASH: gàːbíːlna not *gaːbíːlna
END RULE RIGHT >> END RULE LEFT: gàːbíːlna not *gáːbìːlna
NONFINALITY >> STRESS CVX: sálag 'hunting dogs' not *salág
STRESS CVXX >> NONFINALITY: màktúːb not *máktuːb

Syncope of vowels in a light antepenult followed by a light penult yields superficially opaque stress patterns with primary stress on a light penult rather than the expected antepenult: /ʔinkasarat/ → [ʔ̀inksárat] 'she got broken' *ʔ́inksarat, 'they (f.) drink', /ʕallamatuh/ → [ʕàllmítuh] 'she taught him' (with a-raising) *ʕállmituh. The standard rule-based approach to these data, following Al-Mozainy (1981) and Al-Mozainy et al. (1985), assumes an initial parse into trochaic feet with final extrametricality, before syncope strands the stress, which then docks on the syllable remaining from the original foot: /ʔin(kása)rat/ → ʔin(k´sa)rat → [ʔin(ksá)rat].

The syllabification judgments provided by Al-Mozainy (1981), however, suggest an alternative transparent analysis of syncope-driven stress. Al-Mozainy reports that triconsonantal clusters are syllabified with a boundary between the first and the second consonant; the stressed syllable thus has a complex onset (reflecting the ranking *COMPLEX CODA >> *COMPLEX ONSET), e.g. [ʔin.ksá.rat]. Because syllables with complex onsets are limited to syncope contexts, we may hypothesize that a light penult resulting from syncope is stressed because it is heavier than other syllable types, not because of any opacity effect. The constraint which ensures stress on CCV from syncope is a weight constraint which requires that syllables with complex onsets be stressed: STRESS CCV. This constraint is independently needed in languages which treat CCV as heavier than CV, e.g. Bislama (Camden 1977), Nankina (Spaulding and Spaulding 1994). Assuming, as earlier, that the heavy syllable preceding CCV resulting from syncope attracts secondary stress, then the unexpected stress on the penult in syncope contexts, i.e. [ʔɪn.ksá.rat] not *ʔɪ́n.ksa.rat, reflects the ranking: STRESS CCV >> *CLASH.

The constraint which drives deletion is a variant of a constraint important in Yupik syncope: one banning stress on light syllables, which, in Bedouin Hijazi Arabic, are open syllables with simple onsets. This constraint, $*[\text{C}\acute{\text{V}}]_{\sigma}$, is ranked above MAX-IO (V), yielding [ʔɪn.ksá.rat] not *ʔɪn.ka.sá.rat or *ʔɪn.ká.sa.rat.

Syncope in Bedouin Hijazi Arabic is subject to a number of restrictions which are also handled by metrical well-formedness constraints. The fact that syncope targets the vowel which creates a syllable with a complex onset rather than a closed syllable is attributed to the greater weight of syllables with complex onsets: $*_{\sigma}[\text{C}\acute{\text{V}}$ is thus ranked above the constraint (familiar from Yupik) banning stress on open syllables containing a short vowel. We thus get [ʔɪn.ksá.rat] not *ʔɪn.kás.rat with loss of the penultimate vowel. Syncope does not occur if the following syllable is closed, as a closed syllable is heavy enough to carry stress; syncope is thus unnecessary in these cases. This reflects the ranking MAX-IO (V) >> $*_{\sigma}[\text{C}\acute{\text{V}}$, thus yielding [saħáb.na] not *sħáb.na. Nor does syncope occur if the following syllable is final ([ráma] not *rmá); this restriction may be reviewed as a response to final stress avoidance: NONFINALITY is thus ranked above both $*[\text{C}\acute{\text{V}}]_{\sigma}$ and $*_{\sigma}[\text{C}\acute{\text{V}}$.

In summary, syncope-driven stress in Bedouin Hijazi Arabic can be attributed to the greater weight of syllables with complex onsets relative to both CVC and CV. The relatively complex conditioning factors governing the target of syncope result from a hierarchically ordered set of preferred and dispreferred docking sites for stress. A similar analysis with certain (important) differences may be extended to other Bedouin dialects of Arabic with similar syncope-driven opaque stress patterns (Kenstowicz 1983, Irshied and Kenstowicz 1984). Finally, it should be noted that this is not an exhaustive account of Bedouin Hijazi Arabic stress (see aforementioned works for analysis of further facts, including stress resulting from high vowel syncope, and blocking of syncope in syllables with glottal stop onset).

4. Conclusions

This paper has shown that Optimality Theory can handle apparent cases of stress opacity triggered by syncope given a sufficiently rich set of weight constraints combined, in the case of Central Alaskan Yupik, with hierarchically ordered faithfulness constraints sensitive to morphology and position within a morpheme. Syncope has been shown to involve deletion of the lightest syllables: open syllables containing short vowels in Bedouin Hijazi Arabic and open syllables containing schwa in Central Alaskan Yupik. Many weight distinctions which are more clearly evident in languages with relatively rich syllable structures reveal themselves in other languages only when syncope creates the relevant syllable types. These weight distinctions arising through syncope, as well as others diagnosed in non-syncope contexts, can be captured through a set of weight-sensitive stress constraints referring directly to stress rather than metrical feet. Although space limitations preclude discussing other languages displaying apparent syncope-induced metrical opacity (see Hayes 1995 for cases), these cases too can be handled within OT using grid-based metrical constraints (see Gordon in preparation for details).

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