AMERINDIA n°21, 1996

Long vowels and morpheme boundaries in Nahuatl and Uto-Aztecan: Comments on historical developments

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Introduction

In this paper, the question of vowel length in Uto-Aztecan with special emphasis on the relation of length found in Nahuatl to the proto-language is explored. It is necessary first , however, to describe certain hypothesis about the structure of proto-Uto-Aztecan (PUA) morphemes.

1. Morpheme structure in Proto-Uto-Aztecan

Reconstructions by Sapir (1913, 1915) and Whorf (1935, 1937) and later by Voegelin, Voegelin and Hale (1962) hypothesized morpheme structures for PUA that reflect the final features found in Numic. Later reconstructions, such as those of Miller (1967) and Campbell and Langacker (1978), paid less attention to these features. In a more recent article, I. Miller (1982) reconstructs final features for proto-Numic, but derives them from PUA *CVCV roots, rather than reconstruct them as features of the proto-language. Both Kaufman (1981) and Manaster-Ramer (1993) have shown that there are reflexes of these features in other Uto-Aztecan branches, suggesting that the features should be reconstructed for the proto-language, much in the way that Sapir and the

Voegelins and Hale had done. My own view goes even farther to suggest that the $CV_{\text{-final features}}$ syllables are probably mostly, if not all, morphemes, and that combinations of these morphemes have lexicalized to form the $CV_{\text{-final feature}}CV_{\text{-final feature}}$ shapes more commonly accepted as morphemes of the proto-language. The arguments for this position are given elsewhere (cf. Dakin 1993a, 1993b), and deal more with semantics, while the arguments proposed here are phonological. The following forms are reconstructed because of the relation between vowel length in various other languages and evidence from Numic. In addition to the reconstruction of syllables with features that are spirantizing indicated simply as *CV-; geminating, marked CV"; and nasalizing, indicated by CV_n, all included by one or another of the earlier analyses cited, in this paper syllables with glottalized vowels are also reconstructed. These have been mentioned in different contexts. For instance, Ianucci gives ***ʔ** as a possible morpheme or word-final consonant for proto-Numic. As will be seen below, evidence for *CVV, or original vowel length, is not completely convincing:

Reconstructed basic PUA syllable types:
*CV_n
*CV"
*CVʔ(V)
*CV
(*CVV ?)

Combinations of the syllables produce additionally the following possible CVCV forms:

*CV_nCV_n	*CV"CV_n	*CVʔ(V)CV_n	*CVCV"
*CV_nCV"	*CV"CV"	*CVʔ(V)CV"	*CVCV_n
*CV_nCVʔ(V)	*CV"CVʔ(V)	*CVʔ(V)CVʔ(V)	*CVCVʔ(V)
*CV_nCV	*CV"CV	*CVʔ(V)CV	*CVCV

2. Long vowels in proto-uto-aztecan

Voegelin, Voegelin and Hale (1962:34) hypothesize the existence of five short vowels, ***a, *o, *i, *ɨ** and ***u,** but make the following note about vowel length:

> Series generating components which are specified for the daughter languages, as LENGTH and one of three kinds of STRESS—, predictable stress, word stress, alternating stress—remain to be reconstructed for proto Uto-Aztecan.

Some more recent reconstructions of PUA include a series of five long vowels parallel to that of short vowels. For instance, Langacker (1977:22) reconstructs distinctive length mainly on the basis of typology, but notes: "The P-UA vowel system has been retained virtually without modification in Numic, Tubatulabal, and Pimic." However, he does not mention long vowels specifically, but seems to be referring rather to the existence of the five vowels, and that ***i*** should be reconstructed rather than ***e.***

Nevertheless, in the list of PUA terms and cognates that is part of "Proto-Aztecan vowels", (1978) Campbell and Langacker include forms with the following long vowels for PUA: ***uu, *oo, *ii,*** and ***aa,*** but give no examples for an ***ii.***

Kaufman (1981:3) argues that "Vowel length can be directly reconstructed from at least Tubatulabal, Serrano, Luiseño, Hopi, Pima-Papago, Yaqui-Mayo and Nahuatl (but not from Numic, Cahuilla-Cupeño)" Regarding Numic, he notes that "Original UA vowel length ... was lost in preNumic before the loss of certain intervocalic consonants."

Reconstructions of the various branches of Uto-Aztecan (proto-Numic, proto-Cupan and proto-Takic, proto-Tepiman) have included long vowels, but do not try to reconstruct the contrast to proto-Uto-Aztecan; in addition, in descriptions it is noted often that there are certain processes through which length would have developed in the intermediate parent languages.

2.1. Proto-Numic

Ianucci (1973:65) makes the following statement about Numic vowels:

> We can reconstruct both short and long vowel phonemes in Proto-Numic. All of the Numic languages have distinctive vowel length, but the long vowels are far outnumbered by short; this makes the evidence for reconstructing specific long vowels somewhat scanty at times ...

2.2. Proto-Tepiman

Bascom (1965:7) does not reconstruct vowel length for proto-Tepiman. Kaufman (1981) suggests that in many cases, Tepiman reverses original proto-Uto-Aztecan, that is short vowels became long, and long short.

2.3. Proto-Takic

Hill and Hill in 1968 argue that proto-Takic must have had length because of the evidence from Serrano (p. 240), and Munro, in her 1990 reconstruction of stress and vowel length in Cupan absolute nouns, states:

> Despite the considerable variation in stress patterns among the modern Cupan languages, Proto-Cupan can be shown to have derived immediately from a language with a long/short vowel contrast and a regular stress rule, with the modern daughter languages' basic stress patterns developing gradually out of this reconstructed system. (p.217).

Munro notes at various points that the Luiseño forms are those that preserve length from a parent language; she does not hypothesize further by suggesting that proto-Uto-Aztecan had long vowels, and it seems more reasonable that she is referring to proto-Takic.

2.4. A view from Nahuatl

As is noted above, the existence of long vowels in Nahuatl is one of the principal kinds of evidence that linguists have used for the reconstruction of vowel length in proto-Uto-Aztecan. However, an examination of long vowels in Nahuatl both internally and in comparison with other Uto-Aztecan languages reveals certain patterns that may reconstruct at least in part to an intermediate proto-language. Long vowels in Nahuatl, as in a number of other Uto-Aztecan languages especially in the southern area, have developed from some of the VʔV and $CV_{\text{final feature}}CV$ sequences that developed to $CVC_{\text{glide}}V$ sequences. Although these processes have been noted before for the various branches, with the exception of Kaufman's initial work they have not been described for Nahuatl. Such an evolution in Nahuatl as well has implications for the reconstruction of proto-Uto-Aztecan.

Patterns of fusion appear to have been shared by a number of southern Uto-Aztecan languages and possibly Hopi and Takic, but not by Numic and Kern. For that reason, it will be argued that their development was an innovation not shared by the latter two branches. Although Munro's work details the development of vowel length in proto-Cupan, the situation in Takic in relation both to proto-Uto-Aztecan and to Nahuatl is still problematic.

3. Derived vowel length in Uto-Aztecan subbranches

In this section, descriptions drawn from different branches of Uto-Aztecan are cited that have noted the development of vowel length from sequences of VCV, where C is a resonant.

3.1. Vowel length from loss of *h and *ʔ in proto-Cupan

Munro, in her reconstruction of stress and length for proto-Cupan, discusses vowel length in Cahuilla and its implications for proto-Cupan:

> Such words illustrate a well-known Cahuilla rule....by which certain intervocalic **h**'s are deleted. Thus we assume that 'basket' is underlyingly /néha-t/ with a syncopated plural whose preconsonantal **h** is preserved. We may extend the same line of argument to propose underlying forms /méhV-t/ and /múhV-t/ for 'gopher' and 'owl'... the fact that Cahuilla preserves vowel clusters in words like **néat** suggests that we should regard the long vowels of **mé:-t** and **mú:-t** as derived from clusters of like short vowels: thus **h**-deletion causes /héhe-t/, for instance, to become **mée-t**, with a medial vowel cluster, which is later simplified to **mé:-t**...(p. 230).

Finally, (p. 248) in a discussion of the term 141. YUCCA SP, Munro notes:

> The alternate forms Cu **paná:-l** (HN) and Ca **pánuʔu-l** (SH) apparently reflect another, complex set—cf. also Lu **paná:ʔa-l** 'stalk of Spanish bayonet'—which suggests that Cu long vowels may sometimes derive from the deletion of intervocalic ʔ as well as ***h...***"

However, Munro also notes other sources of vowel length. For instance, she divides the development of stress patterns in Cupan into seven stages, but notes of the second stage: "Proto-Cupan probably had a productive pattern of affective length alternations in verb roots (CVCV-/CV:CV-) like those seen in the Luiseño pairs ..

> **chúŋi-** 'to kiss' /chú:ŋi-/ 'to suck'
> **máha-** 'to stop hurting' /má:ha-/ 'to make up a quarrel'
> **qás.a-** 'to make a clashing noise' /qá:s.a-/ 'to talk loudly' (p. 226)

3.2. Numic final features and vowel length

The term consonant gradation in Uto-Aztecan is another way of referring to final features. Although Langacker makes several comments about consonant gradation, he concludes "Outside of Numic only remnants of such a system survive..."(1977:23). However, the remnants are important for historical

analysis, as noted in Manaster-Ramer (1993), and by Kaufman (1981:1-79). Of interest here are the contrasts that involve PUA ***p.**

For proto-Numic, Ianucci contrasts geminates he derives from /*hC/ and /*NC-/ clusters with forms with a single consonant /*-C-/: "Proto-Numic medial /*-C-/ can probably be regarded—as in the modern languages—as a spirantized (intervocalic lenition) variant of the plain initial consonant. ... (1973:83-4). The intervocalic lenition of ***p** has produced /w/ in a number of other languages.

In his reconstruction, Ianucci also states that "...some of the long vowels, as well as virtually all of the vowel clusters (i.e. of different vowels), that we find in the various languages are either the result of the deletion of an earlier intervocalic consonant—especially /*y *w *h *ʔ/ ...—or they occur across morpheme boundaries."

Kaufman, while he argues that "Numic languages should not be taken as the most archaic of the family."(1981: 3), later on comments: "Common Numic has (double) vowels and vowel clusters which result from the loss of intervocalic consonants" (1981:16).

3.3. Hopi

Although Hopi shows CVCV stems in contrast with CV:CV ones, vowel lengthening in open syllables seems to be an innovative, productive process in the language, complemented by the addition of second, probably derivational syllables, to the stems with long vowels.

3.4. Tepiman

For Southern Tepehuan, María Ambriz (1994) has suggested that long vowels have evolved in many cases from a metathesis of CVCV forms to CVVC, in which the dipthongs that arose from the VV sequences, then became long vowels. It may be that this analysis applies to the rest of Tepiman as well, and relates to Kaufman's perception that vowel length has often been reversed in those languages.

3.5. Corachol

Corachol, on the basis of materials available and the analysis of Vázquez (in press) seems to have shared with Nahuatl in the development of length from Uto-Aztecan dipthongs, since contrasts in the stress system relate to the same

length contrasts found in Nahuatl; however, Corachol has innovated in other ways, especially as exemplified in Cora through a laryngealization of vowels that rarely corresponds to the laryngealization in the other languages, while on the other hand, losing the mentioned short/long contrasts that had developed as in Nahuatl, and lengthening vowels under other conditions.

4. Nahuatl

4.1. Short vowels

The evolution of Nahuatl vowels was discussed at length by Campbell and Langacker in 1978. Although their basic points about the fate of PUA ***u** in Nahuatl were disputed in Dakin 1983, Canger and Dakin 1985, and Manaster Ramer and Dakin (ms), they noted several important variants in the reflexes of short vowels, including the frequent loss of short vowels in the first syllable of CVCV forms, and the introduction of an epenthetic /i/ to avoid word-initial CC clusters and word-internal CCC ones following such loss. As noted earlier, it is also necessary to take into account the final features that can be reconstructed for PUA, since Nahuatl short vowels reflect them systematically.

4.2. PUA sources for short vowels in Nahuatl

It now appears that PUA *CV-, *CV_{n-}, and *CV"- are the sources of short vowels in Nahuatl. They show consistent patterns especially if one considers the reflexes in Numic and Taracahitan languages. The reconstruction and correspondence patterns for representative languages are given below. In the Appendix, additional reconstructions and sets of cognates support each rule.

4.2.1. PUA *CV"(geminating following consonant) > proto-Nah CV

PNum	PCupan	Hopi	Guarijío	Mayo	Tubar	O'odham	Nah
CV"	CV	CV	CVh	CV"	CV	CV:	CV
Pn **pɨtti(tɨn)**	**pɨtɨ**	**pehtiáme**		**bette**		**we:č**	**eti:-k**

< PUA ***pɨ"-tɨ** 'heavy'

4.2.2. PUA *CV_n (nasalizing following consonant) > proto-Nah CV

PNum	PCupan	Hopi	Guarijío	Mayo	Tubar	O'odham	Nah
CV_n	CV	CVn	CVh	CV"	CV	CV:	CV
Pn **tɨm-**		**tɨm**	**tehté**	**tétta**	**te-**	**če:-**	**te-tl**

PUA ***$tɨ_n$-pi** 'stone, rock' > proto-Nah **te-tl** 'rock'

4.2.3. PUA *CV (spirantizing following consonant) > proto-Nah CV

PNum	PCupan	Hopi	Guarijío	Mayo	Tubar	O'odham	Nah
CV-	CV-	CV		CV"	CV		CV
Kw **kovo-**				**kabba**	**kɔva-**		**ka-kawa-tl**
'pod'				'egg'	'egg'		'cacao' (little egg)

PUA ***kapa-** 'pod, shell' > proto-Nah **ka-kawa-tl** 'cacao'

4.3. Nahuatl short-vowel reflexes of proto-Uto-Aztecan vowels:

4.3.1. PUA *a > proto-Nah *a, *e, and ø

In most environments PUA ***a** > ***a** in Nahuatl. However, PUA ***a** in CaCV stems became ***e** after the bilabials ***m** and ***p**, as in PUA ***ma"-ta** > Nah **metla-tl** 'grinding stone' and PUA***pa"ta**(?) > Nah **petla-tl** 'straw mat' and was lost in some other environments. Suffix final ***a** was lost word final, or became ***e** before a following ***-t** plural suffix.

Also PUA ***ahi** generally became short ***e,** as in PUA ***tahi** > Nah **tle-tl** 'fire' and PUA ***ma(h)i**[1] > Nah **me-tl** 'agave', from which Nah **me-ka-tl** 'twine' is derived (Dakin, 1996).

4.3.2. PUA *o > proto-Nah *o

Apparently PUA ***o** became Nah ***o** in all environments.

4.3.3. PUA *ɨ (mid-vowel) > proto-Nah *e, *o

The unrounded mid-vowel ***ɨ**[2] , became ***e** in most environments, but usually ***o** after ***s** and in some other environments:

PUA ***sɨkɨ** 'acid'	>	Nah **šoko-k** 'acid'
PUA ***sɨ-li-wa** 'divide'	>	Nah **šolowa** 'to wrinkle'
PSUA ***mɨ-** 'reflexive prefix'	>	Nah **mo-**

For instance, the Nahuatl reflexive prefix **mo-** apparently is cognate of the Tepecano prefix **mɨ-,** which would reflect a PUA ***mɨ-.** It is easier to understand the morphophonemic variation between **mo-** with the back vowel before most CC- initial stems and **mi-** with the front vowel before a -hC- stem in Nahuatl, if the original vowel were a central one.

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1 Since Tubar has mañi-t, it seems probable that the PUA form was *manyi- that then became *mahi.

2 Reconstructions in the Appendix show *e for the PUA *i mentioned here; some linguists reconstruct it as a more anterior *e; however, it probably really was a *ə, as suggested by Kaufman (19481).

4.3.4. PUA *i > proto-Nah *i

PUA ****i** became ***i** in all environments; it was lost when unstressed in many positions.

4.3.5. PUA *u > proto-Nah *ɨ (*ɨ > i, e)

PUA ****u**, as argued by Canger and Dakin 1985, became ***ɨ** in pre-Nahuatl, a change probably shared with Corachol; it then split, so that ***ɨ** must have been retained after ***s** and ***t** and before another central consonant, later becoming **i** in Eastern Nahuatl and **e** in the Western Nahuatl. In other environments, pre-Nahuatl ***ɨ** merged with the reflex of PUA ***i** as Nah ***i.** Words showing the change are given below:

***tusu** 'to grind'	>	Nah **tesi/tisi**
***sun-** 'nit'	>	Nah **ah-selin**, **ah-silin**[3]
***sutu-y** 'nail, claw; finger'	>	Nah **iste**, **isti**
***su"ŋ**V- 'corn'	>	Nah **sen-tli**, **sin-tli**
***tu$_n$-** 'hill, rise'	>	Nah **tlatel-li**, **tlatil-li**
***muku** 'to die'	>	Nah **miki**

4.4. Morphophonemic long vowels in Nahuatl

Sapir (1913:424) proposed the existence of processes of assimilation in Nahuatl, particularly that of a short vowel to /o/ before /wa/. This change was described in much more detail by Canger in 1980, who also noted that the long /o:/'s that appeared morphophonemically in some verb forms must derive historically from /owa/, which in turn would have come from /Vwa/.

4.4.1. Long o: < /owa/

|tla-pol**i-wa-**li-li|	>	tla- pol**o:**-l-li 'something lost'
|-pol**i-wa-**ti-we|	>	-pol**o:-**tiw 'went to lose'
|čol**owa-**s-ka|	>	čol**o:**s 'will flee'

4.4.2. Long i: < /iya/ and /ili/

It is also evident that /iya/ and /ili/ become /i:/ morphophonemically, as in the following constructions:

mo-tla:l**i-ya-**s	> mo-tla:l**i:**s 'will sit down'
koč**i+li-**wa	> koč**i:**wa 'one sleeps (impersonal subject)'

3 *pa- 'on top' + *sun- 'nit', by lenition of *p > h and metathesis of the *pa > ah-.

e:**wa+(li)-**wa > e:**o:**-wa 'one flies up (impersonal subject)'
koč**i+li**+ti-ya > koč**i:**tiya 'makes sleep'
p**iya**+li-ya > p**i:-**li-ya 'holds for'
ši-mo-tla:l**i-ya-**ka:-m > ši-mo-tla:l**i:-**ka:n 'sit down (pl. subject)'

In Nahuatl y > š/V__+C, # when V is the root vowel; however, a located another mora removed form the root vowel y > h

4.4.3. Long a: < /a-ha/

k^{w}**a-ha-**li-ya > k^{w}**a:-**li-ya 'eat for'

4.5. Historical sources of Nahuatl long vowels

The comparison of Nahuatl long vowels with other Uto-Aztecan languages and the reconstruction of PUA shows them to have two principal sources. First, some Nahuatl long vowels correspond to specific types of single syllables in PUA. Secondly, other long vowels in Nahuatl are derived from bisyllabic sequences in words that are minimally trisyllabic.

4.5.1. Long vowels with PUA syllable to proto-Nah syllable correspondences

4.5.1.1. PUA *CVʔV > proto-Nah CV:, CVh

Laryngealized vowels in PUA become Vh or V: in Nahuatl. They show the following correspondences with other Uto-Aztecan languages:

PNum	PCupan	Hopi	Guarijío	Mayo	Tubar	O'odham	Nah
CVʔV	CV:	CV:	CV	CVʔV, CV:	CV-	CVh-	CVhV
***kɨʔɨ**	***qeʔe**	**kɨ:ki**	**kɨʔ-**	**keʔe**	**ke-**	**kɨʔɨ**	**keh-coma**

PUA ***kɨʔɨ** 'to bite, use teeth' > Nah **keh-coma** 'to bite'
PUA ***siʔi** 'guts, to urinate' > Nah **ši:ša** 'to urinate'

4.5.1.2. PUA *pV > proto-Nah V:

In Dakin (1991), it was initially suggested that some initial long vowels in Nahuatl derive from PUA ***p**V sequences, since word-initial ***p** > ***h**, and the ***h** probably voiced to become a long vowel. Apparently, the syllable closing feature could be important as well, but the details are not yet clear. Examples of ***p**V > *V: follow.

PUA ***pu-si** > Nah **i:š-tli** 'face'
PUA ***pa-ka** > Nah **a:-ka-tl** 'reed'

4.5.2. PUA two-syllable sequences > proto-Nah CV: in three-syllable words

4.5.2.1. Kaufman's hypothesis

Kaufman in 1981 noted that many long vowels in Nahuatl, particularly those in none-root-initial syllables, are derived from sequences with either ***w** or spirantized ***p**. These included many cases of /o:/, as seen below:

*Long **o:** < /owa/ (Kaufman)*

a:yo:-tl 'turtle' < ***ʔahya-ʔ-wɨh-ta** (+ augm) (p.225)
tekoloo-tl 'owl' < ****tukuri-wɨh-ta** (+ augm)

Synchronic descriptions of most Numic languages describe a lenis or fricative allophone for intervocalic /p/, so that it seems probable that through lenition, a [B] allophone of ***p** merged with the intervocalic allophone of ***w.** Kaufman maintains that the first vowel was long, and that the ***w** was simply lost. The alternative suggestion made here is that the length is from coalescence of the sequence. The coalescence does not happen in bisyllabic words where a mono-syllabic stem would result because these are avoided in general in the language.

4.5.2.2. Sequences in three-syllable words with *V_pV and *V_wV >V:

PUA lenis ****p** > ***w** in pre-Nahua, and in most cases, the VwV sequence became a long vowel in three-syllable words.

4.5.2.2.1. PUA *CV(n)pV, *CV(n)wV(one vowel is *a) > proto-Nah Co:

(the other is not **i** or **a**)

PUA ***ta-pu(-ci)** 'rabbit' > Nah **to:-či-n** 'rabbit'
PUA ***tɨn-wa-(ka)** (or ***tɨn-pa-kaʔ**) 'name' >Nah **to:-ka-yi-tl** 'name'

4.5.2.2.2. PUA *CV(n)pV,*CV(n)wV(both vowels are *a) >proto-Nah Ca:

PUA ***tan-wa(-ka)** 'man, person' >Nah t**la:-ka-tl** 'man'

The reason for a form such as ***sin-wan** giving /a:/ may be that the accent fell on the ***a**, or that the ***r** blocked rounding.

PUA ***sin-wan(-ri)** 'sand' > Nah **ša:-l-li** 'sand'

4.5.2.2.3. PUA *CV(n)pV, *CV(n)wV(both vowels *i or *u)>proto-Nah Ci:

PUA ***ci-pu** ' bitter' >Nah **či-či:-k** 'bitter'(reduplication)

4.5.2.2.4. PUA *CV(n)pV, *CV(n)wV(both vowels are *ɨ)>proto-Nah Ce:

PUA ***tɨn-pɨ-ŋɨ*** 'mouth, lip' >Nah **te:-n-tli** 'mouth'
PUA ***sɨ-pɨ*** 'cold' >Nah **se-se:-k** 'cold' (reduplication)

When the syllable is a geminating one or has a glottalized vowel, the coalescence does not occur:

4.5.2.2.5. PUA *CV"pV, *CVʔVpV > proto-Nah CVpV

In contrast to the forms derived from *CVpV sequences discussed in section 4.5.2.1, the following examples contrast because ***p*** does not soften after the glottalized vowel, or before a geminate consonant, since these block lenition.

PUA ***siʔi-pɨ-*** 'to peel' > Nah **ši:-pe:-wa** 'to skin, peel'
PUA ***ta"-pa-*** 'to break' > Nah **tla-pa:-ni** 'to break'

4.5.2.3. PUA *VnV > SUA *VrV *CV1nV1(V1 is *u or *i)> proto-Nah i:

PUA *CVC**i-ni+wa** > Nah CVC**i:-wa** 'impersonal'

*'verb+nominalizer ***ni** + non-specified agent*

PUA ***koci-ni-wa*** > Nah **koči:-wa**[4] 'one sleeps'

4.5.2.4. PUA *V(n)yV > proto-Nah *V:

PUA ***mɨya(-ca)**[5] 'moon' > Nah **me:-c-tli** 'moon'

4.5.2.5. PUA *aha > proto-Nah a:

PUA ***taha"/teha"*** 'put away' > Nah **tla:-li-ya** 'to put', Nah **tla:-ti-ya** 'to hide', Nah **tla:-sa** 'to throw'

4.5.2.6. PUA *ayɨ > proto-Nah a:

PUA ***payɨ*** > Nah **pa:-ki** 'to be happy'

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4 PUA *n > pre-Nahuatl -r-/V_V, which is found as Nahuatl -l- when not between two high vowels, as in tla-kwa-lo 'one eats', from *tla-kwa-li-wa (Dakin, 1990).

5 Manaster Ramer (1992) has identified and strongly argued for an important NUA innovation by which PUA *c > NUA *y. Manaster Ramer includes the terms for 'moon' as examples of the correspondence, and analyzes the NUA *y as cognate with Nah *c. Although I am in agreement with his identification of the innovation, I think that in the case of 'moon', the NUA forms with mIya are cognate with Nah me:-, and that the Nah -c is a suffix not found in the NUA words.

4.5.2.7. PUA *VN- > Nah V; VNya > Nah V:

PUA ***mɨ$_n$-si*** 'cloud' > Nah **miš-tli/meš-tlĩ** 'cloud'
mɨ$_n$-ya-(ca) 'moon, month' > Nah **me:-c-tli** 'moon, month'

4.5.2.8. PUA *ahi > proto-Nah e

Although these are not original three syllable formations, through coalescence of ***ahi,*** one would expect Nah ***e:*** here, but it shortens to ***e.*** Given that Corachol forms show a metathesis of the second CV, from ***tahi** > ***taih,*** and ***ma$_n$yi** > ***mahi** > ***maih,*** and that Southern Tepehuan also had such metatheses, it seems possible that Nahuatl shared in the development in this case, and that the resulting ***e:*** shortened before the glottal.

PUA ***tahi*** 'fire' > Nah **tle-tl** 'fire'

4.5.3. PUA *CV-CV > proto-Nah *CVCV or *iCCV

It is important to note again that two-syllable sequences did not coalesce because monosyllables are avoided.

PUA ***sa$_n$-wa*** 'leaf' > Nah **iswa-tl** 'leaf'
PUA ***ta-pɨ*** 'sun, day' > Nah **ilwi-tl**[6] 'day'
but: PUA ***ta-pɨ-na-*** 'to be hot (the sun to go along)' > Nah **to:-na** 'to be hot'

5. Conclusions

While the case for most if not all of Nahuatl long vowels being derived from different types of sequences seems quite strong, the question of long vowels in proto-Uto-Aztecan having a similar derivation has only been tentatively explored.A word of caution is necessary, because in general in languages long vowels tend to develop from such secondary sequences only when a short/long vowel contrast already exists, since drastic typological changes tend to be avoided[7]. However, the Nahuatl evidence is presented here in the hope that such a situation can be explored for the different branches and the proto-language in greater detail. It would be interesting to find that to the contrary of the general rule, no original long vowels can be reconstructed for PUA, which is precisely what Nahuatl evidence would suggest.

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6 PUA *t > *tl or *l/_a, *p > w/V_V, then *a is lost before Nahuatl /w/, and an epenthetic i is prefixed before the stem-initial consonant group to give the proper phonological form in Nahuatl ilwi-tl; by a similar process PUA *tappi- 'to tie', with the geminate p > *tlapi- > Nahuatl ilpi-a (Dakin, 1989).

7 Here I am grateful to comments by Drs. Wolfgang Dressler, Verónica Vázquez, and Ricardo Maldonado, and Heriberto Avelino at a recent presentation of these hypotheses in the CILI of Guadalajara.

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APPENDIX : SAMPLE COGNATE SETS
(Numbering follows sections in paper)

Abbreviations:

Ca Cahuilla (Munro; Hill & Hill)
Cu Cupeño (Munro; Hill & Hill)
Eud Eudeve (Lionnet)
Gu Eastern Guarijio (Miller)
GuO Western Guarijio (Barreras)
Hp Hopi (Shaul)
Hui Huichol (Grimes et al)
Kw Kawaiisu (Zigmond, Booth and Munro)
Ls Luiseño (Munro; Hill & Hill; Bright)
My Mayo (Lionnet, Collard and Collard)
Nah Nahuatl
O'o O'othham (Saxton et al.)
PCu Proto-Cupan (Munro)
Pn Panamint (Dayley)
Se Serrano (Munro; Hill & Hill)
SP Southern Paiute, Sapir
Tbr Tubar (Lionnet)

4.2.1. PUA *V"-, *V- > Nah V (and Nah Ø)

*ka"-ni- house, shelter
SP qanni-s house
(n geminates in SP, but goes to hn in Pn and some other Numic languages)
Pn kahni
Tu hani:-l
Hp qeni place, room
My ka:ri
(r does not geminate, but lengthens preceding vowel in Mayo)
Eud kal/i-,-kal
Nah kalli house

ku"-na-/ku_n-na sack (M ku-11)
SP qunna-s sack
PCu *kú:ni-la
Nah ki- (čiki-witl, šikipilli) basket, bag

*sa"-na- gum, to stick
SP sanna-g gum
Tu sa:na-t pitch
Hp sa:na gum
Nah salo-wa to stick

*kwasɨ" to ripen, cook
Pn kwasɨ"- to ripen
(s does not geminate in Numic)
My bwasse to ripen
Tbr kvase-, kvasi- to ripen
Nah [i]kwsi to ripen, cook

*kwi"-ta excrement
Mn k^witta-ppɨ excrement
Gu wihtá (s.) excrement
wihtá-ra
My bwitta excrement
Tbr kvitá-t excrement
Nah kwitla-tl excrement

*kwi"-ca- excrement
SP qwitca- to defecate

*pɨ"-ti heavy
Pn pɨtti(tɨn) heavy
Tu pɨlɨ:ʔɨt heavy
O'o we:č
GuO pehtiáme heavy
My bette to be heavy
Nah eti:-k heavy

*su"-tu nail, finger (this set is problematic, especially in comparison with that of *pe"-ti 'heavy') (M su-01)
Pn -situn nail
SP šɨču-ppɨ nail
(č se interpreta como -tt- ante u)
Tu sulun-t
SP sɨt-su- finger-nail, claw
GuO suhtú-ra finger
My súttu nail
Nah iste-/isti- nail

4.2.2. PUA *VN > Gua Vh = My V" = Nah V

$*tɨ_n$-pi" *stone, rock*
SP tɨm-pi-" rock, iron
O'o če:- rock
GuO tehté rock
My tétta rock
Nah te-tl rock

$*ta_n$-mɨ *tooth*
Pn taman
SP taŋwa-N tooth
Tu tamant teeth

Hp tama
GuO tamé-ra tooth
My támmi tooth
Nah tlan-tli tooth

**tɨ$_n$-ma/tɨ$_n$-wa* *to steam (to use stones?)*
SP tɨʔma- to roast under ashes; to bury
Hp tɨma griddle
Gu teméi (s.) tortilla (PUA *VN > V/_C$_{+nasal}$)
Nah tema to steam
Nah tama-l-li tamale

**wi$_n$ca* *thorn*
Pn winnu(pi) thorn (PUA wi$_n$ca > PNUA wi$_n$yV > winnu-)
GuO wehcha-ra thorn
Nah wic-tli thorn

**woŋko* *pine*
SP ɔgɔ- fir
Pn wo$_n$kopin
Tu wo:$_n$hal
PCu *wəxé- pine
GuO ohkó pine
Nah oko-tl pine

*PSUA *pahc-* *first*
GuO pahčá first
Nah ač-to first

*PSUA *tah-ku* *palm*
Gu tahkú (s.) 'palmilla, tipo de planta'
GuO tahkú (s.), palmilla
Eud tákut (J)takát, (J)takít palm
Nah tlako-tl palm

*PSUA *yah-ka* *nose*
GuO yahká-ra nose
My yékka nose
Nah yaka-tl nose

4.2.3. PUA *V-pV> Nah VwV

*ka-pa pod; pot, shell
Kw kovonigwi= pod
My kabba to lay an egg
Tbr kɔva- egg
Nah kakawa-tl cacao

*yɨ-paN-na" autumn
Pn yɨpani autumn
SP -yɨvan:a-g autumn
Nah yowa-l-li night, dark

4.5.1.1. *VʔV > Nah Vh

*ciʔi to spit
Kw čičiiʔi-,
Nah čihča to spit

*kɨʔɨ to use teeth
SP qɨʔɨ to bite
My kéʔe- to bite
Tbr kéra-k
Eud ké, ket bite, mouthful
Nah keʔ-coma to bite

*suʔu grandmother
Hp soʔo grandmother
Nah sih-tli grandmother

*suʔi jackrabbit
Hp sowi jackrabbit
PCu *suʔiš jackrabbit
Nah sih-tli jackrabbit

PUA *VʔV > Nah V:

*koʔo to hurt
My kóʔko illness
Tbr kɔ-, kɔ-kɔ`
Nah koko-ya, koko-wa to get sick

*kwaʔa skirt
My koá'ari enaguas
Tbr koayí-t
Eud kóa edge; skirt
Nah kwe:yi-tl skirt

*kwaʔa-we- eagle
Gu waʔ-wé (s.) eagle
Nah kwa:w-tli eagle

*oʔo bone
SP ɔɔ- bone
SP ɔ round object
SP ɔ-paq:i-, ɔ-vagi- there is a hole
SP ɔɔ-mpa fist-fight
SP ɔɔ-y'ai- to be lean, starved
My ótta
Eud ho-wa-t (-ouh-, -owa- reduced forms) bone
Nah o:mi-tl bone

*poʔi to lie down
SP peʔtí/peʔti-pó, suj. pl. to be lying down, sg. subj.

Gu poʔí/poʔi-má to be lying down
Tbr hɔne-
Eud boʔó-n to lie down
Nah o:- to be lying down

*siʔi guts, to urinate
Kw siʔi-gwi to urinate
Kw siʔi-pɨ urine
PCu *ṣa:ʔi-š guts
SP si'i-s to urinate
EU sísa-n to urinate

*siʔi-ka, siʔi-ku navel
SP sigu-n navel
Gu sikú (s.) navel
MY si:ku navel
EU siikát navel
Tbr sikú-r
Nah ši:k-tli navel

*siʔi-wa guts
EU siwát stomach, guts

*siʔ-pɨ to scrape, peel
Pn -sipeh, -saape to peel
Pn -sii-wah to scratch
SP si-va= to whittle
Gu si-ba-ná/-má to scrape
Gu siʔ-pána-ni (siʔpáca-ni) (v.t.) to tear, split apart a rag
Tbr si-pe-, si-pe-daʔa-m to be peeled (as a snake that has shed its skin)
Nah ši:-pe:-wa to peel, skin

PSUA *si:-ta sprouting corn ear (probably < PUA *siʔ-ta)
Gu sitá, (or) sita-póa cornsilk
Hui sita sprouting corn ear
Nah ši:-lo:-tl sprouting corn ear (probably < PUA *siʔ-ta-pe or *siʔ-ta-hawi)

*suʔu- star
Hp soohu star
PCu *sú:ʔu-la
Gu soʔpóri (s.) estrella
Nah si:-tla-li-n star (<*si:-la-li-n)

*toʔi cattail
SP toʔi-vi 'cattail'
Nah to:-li-n cattail

*-paʔi to have, possess
Pn -paʔi-n to have
Nah -wa:-n, -waʔ mediated possession

*waʔi(-ke) to dry, roast
SP wai- to roast in the ashes
Eud wáke-n to dry up, get thin
Tbr mwai-
Eud wa:wa (guaagua) to dry; roast
Nah wa:-ki to dry (iv)
Nah wa:-¢a to dry (tv)

*waʔai- fibrous and flat
SP waʔai- grass seed
SP waʔa-" cedar

4.5.1.2. PUA *pV> Proto-Nah V:

*payi three
SP pai three
Gu paiká three
Nah e:-yi three

4.5.2.2. Long vowels from VCV sequences

4.5.2.2.1. PUA *V-pV > *V:

*ci-pu bitter
PCu *čí:vu-t
Eud cipu
Nah či:či:-k bitter

*haya-pɨ- turtle
Tbr haya-wé-t turtle
Nah a:yo:-tl turtle

*haya-pɨ-ʔ (Kaufman) squash
Tbr haya- squash
Nah a:yo'-tli squash

*na-pu prickly pear; nopal
PCu *ná:və-t
My naábo; nabo-taáka-m prickly pear
Eud nabúc
Nah no:-č-tli prickly pear fruit
Nah noh-pal-li nopal prickly pear

*ta-pɨ sun, day
Pn tape(ttsi)m tapai(ttsi) sun; day; in the daytime
Nah [i]lwi-tl day
Nah to:-na 'to be warm, to shine (sun)'
Nah tlap-ko-pa east

(Contrast with CCV sequence in *tape > Nah ilwi-tl 'day')

*ta-pu rabbit
SP tavu- cotton-tailed rabbit
Pn tapu-n, tapu"-ci cottontail
Kw tavu-ci cottontail
My taábu rabbit
Eud tábu
Nah to:-či-n rabbit

4.5.2.2.2. PUA *Vŋ-wa > Gu Vwa = My V:wa = Nah V:

*siŋ-waN sand
SP siŋ-wa-mpU- sand, gravel
Pn pa-siŋo-mpin
Gu se-té
Eud sá
Nah ša:-l-li sand

(*sɨŋ-waʔ) > PSUA *sɨwa flower
Gu sewá flower.
My seéwa flower
Nah šo:-či-tl flower

*ta$_n$wa-ka- person, man M273a (*tawa)
Nah tla:-ka-tl man, person

*tɨ$_n$-pɨ- mouth, to name
Pn tɨmpe- mouth
SP tɨmpa- mouth
My teé-ni/te-m- mouth
Nah te:-n-tli mouth
Hp tuŋwa name it
PCu *təə:wa-la
Gu tewá, (o) rewá name
Nah to:-ka-yi-tl name

4.5.2.2.3. PUA*CV($_n$)pV,*CV($_N$)WV (both vowels are *i or *u) >Nah Ci:

PUA *ci-pu bitter
Ls cívu-t
Hp cí:vo
Pg sív
My ciibu
Nah či-či:-k bitter (reduplication)

4.5.2.2.4 PUA *CV($_n$)pV, *CV($_n$)wV (both vowels are *ɨ) > Nah Ce:

*te-N-Ha tell, order
Pn tɨŋa to tell
Nah tena to complain

(perhaps Nah [i]htowa to speak ?< *pu-tɨŋ-wa)

4.5.2.2.5 PUA *CV"pV > Nah CVpV

Notice the contrast with geminated *p:

*ta"-pa to split
Gu taʔpá-ni/-ma (v.i.) to split
Gu taʔpána-ni (taʔpáca-ni) (v.t.) to split
Nah tlapa:ni to split

*ta"-pV to tie
SP tap:it:ca- to tie
Hui tapi- to tie
Nah ilpiya to tie

4.5.2.5. PUA *aha > Nah a:

*taha/teha put away
Pn taha" put (away), locate, situate,place
Nah tla:tia to hide
Nah tla:lia to put

4.5.2.6. PUA *ayɨ > Proto-Nah a:

*payɨ to be happy
Eud báde-ce-n to be happy
Gu pohá-ni/-ma (v.i.) to be happy
Nah pa:-ki to be happy

4.5.2.7. PUA *VN- > Nah V; VNya > Nah V:

*me$_n$-si cloud
Eud mosít cloud
Gu to-mó-a-ri cloud
Nah miš-tli/mes-tlĩ cloud

*me$_n$-ya moon, month
PCu *məəyi-la
Eud me-cá-t moon, month
Tub
Nah me:-c-tli moon, month

4.5.2.8. PUA *ahi > Nah e

*mahi, *ma$_n$yi agave, maguey
PCu *ʔamú:-l
Gu to-to-sá, (o) mahí totosá (s.) kind of agave

	Eud	méit	agave
	Nah	me-tl	maguey
*tahi		fire	
	Eud	té, J té'e	fire
	Nah	tletl, tat, tlitl	fire
*tah-		to be hot, to burn	
	Gu	tahtá-ni/tahtaré-ma	
		(o) tahtá-wa/tahtaré-ma (v.i)	
	Nah	tlatla	to burn
*sa_n-wa		leaf	
	SP	saŋwa-s	sagebrush
	Pn	samapi	juniper, cedar
	PCu	*ṣa:ma-t	
	GuO	sawá-ra	leaf
	My	sawwa (saugua)	grass
	Tbr	samoá-r, samwá-t	
	Nah	[i]swa-tl	corn leaf