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UTO-AZTECAN MORPHOPHONEMICS[1]

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0. In my view, PUA split first into northern PNUA and southern PSUA. PNUA became Takic, Numic, Tu, and Ho. PSUA became Taracahitic, Tepiman, Corachol, and Az.

Some processes described below apply only to the *-na-class, a set of verbs with special thematic suffixes: causative *-na- and *-ca- (PSUA) or *^{i}-na- and *^{i}-ca- (PNUA), intransitive *-∅- (PSUA) or *-ki- and *^{i}-tai- (PNUA). I plan to deal with the history of this class in another paper.

1.1. Hill and Hill[2] reconstruct for Proto-Cupan a small set of mobile-stress stems best preserved in Cu, where stems like max-^{m} *to give* (note superscript) have forms like CV́C *will do*, cə́m-CVC-pi *us to do*, CVC-á-nuk *having done*, CVC-í-və-ʔəc *doer*, CVC-qál *was doing*.

Ho CV́CV verbs with extrashort vowel V̨ show a stress shift to CVCV́- (CVCV́- with simple short V before preaspirated stop) before suffix: tɬ́wa *saw*, future tiwą́-ni, agentive tiwá-^{h}qa.[3] Ho CVCV́- matches Cu CVC-á- since Cu augment -á- is a reinterpreted stem-final vowel (*CVCá-). Prefix stress is found with Ho nouns, provided the prefix causes preaspiration of stops: pá:sa *field*, ʔí-^{h}pàsa *thy field*, ʔi-vása *my field*.

Ho and Cupan suggest a minimal alternation of PNUA simplex *CV́CV with presuffixal *CVCV́- (for presuffixal i-ablauted *CV́Ci-, see **2.1** below). Prefix stress in some PNUA forms is also likely.

1.2. Tu preserves a vestige of *CV́CV versus *CVCV́-. Tu /-CVCV-/ verbs normally become CV:CV-, reduplicated (henceforth rdp.) ʔV:-CVCV:- by an

[1] I presented evidence for a genetic NUA/SUA split at the annual meeting of the American Anthropological Association, San Francisco, December 1975. I am grateful to the National Science Foundation and the University of Chicago Department of Anthropology for providing funding for this work. Personal acknowledgements are due to Norman McQuown and Calvert Watkins, among many others. Abbreviations: Az(tec), Ca(huilla), Cu(peño), Ho(pi), Hu(ichol), Lu(iseño), Mo(no), Pa(pago), Se(rrano), SoPa (Southern Paiute), Ta(rahumara), Tu(batulabal), Ya(qui).

[2] Jane Hill and Kenneth Hill, "Stress in the Cupan (Uto-Aztecan) Languages," *IJAL* 34 (1968): 233–41.

[3] Most Ho forms cited in this article are from Whorf's work on the phonologically archaic Third Mesa dialect (B. L. Whorf, "The Hopi Language: Toreva Dialect," and "The Milpa Alta Dialect of Aztec," in *Linguistic Structures of Native America*, ed. Harry Hoijer et al., VFPA, no. 6 [New York: Viking Fund, 1946], pp. 158–83, and 367–97). The dialects used in the Voegelins' studies show the following developments: *CV^{h}CV → CV:CV (merging with *CV:CV), *^{h}C → C, and *V̨ → V (extrashort and short vowels merge). See C. F. Voegelin and F. M. Voegelin, "Hopi Domains," *IJAL Memoir* 14 (1957); and C. F. Voegelin, F. M. Voegelin, and Kenneth Hale, "Typological and Comparative Grammar of Uto-Aztecan: I (Phonology)," *IJAL Memoir* 17 (1962).

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alternating-length rule. However, a few, such as /-wwiši-^{m}/ *to be ripe* (again note superscript), instead form CVCV-:, rdp. ʔV:-CVCV:-, for example, wiši:-, rdp. /ʔi:-wwiši:-/ (secondarily shortened to ʔi-wiši:-).[4] A base-form */-wwiši:-/ is not possible for reasons which I cannot go into here. I view this irregular lengthening to CVCV:-, instead of expected CV:CV-, as a reflection of PNUA presuffixal *CVCV́- with stem-final stress.

By comparing the actual stems in the Tu, Ho, and Cu verb classes (and with Lu and Ca correlated classes), we can reconstruct these PNUA mobile-stress verbs: *tiwa-^{m} *to see*, *naŋa-^{m} or *ŋaŋa-^{m} *to cry*, *maka-^{m} *to give*, *kati-^{m} *to sit*, *pisa-^{m} *to go out*.

1.3. The PNUA *-na-class had similar stress alternations in its thematic forms. I reconstruct causative *CV́'CV-ki-na- and *CVCV́-mi-na-. The latter shows expected presuffixal *CVCV́-. Recessive stress in *CV́'CV-ki-na- is due to morphophonemic hardening (**3.1**) of stem-medial *C to *'C (geminated or preaspirated), creating a heavy syllable.

Ho CV́^{h}CV-k-na and CVCV́-m-na preserve the alternation. Synchronically, however, instead of consonant-grade being morphonemic (primary) and stress secondary and derivative, we probably now have uniform base-form /CV́^{h}CV-/ with morphophonemic (primary) stress-shift in CVCV́-m-na and subsequent automatic deaspiration of nonposttonic stop.

Se shows corresponding forms like nib-k-in(a-) and nibi-m-in(a-) *to bury* with loss of stem-final vowel in *CV́'CV- and preservation of it in *CVCV́-, presumably because of the stress difference. This confirms my PNUA reconstructions.

Curious Cu alternations such as sálək^{w}- (punctual) versus sələ́k^{w}- (durative) *to scratch*, though involving originally trisyllabic *CVCVCV- stems, may be obscurely related to these *-na-class alternations, since hardened stem *CV́'CV- was punctual and unhardened *CVCV́- was nonpunctual, but details behind this Cu type are difficult to work out.

1.4. It appears that all PNUA *CVCV- (not *CV'CV-, *CVNCV-, etc.) verbs were in the mobile-stress class, and no others were. Combining this with the information in **1.3**, I conclude that the PNUA stress rule gave *CVCV- stems *CV́CV stress without suffix, and *CVCV́- presuffixally (except *CV́Ci- with i-ablaut suffix). *CV'CV- (and *CVNCV-) stems with heavy initial syllable, on the other hand, had invariable initial stress (*CV́'CV-). PNUA stress was probably low-level and automatic. This rule is also consistent with the treatment of prefixes in Ho ʔi-^{h}pasa *thy field* versus ʔi-vása *my field*, since prefix stress correlates with preaspiration (hardening) and hence with heavy prefixal syllables.

1.5. Taracahitic evidence suggests that the PSUA stress rule was similar, except that *CV'CV- and *CVNCV- had merged with *CVCV- as PSUA *CVCV-, whereupon all bisyllabic stems came to show the alternation *CV́CV (suffixless) versus *CVCV́- (i-ablauted *CV́Ci-).

This is basically the Ya situation, and such alternations have extended to newly created CVCCV- stems: ʔómte *enojarse*, ʔomté-kai *siendo enojado*.

1.6. Both Ho and Ya have compounds or "nexus" constructions which may show stress shifts: Ho qále *strong* and másа *wing* form "loose nexus" qalé-masà *strong wing*

[4] The superscript ^{m} is synchronically inappropriate since mobile stress as such is not involved, but I use this superscript to emphasize the historical connection between this Tu class and mobile-stress classes in other languages.

and (frozen) compound qalé-msa *primary wing;* Ya ʔíli *chico* and ʔúusi *muchacho* form ʔilí-ʔuusi *muchachito*. Ho "infinitive" combinations, for example, k-class intransitive CVCV́-k (followed by a sort of auxiliary verb) are formally similar.

Note, however, that Ho extends stress shifts in such forms to CV́CV (not just CV̨CV) stems like qále. This is a Ho innovation vis-à-vis PNUA.

2.1. An example of i-ablaut is PNUA *ta'pa- *to split* plus suffix *ⁱ-na- (note superscript) becoming *ta'pi-na- (Ca -čapin-). I-ablaut is triggered by certain suffixes, but affects the final vowel of the preceding morpheme.

In Tu, SoPa, etc., this is all there is to i-ablaut. However, there are indications that i-ablaut in the protolanguages was more complex. It was probably originally a reduction (including destressing of an otherwise stressable vowel) bordering on syncope. Vowel-quality of *u and *o was unaffected, but *a, *i, and *i merged as a weak *i. Ablauted *i (unlike ordinary *i) further caused palatalization of preceding *t to *c (or *č, if distinct from *c; if so, *c similarly became *č and *s became *š). Thus, *mati *to know* became *maci-, etc.

2.2. Ya provides evidence that *o and *u did not become *i: ʔetého- *platicar* plus passive ⁱ-wa- becomes ʔetého-wa-, not *ʔetéhi-wa-. Stem-final a also avoids ablaut if preceded by w (u) or ʔ (téuwa- *decir*, yaʔa- *hacer*).

Some Ho i-ablaut suffixes, for example, passive ⁱ-lti, ablaut only a, i, and i, while ö (*o), o (*u), and the new phoneme e are unaffected. This Ho/Ya correspondence, crossing the NUA/SUA division, suggests the proper PUA reconstruction.

Because stem-final *i was rare, and since i-ablaut of *i became largely vacuous as *t → *c alternations became leveled out, through minor developments a simple stem-final *a/*i alternation could be achieved, with *a having only a tentative claim to underlying primacy on the basis of the suffixless *CVCa form. Thus in Ta, I am inclined to segment -a- and -i- as stem augments added to -CVC- roots. This segmentation is even clearer in Cupan (Cu, Lu, Ca), where suffixless *CVCa has become *CV́C, contrasting with suffixed *CVC-á-Sff and *CVC-í-Sff.

2.3. Examples of *t → *c before ablauted *i are: Ho ʔí:ci-lti *it's closed up* (< ʔí:ta); Pa wíhos /wiho:si-∅/ *vomit* (< /wiho:ta/) (Pa s < PUA *c); Hu -ša:cí-ka *platicar* (< -šata-); Az mači-liya *to know about* (< mati-). Ta preserves no alternations, but mači- *saber* has generalized the old palatalized form. Ta does show s/š and c/č alternations (os-á- versus oš-i-' *escribir*), also found in Aztec (a:si *to reach*, passive a:ši-wa).

2.4. Ho and Ya provide the clearest evidence that i-ablaut involved reduction (destressing with possible syncope). In Ho, i-ablaut suffixes generally produce syncope, except where syllabic conditions prevent this. In the k-class (*-na-class), transitive theme CV́ʰCV-k-na /CV́ʰCV-ki- plus ⁱ-na/ and its derivatives, such as CV́ʰCV-k-na-ma, show syncope of the i-ablauted vowel. In the example CV́ʰCV-k̨i̇-n-va with future ⁱ-va, ⁱ-na- is itself i-ablauted and syncopated to ⁱ-n-, creating a cluster nv which prevents the preceding i-ablauted vowel from being syncopated. Another i-ablaut suffix, distributive ⁱ-ta, almost always syncopates the preceding vowel. Syncope of unablauted vowels is uncommon.

The i-ablauted forms of Ya verbs seem never to permit stem-final stress (*CVCí-) even in conditions favoring this stress and showing it with unablauted vowel (CVCá-, CVCé-). Furthermore, many stems show

TABLE 1

	no ablaut	i-ablaut
Suffixless .....(1)	*CVC-a	
CV suffix .....(2)	*CVC-á-CV	(4) *CVC-i-CV
CVCV suffix(es) .....(3)	*CVC-á-CVCV	(5) *CVC-i-CVCV

stem-final syncope instead of i-ablaut: buíka *cantar* becomes buík-, while buíte *correr* becomes buíti-. The choice depends on the consonant(s) preceding the stem-final vowel.

2.5. In PNUA, i-ablaut could apply iteratively, so if future *^{i}-pai- followed causative *^{i}-na-, both the stem and *^{i}-na- underwent ablaut (e.g., *CVCi-ni-pai-). This is clearly the case in Tu and Ho; the Numic and Takic data are inconclusive but do not contradict this. The PSUA situation is not clear, however. Ya and Ta permit i-ablaut only of the stem-final vowel, not of any suffix-final vowels. Tepiman seems to permit iterative i-ablaut, but more information from Az and Corachol is needed before the PSUA situation can be reconstructed.

2.6. Ta has undergone a number of analogical developments. I-ablaut survives only with a few -CVCa- stems (i.e., it is far less productive than in Ya), and as indicated in **2.2**, I prefer to write -CVC-a- and -CVC-i- with segmented augment. The Proto-Taracahitic paradigm of such stems, based on Ya, is shown in table 1.

The segmentation of -a- and -i- was actually a Ta innovation, but for simplicity, I reconstruct it here for the protolanguage. Note the stress patterns. Ta first lost the initial stress in form 5 (i-ablauted form with bisyllabic suffix or suffix complex), resulting in *CVC-i-CVCV. By analogy to this, form 4 then became *CVC-i-CV́ with final stress. Then suffixless form 1 became *CVC-á by analogy to forms 2 and 3. This resulted in generalization of augment stress in unablauted *CVC-á- and of suffix-initial stress with i-ablauted *CVC-i-'. This is the situation with attested Ta stems like os-á-/oš-i-' *escribir* (os-á, os-á-re, os-á-e, oš-i-méa, oš-i-rá, oš-i-mée, etc.).[5]

Furthermore, many bisyllabic stems which lack or have lost *a/*i alternations preserve these stress patterns, for example, ča?pí-/ča?pi-' *coger* (ča?pí, ča?pí-re, ča?pi-rá, etc.). Ta has even extended the stress alternation to other verbs like kapóna *trozar*. On the pattern ča?pí- : ča?pi-', we get kapóna- : x, and solving for x, we get kaponá- with stress shifted one syllable to the right (kapóna, kapóna-re, kaponá-ra, etc.).

2.7. Proto-Cupan, unlike PNUA, permitted stressing of i-ablauted vowels, probably only with mobile-stress stems, thus *CVC-i- alongside *CVC-á-. When the augments were unstressed, they were deleted (e.g., Cu cə́m-CVC-pi *us to do*, CVC-qál *was doing*), except when reinter-

[5] For the Ta data, see especially David Brambila, *Gramática Rarámuri* (Mexico City, 1953), chaps. 11 and 14. Brambila's "primera conjugación, primer modelo" and "tercera conjugación" basically have fixed stress. The "primera conjugación, segundo modelo" (e.g., kapóna-) and "segunda conjugación" (e.g., ča?pí-) show mobile stress and differ only in that the kapóna-type has underlying stem-penultimate stress, while the ča?pí-type has underlying stem-final stress. Brambila's "tiempos primarios" are the ones which show rightward stress shift for all mobile-stress verbs and the -i- augment for stems like os-, while the "tiempos secundarios" retain recessive stress and show the -á- augment.

preted as part of the following suffix (Lu future -an from *-ni, causative Lu -i-, Cu and Ca -in- from *^{i}-na-, etc.).

Cu basically preserves this situation. In Lu, *CVC-í- survives as CVC-í:-, for example, qal-í:-vu-k-t-um *former inhabitants* from qal-^{m} (note that CVC-í:- must be distinguished from thematic CV́C-i- with stem stress). Lu generally abandons the *CVC-á- form, replacing it with *CVC-í- or *CV́C-, but traces survive: mon-^{m} *to go* has a by-form mon-á-, and tow-^{m} *to see* (*tɨwa-^{m}) forms past usitative tuw-ók (*tɨwá- plus *^{u}-'ka-, cf. **2.12**).

Ca has regularized stem-initial stress, but preserves augments -a- and -i- with former mobile-stress stems in positions where the augments were stressed. Thus kʷá^{ʔ}-^{m} (Proto-Cupan *kʷa^{ʔ}-^{m}) has subordinated forms kʷá^{ʔ}-a-nuk and kʷá^{ʔ}-i-ve matching Proto-Cupan *kʷa^{ʔ}-á-nuk and *kʷa^{ʔ}-í-vɨ (preserved in Cu).[6]

Among reconstructible Proto-Cupan mobile-stress stems are *tɨw-^{m} *to see*, *ŋaŋ-^{m} *to cry*, *yax-^{m} *to say*, *tav-^{m} *to put down* (and derivatives), *kʷa^{ʔ}-^{m} *to eat*, and *na^{ʔ}-^{m} *to burn*. Subordinating suffixes *^{a}-nuk and *^{a}-pi required the *-á- augment, subordinator *^{i}-vɨ the *-í- augment.

Not only does Ca distinguish *CV́C-^{m} from fixed-stress *CV́C- (only the former takes augments), it also distinguishes CV́CVC-^{m} from CV́CVC- (in the same way): -čéxen-^{m} *töten*, gerund -čéxen-a-nuk, but -čéŋen- *tanzen*, ger. -čéŋen-nuk. It is possible that this correlates with an earlier *CV́CVC- versus *CVCV́C- opposition, with the former allowing stressed or semi-stressed augments (*CV́CVC-á-, etc.). Cu preserves both stress patterns (CV́CVC- and CVCV́C-), though neither permits suffix stress and neither shows augments. Lu has generalized CVCV́C- stress.

[6] Of course, using superscript ^{m} for Ca verbs is synchronically inappropriate, but it does bring out the Ca/Lu/Cu connections.

2.8. Both Ya and Ta show minor vowel-harmony processes in conjunction with i-ablaut. Ya Cé^{ʔ}e- stems, such as hé^{ʔ}e- *beber, comer*, form i-ablauted Cí^{ʔ}i-. Ta CeCá- stems like wepá- *azotar* become CiCi-′ (wipi-′) under i-ablaut.

2.9. Two PUA i-ablaut suffixes can be reconstructed with confidence. Passive *^{i}-wa- is well attested (Ho, Ya, Tu, Az; Az allomorph -lo:- reflects *-li-wa- with syncope of *i and postconsonantal *wa → o:). Desiderative-future *^{i}-pai- (ending unclear) survives in Ya ^{i}-bae, Tu ^{i}-ba^{ʔ}a-, Se -ib, and Ho ^{i}-va.[7]

PNUA had punctual *^{i}-na- and distributive *^{i}-ca- as causative *-na-class thematic suffixes; *^{i}-na- is well attested (Lu -i-, Ca and Cu -in-, Ho ^{i}-na-, Tu ^{i}-na-, SoPa ^{i}-na-), while *^{i}-ca- survives in SoPa. PSUA, however, had nonablauting *-na- and *-ca- preserved in Pa (-n, -ṣ), Ta, and Az.

PNUA has mediopassive distributive participial suffix *^{i}-pɨ-, surviving with various grammatical specializations in Ho ^{i}-vɨ, Tu ^{i}-bɨ:-, Se subordinator -ib(ɨ-) (distinct from fut. -ib < *^{i}-pai-), Cu ^{i}-və-^{ʔ}əc, Ca ^{i}-ve-, and Lu ^{i}-vu-. The corresponding punctual form *-'pɨ- did not show i-ablaut. I know of no SUA cognates of either form.

PNUA intransitive distributive *-na-class suffix *^{i}-tai- survives in SoPa ^{i}-cai- and Ho ^{i}-ta. No SUA cognates are known.

PSUA causative-indirective *^{i}-ya- is found in Az ^{i}-ya-, Hu ^{i}-ya-, Pa /-ida-/, etc. I know of no NUA cognates. PSUA causative-indirective *^{i}-li- and its extension *^{i}-li-ya- (Az ^{i}-li-ya-, Ya ^{i}-rai-, Ta ^{i}-ri-, Hu ^{i}-ri-) match PNUA nonablauting *-ni- (with regular *l → *n) found in SoPa indirect

[7] Ya e at the end of a verb stem or verbal suffix can reflect *i as well as *ɨ (e.g., future ^{i}-ne from *^{i}-ni). Final *i in a Tu verb stem or verbal suffix becomes a, see **2.13**. Ho ^{i}-va can reflect *^{i}-pai, note distrib. ^{i}-ta from *^{i}-tai- (SoPa ^{i}-cai-).

causative -ni-, Tu benefactive /^{a}-na-/ (**2.13**), and Ca causative allomorphs -an- and -ani-.

PSUA causative *^{i}-tu(w)a- or *^{i}-tu-ya- found in Ya ^{i}-tua-, Pa /^{i}-tuda-/, and Az ^{i}-ti-ya- is well attested, but there are no certain NUA cognates (SoPa -ttu$^{?}$i- and Ho ^{i}-toy- in CVC-toy-na are possibilities).

PSUA future *^{i}-ni- in Ya ^{i}-ne- and Pa /^{i}-ni/ matches PNUA nonablauting *-ni- (Ho -ni, Lu -an).

I see no way to predict i-ablaut in PSUA on phonological or grammatical grounds. In PNUA, on the other hand, i-ablaut seems to be regular with suffixes beginning in *-Ca or *-Ci with unhardened consonant, while others (including *-'Ca and *-'Ci) avoid ablaut. Because of serious discrepancies between PSUA and PNUA in this regard, PUA reconstruction is very difficult.

2.10. There was also a suffixless stem-final i-ablaut producing nominalized verbs; Pa wíhos /wiho:si/ *vomit* from /wiho:ta/ *to vomit;* Ho tɨ́ki *cut* (*noun*) from tɨ́kɨ *to cut;* Ya nóoki *palabra* from nóoka *hablar* (some Ya verbs take suffix -i or -$^{?}$i). Tu and Takic also have such forms. This nominalization is often a product-of-action or instrumental nominal. Nominal suffixes such as absolutive *-t may be added, but the i-ablaut is not triggered by these suffixes.

2.11. It is important to distinguish i-ablaut and stem-final -a-/-i- alternations in Ta and Cupan, which reflect reinterpretation of i-ablaut patterns, from a historically unrelated alternation of stem-final *a (usually transitive) and *i (usually intransitive). This is productive in Az, where, for example, causative thematic suffix -na- has developed an intransitive form -ni-. Some SoPa stems such as -op- (*hair*) *to fall out* show intrans. -i-, and punctual variant -aa-, versus trans. -a- (-op-i-, -op-aa-, -op-i-). In both languages, the form with *a is semantically the causative (or factitive) of the intransitive stem in *i.

Ya alternations like kópta *olvidar algo* versus kópte *olvidar* (with e from *i in this position) show a different semantic relationship; the form in *a, rather than adding a (causal) agent, adds a direct object to the intrans. form in *i. Ta has a more complex alternation distinguishing simple trans. in -á from a form with "incorporated" third-person pronominal in -é and one with incorporated indirect-object pronominal in -í: (uč-á- *colgar*, uč-é- *colgarlo*, uč-í:- *colgarle*).

The historical relationships among these Az, SoPa, Ya, and Ta alternations are complex, but the main point here is that none of them is related historically to true i-ablaut.

2.12. A minor u-ablaut process is perhaps reconstructible for PUA. Lu stem-final a or e usually become u before past -k(a-), for example, bíču-k and múhu-k from bíča- *ver* and múhe- *tirar*. Lu generally ablauts stem-final a (including -a- reduced from thematic -ax- < *-kɨ-) to u before past usitative -k, for example, néč-u-k from néč-ax- *to be paid.* This suggests PUA *^{u}-'ka- ablauting *a and perhaps *ɨ to *u. Tu past ^{i}-wkaŋ, probably cognate, may preserve an indirect vestige of u-ablaut in its initial w.

2.13. Tu shows an innovative a-ablaut with benefactive /^{a}-na-/, reflecting PNUA *-ni-. A-ablaut here arose as a device to prevent ambiguity between *-ni- and causative *^{i}-na-. In PNUA, there were a large number of verbs ending in *i. For these stems, benefactive *CVCi-ni- and *CVCi-na- were distinguished only by the suffix vowel. However, Tu shows word-final truncation (as do Takic and, to some extent, Numic languages), so in the

suffixless forms (like modern Tu past punctual), both merged as *CVCi-n. Also, since i-ablaut is iterative in Tu and PNUA, when an i-ablaut suffix like future *^{i}-pai- was added, the two merged as *CVCi-ni-pai- (modern Tu CVCi-ni-ba$^{?}$a-).

The other common stem-final vowel was *a, and for these verbs, there was no ambiguity: benefactive *CVCa-n(i-) versus causative *CVCi-n(a-), future forms *CVCa-ni-pai- versus *CVCi-ni-pai-. By analogy, stems in final *i altered their benefactive form to *CVCa-n(i-), distinguishing this from causative *CVCi-n(a-). A-ablaut had been created. It applied clearly to *CVCi- stems and could be considered as applying (vacuously) to *CVCa- stems. It then spread to *CVCi-, *CVCo-, and *CVCu- stems by analogy.

At a later period, Tu changed all final *i's in verb stems and verbal suffixes to another vowel, usually *a. Thus *CVCi- stems are now CVCa-, and benefactive *^{a}-ni- (PNUA *-ni-) is now /^{a}-na-/. Consequently, a-ablaut can be clearly seen only with morphemes ending in i, o, or u. It no longer has any disambiguating function.

3.1. Hardening, as I use the term, is a morpheme-internal process (gemination, preaspiration, rarely glottalization) associated with punctual aspect, generally confined to *-na-class verbs. The symbol 'C represents a hardened consonant.

I want to emphasize that the processes described here have absolutely nothing to do historically with junctural "geminating power," by which a suffix -CV- becomes -'CV- after certain stems (i.e., CVCV'- plus -CV- → CVCV-'CV-).

3.2. SoPa thematic verbs in -kki-/^{i}-na- distinguish punctual -CVCCV- (i.e., -CV'-CV-) from durative -CVCV- if the medial C is a stop: pakka-kki- (punctual) versus paka-kki- (durative) *to tear* .The -CVCCV- type is matched by Mo, for example, qwahca-$^{?}$i- *to fall*, though Mo has replaced the old durative *CVCV- by a reduplication (qwaca-ca-). Clearly, Proto–Numic distinguished punctual *CV'CV- from durative *CVCV- at least with medial stop.

We have seen above that Ho and to some extent Se reflect PNUA *-na-class causative themes *CV́'CV-ki-na- (punctual) and *CVCV́-mi-na- (distributive). Ho also preserves traces of this stem-alternation in intrans. forms: punctual CV́^{h}CV (*CV'CV) versus distrib. (CV-)CV́C-ta (*CVCi-tai).

Lu thematics in -ax-/-i- often show vowel-length alternations, for example, punctual xép- *to miss a little*, durative xé:p- *slowly, barely miss*. These reflect *CV́'CV- and *CV́CV-, respectively. The *CVCV- stem with stressed vowel in open syllable underwent originally automatic vowel lengthening. Then the consonantal alternation was leveled out and the vowel-length distinction became morphophonemic.

We can thus safely reconstruct the *CV'CV-/*CVCV- alternation for the PNUA *-na-class (to which all of the thematic classes mentioned here are related), at least for medial stops. For other medial consonants it is not certain that a phonemic *'C/*C opposition was possible. Lu CV́C-/CV́:C- alternations occur with any second C, but an alternation originally restricted to vowels before stops might have extended to other stems by analogy. Ho distinguished CV̨CV versus CV́CV with medial nonstop (parallel to CV̨CV versus CV́^{h}CV with medial stop). We might reconstruct CV́CV as *CV'CV- and CV̨CV as *CVCV-, with a *'C/*C opposition like that with stops. Since all k-class (*-na-class) Ho stems are CV́CV (with stop CV́^{h}CV), never CV̨CV, we can posit hardening of stems like láŋa *to be*

pulled (*la'ŋa-) as well as stems like yí^{h}ti *to run (pl.)* (*yi'ti-). However, again we have the possibility of analogical extension of vowel-length pattern from the type yí^{h}ti to the type láŋa.

3.3. Some leveling of expected consonant-quality oppositions reflecting *'C versus *C has taken place. Ho rí^{h}pa *to be separated* would be expected to form caus. distrib. *rivą́-m-na with regular intervocalic *p → v, but instead we get ripą́-m-na with analogical restoration of consonant quality (preaspiration is not possible except after stressed vowel). Similarly, Lu might be expected to show alternations like CV́t- versus CV́:l- (or CV́:ð-), CV́p- versus CV́:v-, etc., but in fact, the consonantism is always leveled one way or the other (e.g., CV́t- versus CV́:t- or CV́l- versus CV́:l-).

3.4. No *CV'CV-/*CVCV- alternations occur in SUA, but this is primarily due to the fact that *'C and *C have generally merged in all these languages. Only *p and *'p have distinct reflexes. Theoretically, we could look for traces of a *CV'pV-/*CVpV- opposition, but we rather expect such a restricted alternation to be leveled out, and this seems to be what has happened. PUA *ta'pa-/*tapa- *to split* (Ca -čáp- is the only clear NUA reflex)[8] shows up in SUA languages as reflexes of the hardened form *ta'pa- (Ta rapá-na-, Az λapa-na-, Pa tá:pa-n).

3.5. In PNUA and the attested NUA languages, there are some instances where punctual hardening applies to *-na-class thematic suffixes as well as to the stems. PNUA mediopassive participles, punctual *-'pi- and distributive or durative *^{l}-pi- (both preserved in Ho and Tu, *^{l}-pi- also in Takic, *-'pi- also in Numic), show a clear *'C/*C opposition as well as an i-ablaut difference.

SoPa distinguishes trans. thematic suffixes ^{l}-n^{ʔ}a- (punctual) and ^{l}-na- (durative). This is certainly a recent innovation. Since SoPa does not distinguish nn from n, it has used glottalization as a substitute for gemination.

Similarly, PNUA intransitive thematic suffix *-ki- (Lu -ax-, Se -q(i-), Ho -k(i-)) has two Numic reflexes, -ki- and secondarily hardened -'ki- (SoPa -kki-, Mo -hki-). This suffix is primarily punctual, so -'ki- can be seen as reflecting an extension of punctual hardening like that in SoPa ^{l}-n^{ʔ}a-.

Mo repetitive -hpa^{ʔ}i- is now productive but was once restricted to the -^{ʔ}i-/-hi- thematic class (*-na-class). I would analyze this as repetitive *-pa- (cf. Se -aba-) and thematic -^{ʔ}i-. This -^{ʔ}i- is usually added to a hardened stem (e.g., qwahca-^{ʔ}i- *to fall*). Thus *-pa- was probably hardened to *-'pa- by a similar process. Morphologically, repetitive aspect is often associated with the punctual in Numic.

4.1. In my view, PNUA had three major verbal reduplications: punctual *C_1V_1-, distributive *C_1V_1-, and iterative $C_1V_1C_2V_2$- (or full stem reduplication). The punctual type survives in SoPa, Lu (past punctual), Se (perfective), and Tu. The distributive type is found in SoPa, Ho, Ca, Lu, Tu, etc. Though formally identical, these two types were not confused since only a minority of stems had a punctual reduplication, and these stems could not form the distributive reduplication. This complementarity can be seen in SoPa, Lu, and Tu, where apparently no single stem can form both types.

4.2. The PNUA iterative is less securely reconstructible. However, Tu has a clearly archaic full-stem iterative type, and several

[8] Palatalization of *t to Ca č here has generalized from the derivative -če-čáp- (*či-ta'pa-) where it is regular.

Takic languages (e.g., Lu, Se) have similar bisyllabic or full-stem types for iterative and similar categories. The Takic types show archaic consonantal alternations, for example, p/v, t/ð, and cannot be recent innovations.

The Ho final -C_2V_2- type, for example, ɨpá-pa-(tà) *was slipping*, can reflect a full-stem type *CVCV-CVCV-. If considered as a compound phonologically, this would regularly become CVCV̆-CCV, note qalé-msa (**1.6**). A minor simplification produces the final -C_2V_2- type.

At first sight, Numic data do not support the full-stem reconstruction. SoPa has an initial iterative C_1V_1- type, while Mono has a final -C_2V_2- type, for example, qwaca-ca-(hi-) *keeps falling*. However, both of these can be taken as contractions of a former full-stem *CVCV-CVCV- type, SoPa by eliminating the second syllable, Mono the third. Thus a full-stem type in Proto-Numic is as good as any other reconstruction.

Actually, Proto-Numic probably had *CVCV-CV'CV-, with hardening of the final consonant if this was a stop. SoPa often distinguishes the iterative from the punctual or distributive by gemination in the former, for example, iterative -iʔippi- from ipi- *to drink*. In Mo, the intermittent iterative with suffix -hki-/-ki- takes the form -CVCV-'CV-ki- with the -ʔi-/-hi- class, where 'C is a preaspirated stop, geminated nasal, or the like (tanɨ-nnɨ-ki- from tanɨ- *to ring*). There is no conclusive evidence from other NUA branches as to whether the PNUA iterative had such hardening.

4.3. PSUA seems to have had a rather different set of verbal reduplications. Tepiman preserves a C_1V_1(:)- punctual type (kú:-kum from kú:m *to gnaw*), matching the PNUA punctual type and like it restricted to a small set of stems.

A PSUA *C_1V_1ʔ- distributive type with glottal stop occurs in Pa with adjectival stems, for example, ṣóʔo-ṣpolk from ṣópolk *short*. In Az, this type is also found with verbs, for example, teʔ-teki- *to cut something up into pieces*. I am not certain whether this type was verbal, adjectival, or both in PSUA.

PSUA also had one or more *C_1V_1- types (possibly with long vowel in some instances) for iteration, intensiveness, etc. Az has intensive-habitual C_1V_1:-, for example, te:-teki- *to slice*, and a similar C_1V_1- type restricted to the -ni-/-na- thematic class. Pa usitative forms like /bɨ-bɨhɨ:-/ from /bɨhɨ:-/ *to take, get*, and Ya initial-syllable reduplications like iterative-intensive čep-čépte- *brincar varias veces* can also be mentioned in support of this PSUA reconstruction.

4.4. A plural reduplication with noun stems took the form *C_1V_1- in PNUA, probably *C_1V_1:- in PSUA. This formation competed with addition of pl. suffix *-mɨ- or *-tɨ- (the latter preserved in Ho and Hu). NUA examples are Ho má:na *girl*, multiple ma-man-t(ɨʔɨ); Lu šuŋá:-l *woman*, pl. šú-šŋa-l-om; Tu kó:yó:-t *turtle*, collective ó:-gó:yó:-t; SoPa poo- *trail*, distrib. po-poo-. SUA examples are Pa bán *coyote*, pl. bá:-ban; Az kʷeya *frog*, pl. kʷe:-kʷeya-ʔ; Hu pl. kin terms like (ne-)má:-máiʔ:-(ma) (*my*) *grandsons*.

In Pa, some verbs also show this pl. reduplication, for example, -wákon- *to wash*, pl. obj. -wá-pkon-. Outside of Tepiman, the only verbal example of this sort that I know of involves NUA reflexes of *tɨwa- *to see*. Ho tɨ́wa has a unique pl. subj. form tɨ́-twa (*tɨ-tɨwa). This must go back to PNUA, since Cu tátwi(n)- *to look around* (cf. Cu təw-^{m} *to see*) matches the Ho reduplication, although it has been specialized semantically.

4.5. Some apparently irregular Ta stop

alternations and the like require comment. Consider baki-′ *entrar*, frequentative a-pagí-. The latter is historically a reduplication *C_1V_1- which has lost its consonant (this also happened in Tu). Generally speaking, PUA stops become lenis b, r̄, etc. word-initially in Ta (and other SUA languages), fortis p, t, etc. medially. In alternations like baki-′/a-pagí-, the reduplicated segment protects the stem-initial C from lenition, so we get p rather than b in a-pagí-. In this and some other examples, the lenis/fortis alternation of stem-initial C is compensated for, as it were, by a reverse dissimilatory fortis/lenis alternation of a following stop, hence the k/g alternation in this example. Note also that reduplication may involve stress-shift one syllable leftward, as it does here.

Looking at other examples, we find that these secondary changes (stress-shift, fortis/lenis alternations) may survive whether or not the reduplicated segment has been lost: r̄ari-′ *comprar*, freq. tará-; níre-*hacerse*, freq. í-nire-; note also nominal plurals like kapóra *bola*, pl. kabóra; čabóči *araña*, pl. i-čápoči.

We thus have a messy situation synchronically, but have some hope of explaining the various alternations historically by assuming *$(C_1)V_1$- reduplication and some originally automatic secondary changes. In particular, I would caution against trying to explain fortis/lenis alternations (p/b, t/r̄, k/g, etc.) in terms of morphophonemic *'C versus *C alternations.

5. PUA, PNUA, and PSUA all had a truncation process by which stem-final *CV was deleted in a (past) perfective form. In SUA, this is best preserved in Tepiman, for example, Pa húḍuñ /huruni/ *to descend*, past perf. húḍ /huru/. A few Pa stems show instead truncation plus -i (ná:d *to kindle*, past perf. ná-i) or loss of ʔ or h (híʔa *to urinate*, past perf. hía).

To the north, Se shows perfective truncation with or without punctual reduplication: kʷu:man *to sleep* versus perf. kʷu-kʷu:m, mɨmɨʔ-q(ɨ-) *to die* versus perf. mɨmɨʔ. Historically, this is a final *CV truncation (e.g., *kʷu-manV becoming *kʷu:ma). Note that in mɨmɨʔ, truncation has affected the thematic suffix -q(ɨ-).

Ho k-class intransitive punctual forms like ʔɨ́wi *a flame occurs* are notable in lacking thematic -k(ɨ-) or its distributive form ¹-ta, which otherwise occurs in all k-class themes. I regard the type ʔɨ́wi as a reflex of a PNUA truncated stem *CVCV (or *CV'CV) from thematic *CVCV-kɨ. Synchronically, we can simply say that -k(ɨ-) is omitted word-finally.

It is important to distinguish these instances of true morphophonemic truncation affecting base-forms from low-level automatic elision of word-final *V found in several UA languages (Tu, Cupan, Se, sometimes in Numic, often in Tepiman and Ya, sporadically in Az). In Se and Pa, for example, the two can be clearly contrasted, since low-level elision may apply to the output of truncation.

I am not sure whether Az preterit forms like -či:w from -či:wa *to make* are best considered as reflexes of PUA morphophonemic truncation or as reflecting later low-level elision; I suspect the latter, in view of other instances of elision such as preterit -k from *ᵘ-'ka, etc.