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MAKAH VOWEL INSERTION AND LOSS

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1. This paper outlines certain sets of rules for vowel insertion and loss (if you prefer, epenthesis, syncope, and apocope), as well as vowel shortening, whose understanding is of basic importance for the analysis and correct segmentation of Makah forms.[1] While its primary purpose is to make available this basic descriptive information, the observations offered concerning the relationships of ordering that these rules display may be of some general interest. These alternations seem to be relatively recent innovations in Makah, since they are not matched in detail by other Nootkan languages, although they have partial analogs elsewhere, especially in Nitinat.[2] These are rules that change the syllable structure of forms; as one would expect, the underlying forms on which they operate are, in this respect, much more like those of Proto-Nootkan than are the resulting Makah surface forms. Their recency of introduction is reflected in synchronic ordering relationships in that, by and large, they follow most other morphophonemic rules with which they interact; that is to say, these other rules operate as though the vowels in question had not been inserted or lost. The only exceptions seem to consist of the occurrence of certain anomalies involving vowel length in reduplicated forms, and of their being followed by a few "bookkeeping" rules, by which I mean general rules whose failure to operate would introduce clear irregularities in the surface phonotactics.[3]

2. Let us take up first the rules for vowel insertion. This consists in the introduction of a long vowel after a monosyllabic stem ending in one or more consonants when this is immediately followed by a consonant embodying glottalic action, one which is

either voiced (b d l w y), or glottalized (ˀp ˀt ˀƛ ˀc ˀč ˀk ˀkʷ ˀq ˀqʷ), or glottal stop (ˀ) itself, including the "hardening" and "softening" morphophonemes when they are realized as glottal stop. This set of consonants will be referred to hereafter as glottalic consonants. The introduced long vowel will match in quality the vowel of the stem, which may be either a, i, or u.

The operation of this rule may be exemplified by forms containing suffixes beginning with some of these consonants: -ba '... thing', -bis 'collectivity of ..., ... thing, ...-ing', -ˀpaɬ 'to smell (like) ..., to taste (like) ...', and -yakʷ 'instrument for ...-ing'. The transcriptions enclosed by [ ] are the forms that serve as inputs to these and other rules; in them the segmentation into morphs is shown (with certain exceptions) by spacing. The forms enclosed by / / are in a conventional phonemic transcription.

diq- 'to sew': [diq ba] /diqi·b/ 'thread'

čuč- 'to twist, spin into string': [čuč ba] /čuču·b/ 'mountain goat; halibut-string wrapping'

ƛix̣- 'red': [ƛix̣.ba] /ƛix̣i·b/ 'woodpecker sp.'

x̣aš- 'bone': [x̣aš bis] /x̣aša·bis/ 'bone'

ˀpac- 'to foam': [ˀpac bis] /ˀpaca·bis/ 'foam'

siq- 'to suppurate': [siq bis] /siqi·bis/ 'pus'

x̣uɬ- 'snot': [x̣uɬ bis] /x̣uɬu·bis/ 'snot'

bis- 'to smell': [bis ˀpaɬ] /bisi·ˀpaɬ/ 'to smell something'

cix̣- 'sour': [cix̣ ˀpaɬ] /cix̣i·ˀpaɬ/ 'to taste sour'

ˀƛax- 'to adze': [ˀƛax yakʷ] /ˀƛaxa·yak/ 'adze'

čatq- 'to spoon up': [čatq yakʷ] /čatqa·yak/ 'spoon'

diq- 'to sew': [diq yakʷ] /diqi·yak/ 'sewing machine'

ˀƛip- 'to comb': [ˀƛip yakʷ] /ˀƛipi·yak/ 'comb'

his- 'to chop': [his yakʷ] /hisi·yak/ 'axe'

ˀtičx̣- 'to file': [ˀtičx̣ yakʷ] /ˀtičx̣i·yak/ 'file'

ˀƛupk- 'to peck': [ˀƛupk yakʷ] /ˀƛupku·yak/ 'bill'

kutx̣- 'to drum': [kutx̣ yakʷ] /kutx̣u·yak/ 'drum'

The following forms show this vowel insertion occurring before a ˀ representing the "hardening" morphophonemes ˀ and ˀ̓, as embodied in the suffixes -ˀiɬta 'nose', -ˀaqƛ 'inside', and -ˀ̓ap causative. The . at the end of these stems indicates that these

morphophonemes are so represented after them; otherwise they would merge with a voiceless stop to give a glottalized stop, and with a fricative or voiced stop to give a voiced consonant plus lengthening of the preceding vowel.[4]

wiš.- 'flat': []wiš. ʾiɬta[] /wiši·ʔiɬt/ 'flat nose'
ƛ̓iẋ.- 'red': []ƛ̓iẋ. ʾiɬta[] /ƛ̓iẋi·ʔiɬt/ 'red nose'
buš.- 'closed': []buš. ʾaqƛ̓ ʾiɬta[] /bušu·ʔaqƛ̓iɬt/ 'clogged-up nose'
ʔapt.- 'to hide': []ʔapt. ʔ̓ap[] /ʔapta·ʔ̓ap/ 'to hide something'.

Vowel insertion does not take place when the suffix begins with one of the set of voiceless (or non-glottalic) consonants (p t ƛ c č k k^w q q^w ɬ s š x x^w ẋ $ẋ^w$ h), insofar as these so occur. This is shown by the following forms, containing the suffixes -$ck^wi\breve{}$ 'debris from ...-ing, remains of ...', -$tu\breve{}p$ '... thing, material, creature', and -sac '... receptacle'.

ẋaš- 'bone': []ẋaš $ck^wi\breve{}$[] /ẋašck^{w}i/ 'skeleton'
his- 'to chop': []his $ck^wi\breve{}$[] /hisck^{w}i/ 'chips from chopping'
baƛ̓- 'to tie': []baƛ̓ $tu\breve{}p$[] /baƛ̓tu·p/ 'cordage'
ʔač- 'to wedge up, block up': []ʔač $tu\breve{}p$[] /ʔačtu·p/ 'wedge'
diq- 'to sew': []diq sac[] /diqsac/ 'sewing basket'
q^wiš.- 'to smoke': []q^wiš. sac[] /q^wiš sac/ 'pipe'.

Vowel insertion does not take place, either, before suffixes occurring farther along in the word than after the first syllable, either because the stem is polysyllabic or because another suffix intervenes:

ɬaḱit- 'to chew gum': []ɬaḱit bis[] /ɬaḱitbis/ 'gum, chewing-gum'
[]ƛ̓iẋ. čat bis[] /ƛ̓iẋčatbis/ 'red face-paint'
čabas- 'sweet': []čabas p̓aɬ[] /čabasp̓aɬ/ 'to taste sweet, smell good'
[]ƛ̓uš akt p̓aɬ[] /ƛ̓ušaktp̓aɬ/ 'to smell like dried fish'
weʔič- 'to sleep': []weʔič yak^w[] /weʔičyak/ 'mattress'
[]ɬic a$\breve{}$s yak^w[] /ɬica·syak/ 'tablecloth'.

Strangely enough, stem-final short vowels are not lengthened before suffixes beginning with glottalic consonants:

ḱu- 'to hook': []ḱu yak^w[] /ḱuyak/ 'hook'
č̓u- 'to stink': []č̓u p̓aɬ[] /č̓up̓aɬ/ 'to stink'
č̓u- 'to stink': []č̓u bap[] /č̓ubap/ 'blue denim', lit. "smelly material"
haʔu- 'to eat': []haʔu ba[] /haʔub/ 'food'

babu- 'work': ⟦babu bis⟧ /babubis/ 'work'
⟦ču ʾiɬta ba⟧ /ču?uɬtab/, /ču?iɬtab/ 'nose'
⟦ƛ̓a· ƛ̓a·škat a yakʷ⟧ /ƛ̓a·ƛ̓a·škateyak/ 'iron'.

3. The situation calling for vowel insertion also arises in certain reduplicative patterns where the monosyllabic stem begins with a glottalic consonant, which thus comes to follow the stem. The repetitive aspect is signalled by complete reduplication of a consonant-final monosyllabic stem and suffixation of -a, plus vowel lengthening:

bis- 'to smell': ⟦bis bi·s a⟧ /bisi·bi·s/ 'to smell repeatedly, sniff'
diƛ̓- 'to lie on back, row': ⟦diƛ̓ di·ƛ̓ a⟧ /diƛ̓i·di·ƛ̓/ 'to lean back repeatedly, row'
t̓apɬ- 'to close the eyes': ⟦t̓apɬ t̓a·pɬ a⟧ /t̓apɬa·t̓a·pɬ/ 'to blink'
ƛ̓ax- 'to adze': ⟦ƛ̓ax ƛ̓a·x a⟧ /ƛ̓axa·ƛ̓a·x/ 'to adze repeatedly'
c̓us- 'to dig': ⟦c̓us c̓u·s a⟧ /c̓usu·c̓u·s/ 'to dig repeatedly'
č̓atq- 'to spoon up': ⟦č̓atq č̓a·tq a⟧ /č̓atqa·č̓a·tq/ 'to spoon up repeatedly'
?uẋʷ- 'to chew': ⟦?uẋʷ ?u·ẋʷ a⟧ /?uẋʷu·?u·ẋʷ/ 'to chew repeatedly'.

These examples illustrate lack of vowel insertion when the stem begins with a voiceless consonant:

pišq- 'to wink': ⟦pi·šq pi·šq a⟧ /pi·šqpi·šq/ 'to wink repeatedly'
tuxʷ- 'to spit': ⟦tu·xʷ tu·xʷ a⟧ /tu·xʷtu·xʷ/ 'to spit repeatedly'
caːsk- 'to ring': ⟦ca·sk ca·sk a⟧ /ca·skca·sk/ 'to ring repeatedly'
čuẋʷ- 'to tickle': ⟦ču·ẋʷ ču·ẋʷ a⟧ /ču·ẋʷču·ẋʷ/ 'to tickle repeatedly'
kutx̣- 'to drum': ⟦ku·tx̣ ku·tx̣ a⟧ /ku·tx̣ku·tx̣/ 'to drum repeatedly'
sit- 'to split': ⟦si·t si·t a⟧ /si·tsi·t/ 'to split repeatedly'
x̣ut- 'to splash': ⟦x̣u·t x̣u·t a⟧ /x̣u·tx̣u·t/ 'to splash repeatedly'.

If the monosyllabic stem does not contain a final consonant, the consonant -ƛ̓- is inserted between the stem and its copy (one could doubtless debate which is which, that is, whether the reduplication is prefixed or else suffixed and infixed -- the language otherwise having no prefixes), -ya is suffixed, there is vowel lengthening, and vowel insertion may again occur:

ba- 'to bite': ⟦ba ƛ̓ ba· ya⟧ /baƛ̓a·ba·y/ 'to bite repeatedly, nibble'
ƛ̓i- 'to shoot': ⟦ƛ̓i ƛ̓ ƛ̓i· ya⟧ /ƛ̓iƛ̓i·ƛ̓i·/ 'to shoot repeatedly'

ƛ̓u- 'to hook': ▯ƛ̓u ƛ ƛ̓u· ya▯ /ƛ̓uƛu·ƛ̓u·y/ 'to hook repeatedly'.

As before, vowel insertion does not occur in the case of a voiceless stem-initial consonant:

qa- 'to prick, pin': ▯qa· ƛ qa· ya▯ /qa·ƛqa·y/ 'to prick repeatedly, pin up'

si- 'to stir': ▯si· ƛ si· ya▯ /si·ƛsi·/ 'to stir repeatedly'

x̣u- 'to bail': ▯x̣u· ƛ x̣u· ya▯ /x̣u·ƛx̣u·y/ 'to bail repeatedly'.

If the stem is polysyllabic, the repetitive formation consists in a repetition of the first consonant and vowel only, suffixation of -a, and lengthening of the first two vowels; a consonant cluster leading to vowel insertion is thus not formed:

t̓ičat- 'to weigh': ▯t̓i· t̓i·čat a▯ /t̓i·t̓i·čat/ 'to weigh repeatedly'

ƛaškat- 'to iron': ▯ƛa· ƛa·škat a▯ /ƛa·ƛa·škat/ 'to iron repeatedly'

ʔackat- 'to jump': ▯ʔa· ʔa·ckat a▯ /ʔa·ʔa·ckat/ 'to jump repeatedly'.

The other reduplicative formation in which vowel insertion may occur is that of the iterative aspect, often attested in idiomatic expressions, which implies sporadic and temporally spread out repetition of an action, as opposed to the steady and frequent repetition implied by the repetitive form. Here only one vowel, usually the second, is long in the surface form for monosyllabic stems; hence when vowel insertion occurs, the stem vowel is not lengthened. Consonant-final monosyllabic stems suffix -š; the following show vowel insertion:

bax̣- 'to collapse; (trap) to fall, snap': ▯bax̣ bax̣ š▯ /bax̣a·bax̣š/ 'to trap occasionally'

bux^{w}- 'to steam': ▯bux^{w} bux^{w} š▯ /bux^{w}u·bux^{w}š/ a place name, lit. "steaming occasionally (?)"

p̓ac- 'to foam': ▯p̓ac p̓ac š▯ /p̓aca·p̓acš/ '"soapberry" dessert', lit. "to foam occasionally"

k̓up- 'to point': ▯k̓up k̓up š▯ /k̓upu·k̓^{w}upš/ 'to point occasionally'

k̓^{w}id- 'to stick on': ▯k̓^{w}id k̓^{w}id š▯ /k̓^{w}iti·k̓^{w}itš/ 'to stick on occasionally; hummingbird'

ʔapt.- 'to hide': ▯ʔapt. ʔapt. š▯ /ʔapta·ʔaptš/ 'to hide occasionally, to play hide-and-seek'.

When the stem begins with a voiceless consonant, there is no vowel insertion; the second vowel is usually lengthened:

cax^{W}- 'to roll, rotate, roll over: []cax^{W} ca·x^{W} š[] /caxca·xš/ 'to whirl around and around'

tu·k^{W}- 'to cover with soil': []tuk^{W} tu·k^{W} š[] /tuk^{W}tu·k^{W}š/ 'mole', lit. "covering with soil occasionally (?)"

ƛaš- '?': []ƛaš ƛa·š š[] /ƛašƛa·šš/ 'black lizard sp.'

łut- '?': []łut łu·t š[] /łutłu·tš/ 'thunderbirds'.

At least one form, though, seems to show lengthening of the first, instead of the second, vowel:

qap- 'to trap': []qa·p qap š[] /qa·pqapš/ 'to trap occasionally'

Monosyllabic stems ending in vowels insert -ƛ- in this pattern also, and they suffix -č instead of -š; vowel insertion again occurs:

k̓^{W}a- '(long object) to bend, break': []k̓^{W}a ƛ k̓^{W}a č[] /k̓^{W}aƛa·k̓^{W}ač/ 'elbow', lit. "bending occasionally".

Here again, the second vowel is lengthened when vowel insertion does not occur:

k^{W}a- 'to back up': []k^{W}a ƛ k^{W}a· č[] /k^{W}aƛk^{W}a·č/ 'lobster', lit. "backing up occasionally".

The length seems to be more variable for polysyllabic stems, and many of the stems are not otherwise attested. Lack of vowel lengthening is seen in:

[]t̓u t̓ubaq š[] /t̓ut̓ubaqš/ 'loon sp.', lit. "diving occasionally (?)"

[]q̓^{W}a q̓^{W}alabaq š[] /q̓^{W}aq̓^{W}alabaqš/ 'fish hawk', lit. "seeing far occasionally (?)".

A -ƛ- apparently replaces a lost postvocalic h:

hu·yu-k^{W}iƛ- 'large swell': []hu ƛ u·yu k^{W}iƛ š[] /huƛu·yuk^{W}iƛš/ 'large swells coming occasionally'.

These forms may show vowel lengthening:

diƛkat- 'to move one's head back': []di di·ƛkat š[] /didi·ƛkatš/ 'to move one's head back occasionally (as in mourning)'

[]c̓a· c̓a·ʔuq^{W} š[] /c̓a·c̓a·ʔuq^{W}š/ 'to fish for salmon from river bank'.

A consideration of the vowel lengthening in these reduplicated forms for the monosyllabic stems will show that a rather anomalous situation has developed, in that the number of long vowels on the surface is generally the same, regardless of whether vowel insertion has occurred. Clearly the process of reduplication precedes that of vowel insertion, and vowel lengthening is part of the reduplicative

patterns, yet the number of lengthened vowels occurring (i.e., whether one or two in the repetitive pattern, and whether zero or one in the iterative pattern) depends on whether vowel insertion is slated to add another long vowel.

Looked at historically, this situation seems to have developed, by analogical feedback, newly in Makah. In the repetitive pattern, it is clear from the evidence of Nootka, which does not insert a vowel, and of Nitinat, which inserts a short vowel, that the original situation was to have lengthening of two vowels, in the stem and in its copy, just as Makah still does for stems beginning with voiceless consonants. When insertion of long vowels developed, Makah avoided a succession of three long vowels in reduplicated monosyllabic stems by refraining from lengthening the first vowel as part of the reduplicative pattern. This brings it about that all monosyllabic stems have in common a lengthening of the last two vowels on the surface; in this they have come to differ from the polysyllabic stems, which still show lengthening of the first two vowels. The actual history may not have been quite so straightforward, however, as the length of the inserted vowel itself may be due in part to analogical influence from the first long vowel of the repetitive pattern, as well as to compensatory lengthening in cases where the following consonant was originally a glottalized resonant.[5]

In the iterative forms, on the other hand, the analogical influence seems to have gone in the other direction. Apparently there was originally no vowel lengthening here. The fact that the monosyllabic stems now usually show lengthening of the second vowel seems to be due to its having spread from the inserted vowel to the second vowel of stems whose shape does not call for vowel insertion.

The handling of these forms, as a matter of descriptive technique, would seem to allow some alternatives. Aside from the vowel length, in order to produce the correct reduplicative pattern for a given stem, one must take into account the number of syllables it contains (whether one or more than one), and, if it is monosyllabic, whether it ends in a consonant or a vowel. This latter factor affects the choice of the suffix, -a vs. -ya for the repetitive, -š vs. -č for the iterative, as well as of the interfix, -Ø- vs. -*-.

If one chose to handle the forms the way I have tacitly done above, this would mean considering also the class (glottalic vs. non-glottalic) of the initial consonant of monosyllabic stems. In the repetitive formation, the first vowel will be short if this consonant is glottalic, otherwise long; in the iterative formation it will be the second vowel that will be short if this consonant is glottalic, otherwise long.

The other approach would involve the use of special morphophonemes which would be operated on after vowel insertion has taken place. (Indeed, the choice of affix allomorphs mentioned above could also be handled by special morphophonemes in a straightforward way, ones that would give -Ø(a), -š, -Ø- when a consonant immediately precedes, but -y(a), -č, -ƛ- when a vowel does. This seems somewhat uninsightful in the case of the -ƛ-, which I like to think of as being inserted to avoid confusion with a CV(·)- reduplication pattern when the stem provides no second consonant to be copied.) We might, for example, handle the vowel-length of the repetitive forms by a morphophoneme (*) occurring between the reduplicative syllables, which would lengthen the first preceding vowel. If vowel insertion occurred, this would have no additional effect:

[ć̓us * ć̓u·s a] > *[ć̓usu·*ć̓u·sa] /ć̓usu·ć̓u·s/ 'to dig repeatedly'

[ba ƛ * ba· ya] > *[baƛa·*ba:yą] /baƛa·ba·y/ 'to bite repeatedly, nibble'.

Otherwise, this would lengthen the first vowel:

[sit * si·t a] /si·tsi·t/ 'to split repeatedly'

[si ƛ * si· ya] /si·ƛsi·/ 'to stir repeatedly'.

An analogous morphophoneme, but located in front of an inserted vowel and lengthening the first following vowel, might be employed in the iterative forms, but their greater irregularity of vowel length makes this less attractive.

Use of morphophonemes in this way could mean that only the number of syllables in the stem need be considered to determine the correct reduplicative pattern.

4. As has been indicated, a stem-final voiceless stop or affricate may merge with a "hardening" morphophoneme of a following suffix to give the corresponding glottalized consonant. If such a

consonant is the last one in a consonant cluster at the end of a monosyllabic stem, vowel insertion will occur before it:

lakč- 'light': [lakč ʼaxs] /laka·čaxs/ 'lamp', lit. "light inside"

caxt- 'loose': [caxt ʼaxs] /caxa·taxs/ 'something loose inside (box, basket, etc.)'

patqʷ- 'belongings': [patqʷ ʼaxs yakʷ] /pata·qʷaxsyak/ 'box, container', lit. "for belongings inside"

šačk- 'sharp': [šačk ʼiɬta] /šača·kiɬt/ 'sharp-pointed'

wičk- 'dull': [wičk ʼiɬta] /wiči·kiɬt/ 'dull-pointed'

cick- 'to throw': [cick ʼaqatu ʔi] /cici·kaqat?u/ 'throw it down!'.

As before, if the glottalized consonant is at the end of a syllable later than the first one, as in the case of initial reduplication, vowel insertion does not take place:

tupk- 'black': [tu tupk ʼabiɬ] /tutupkabiɬ/ 'black ears'.

The rule for vowel insertion thus follows the rule for hardening of such consonants, as is to be expected, since the latter goes back to the Proto-Wakashan period. In the previously-examined patterns leading to vowel insertion, the new vowel appeared at the point of junction between stem and suffix, whereas here it is inserted within the stem itself, before the last consonant. Since these glottalized stops and affricates are "link phonemes" in that their glottalization is derived from the following morpheme while their other features come from the preceding (stem) morpheme, there is no point between phonemes here which is also between the morphemes. What all the cases have in common is that the vowel is inserted before the first consonant which embodies any feature deriving from the second of the two morphemes, as long as this is preceded by another consonant.

This is not, however, merely a rule which operates on a cluster of consonants occurring after the first syllable of a word. That a morpheme boundary must be felt to be present for it to operate is shown by a few polysyllabic words, most if not all of them borrowings into the language, which fail to show vowel insertion although the conditions for it are otherwise met:

[pi·šbe·da] /pi·šbe·d/ 'fisherman'

[bu·sbus] /bu·sbus/ 'cow, bull'

[du·kʷbi·s] /du·kʷbi·s/ man's name

[ċi·kċi·ka] /ċi·kċi·k/ 'wagon'
[ṗu·q^{w}ƛuɬ] /ṗu·q^{w}ƛuɬ/ 'hermit crab'
[ƛa·šq̇i·lux^{w}] /ƛa·šq̇i·lux^{w}/ 'turkey'.

5. Another phonological rule which precedes vowel insertion is a fairly widespread one calling for the assimilation of an i to a preceding u from which it is separated by a ? (from whatever underlying source), as in these examples:
?u- objective stem: [?u ʾiˇks] /?u?u·k^{w}s/ 'to eat it, drink it'
bu· 'four': [bu· ʿiq] /bu·?uq^{w}/ 'the four'.

We will see below (sec. 18) that this rule operates even when the first u is subsequently lost. Some forms show a difference as between informants in whether or not the rule operates, such as the following, for which the assimilated variant is more widely attested in my data:
[ču ʾiɬta ba] /ču?uɬtab/, /ču?iɬtab/ 'nose'.
Other forms obtained, such as the following, fail to show the operation of this rule:
čˇu- 'to stink': [čˇu ʿis] /čˇu?is/ a place name, lit. "stinking beach"
du·- 'to sing': [du· ʾiƛ] /du·?iƛ/ 'to sing for awhile'.

In any case, a /u·/ introduced by the vowel-insertion rule does not condition assimilation of a following i, hence can be said to have been introduced subsequently to the operation of the assimilation rule:
hus.- 'wrinkled': [hus. ʾiɬta] /husu·?iɬt/ 'wrinkled nose'
tupk.- 'black': [tupk. ʾiɬta] /tupku·?iɬt/ 'black nose'.

6. Yet another rule which tends to precede vowel insertion is that for unrounding of labialized dorsal consonants before another consonant. When one of the consonants k^{w} k̇^{w} x^{w} g^{w} ġ^{w} ẋ^{w} is preceded by a, i, or another consonant, its labialization will be lost when it comes to stand before another consonant or word-finally (among other environments), so that it will be replaced by its respective unrounded counterpart k k̇ x g ġ ẋ.[6] This may be illustrated with the stems lak^{w}- 'to stick one's tongue out, to lick', ġak^{w}- 'to whittle, cut sideways with a knife', and ġapk^{w}- 'to hug'. Labialization is attested in forms such as these:
[lak^{w} ʾiɬta ba] /lak̇^{w}iɬtab/ 'point on bow of canoe', lit. "sticking-out-nose-thing"

[q̓ak^{W} abu·p] /q̓ak^{W}abu·p/ 'to peel (potatoes)'
[q̓apk^{W} a· ʔit s] /q̓apk^{W}e·ʔits/ 'he's hugging me'.

The following forms show the loss of labialization when these stems occur before a consonant:
[lak^{W} ši↓] /lakši↓/ 'to stick one's tongue out, lick (once)'
[q̓ak^{W} ck^{W}i·̆] /q̓akck^{W}i/ 'shavings from whittling'
[q̓apk^{W} ši↓ ʔit s] /q̓apkši↓its/ 'he hugged me'.

This loss also takes place when vowel insertion occurs, even though the stems are followed by a vowel on the surface. Examples with the suffix -yak^{W} 'instrument for ...-ing':
[lak^{W} yak^{W}] /laka·yak/ 'tongue', lit. "licker"
[q̓ak^{W} yak^{W}] /q̓aka·yak/ 'knife'.

Similarly in reduplication with vowel insertion, as in these repetitive forms:
[lak^{W} la·k^{W} a] /laka·la·k/ 'to lick repeatedly'
[q̓ak^{W} q̓a·k^{W} a] /q̓aka·q̓a·k/ 'to cut repeatedly, whittle, whittle repeatedly'
[q̓apk^{W} q̓apk^{W} a] /q̓apka·q̓a·pk/ 'to hug repeatedly'.

And in this previously-met iterative form:
[cax^{W} ca·x^{W} š] /caxca·xš/ 'to whirl around and around'.

Therefore, vowel insertion generally also occurs subsequent to labialization.

Nevertheless, the treatment of labialization is somewhat variable in this environment (as elsewhere, especially before "incremental" or word-forming suffixes beginning with a vowel, where it is also usually lost), and a few forms with retained labialization have been recorded, such as the following:
ṫiq^{W}- 'to sit': [ṫiq^{W} c̓ita] /ṫiq^{W}i·c̓it/ 'to sit in water'
six^{W}.- 'scabby': [six^{W}. ʾiɬta] /six^{W}i·ʔiɬt/ 'scabby nose'.

7. Among the most interesting rule-ordering relationships involving both vowel insertion and vowel loss are those having to do with the rules for variable-length vowels. Such vowels (symbolized V̆·) are long if in the first or second syllable of a word, short if in the third or a later syllable. This may be illustrated by the suffixes -dă·k^{W} 'to have', -ʾĭ·ks 'to consume', and -ʾĭ·x̣a 'to feel, suffer from lack of ...; be hurt, suffer, die, be killed from ...'. Their vowel is long when they follow a monosyllabic stem, so that the

variable-length vowel is in the second syllable of the word:
[]bu· da·k^{w} s[] /bu·da·ks/ 'I have four'
[]ča ʾi·ks[] /če?i·ks/ 'to drink water'
[]ča ʾi·xa[] /če?i·x/ 'to be thirsty'.

On the other hand, their vowel is short when more than one syllable precedes in the word:
[]šuča da·k^{w} s[] /šučadaks/ 'I have five'
[]kašču q ʾi·ks s[] /kaščuq^{w}ikss/ 'I'm eating a hair-seal'
[]tupaɬ^{y} ʾi·xa[] /tupa·yix/ 'to drown in salt water'.

Variable-length vowels go back at least to the Proto-Nootkan period. With one apparent exception, the rules controlling their length take effect before vowel insertion. Thus when vowel insertion takes place in front of a suffix containing such a vowel, it will appear to be in the third syllable on the surface, but it will be in only the second syllable when its length is determined, hence will be long.[7] The following examples involve the suffixes -da·k^{w} 'to have', -ʾi·ks 'to consume', and -cu· 'packed in':
[]ɬuč da·k^{w} ši ʔaƛ wa·t ʕi[] /ɬuču·da·kšʔaƛwa·d/ 'he got married (I am told)'
[]siq da·k^{w} ʔaƛ ʕi[] /siqi·da·kal/ 'she's cooking'
[]custk da·k^{w} ši ʔaƛ it s[] /custku·da·kšʔaƛits/ 'I just got some new ...
[]q^{w}iš. ʾi·ks[] /q^{w}iši·ʔi·ks/ 'to smoke (cigarette, etc.)'
[]ƛuš cu· ʔaƛ ʕi[] /ƛušu·cu·ʔal/ 'it's empty (of container for liquid)'.

One example has been noted, however, which seems to indicate that a vowel inserted before a stem-final consonant, as described in sec. 4, creates an additional syllable causing a following variable-length vowel to be short. The suffix here is -ʾa·ʔa·p 'to buy':
[]custk ʾa·ʔa·p[] /custu·k^{w}aʔa·p/ 'to buy a new one'.

8. Aside from certain details or irregularities that have been pointed out, we have now seen that vowel insertion is ordered so as to occur subsequent to the operation of several other phonological processes: reduplication, hardening, vowel-quality assimilation, delabialization, and length-determination of variable-length vowels. Only one rule has been noted that clearly follows vowel insertion; this is one requiring that only labialized dorsals occur after u. This rule operates without exception and leaves obvious traces in

the surface phonotactics.[8]

One situation in which this rule operates is when a suffix beginning in an unrounded dorsal comes to follow a stem ending in u. This can be illustrated by suffixes on the stem bu· 'four':

[]bu· x̣ta·k[] /bu·x̣^{W}ta·k/ 'four sackfuls'
[]bu· q̓ičx̣[] /bu·q̓^{W}ičx̣/ 'four years'
[]bu· qapɬ[] /bu·q^{W}apɬ/ 'four dollars, round objects'

The basic, unrounded, initial consonants of these suffixes can be seen when they occur after other vowels or consonants, as can be illustrated with the stem šuč̓a 'five':

[]šuč̓a x̣ta·k[] /šuč̓ax̣ta·k/ 'five sackfuls'
[]šuč̓a q̓ičx̣[] /šuč̓aq̓ičx̣/ 'five years'
[]šuč̓a qapɬ[] /šuč̓aqapɬ/ 'five dollars, round objects'.

The rounding of these consonants also occurs as a result of the assimilation of a preceding i to u, as can be seen in the first two examples of sec. 5.

Rounding of the glottalized dorsals k̓ and q̓ to k̓^{W} and q̓^{W} as a consequence of insertion of /u/ will occur in several circumstances. If a suffix begins with k̓ or q̓, vowel insertion may occur before it so that these consonants are then affected:

[]ɬuɬ q̓adi ʾaɬ s[] /ɬuɬu·q̓^{W}ada·ɬs/ 'I feel fine'.

For a monosyllabic stem containing u and ending in a consonant cluster whose last member is k or q, vowel insertion under the circumstances explained in sec. 4 will lead to rounding of this consonant:

[]yučk ʾax̣s[] /yuču·k̓^{W}ax̣s/ 'narrow (house, canoe, etc.)'
[]lušk ʾiɬta[] /lušu·k̓^{W}iɬt/ 'turned-up nose'.

Thirdly, complete reduplication of a monosyllabic stem beginning in k̓u- or q̓u- will lead to vowel insertion and rounding of the second occurrence of this consonant:

k̓up- 'to point': []k̓up k̓u·p a[] /k̓upu·k̓^{W}u·p/ 'to point repeatedly'
k̓up- 'to point': []k̓up k̓up š[] /k̓upu·k̓^{W}upš/ 'to point occasionally'
k̓ux^{W}- 'to suck': []k̓ux^{W} k̓u·x^{W} a[] /k̓ux^{W}u·k̓^{W}u·x^{W}/ 'to suck repeatedly'.

9. We turn now to the rules for vowel loss and shortening. This paper does not concern itself with all manifestations of what might be called vowel loss in Makah; in particular, there are conditions for the apparent loss of i, and to a lesser extent u, especially in sequences of

inflectional suffixes, which differ from the rules considered herein in that they are either somewhat sporadic in operation or are a property of particular morphemes or morpheme sequences. The vowel loss we will be considering here is sharp and consistent, not a matter of mere unvoicing or of free variation. Aside from assimilatory effects they may have on retained vowels, it is not possible to ascertain the quality of the lost vowels merely by obtaining repetitions or careful pronunciations of the forms; related forms in which the vowels are retained must be elicited. The following sections will give the rules for vowel loss in two environments -- word-finally and before ʔ --, and for vowel shortening, after which their general effect on the surface phonotactics will be summarized and the ordering relationships of these rules to each other and to other rules will be considered.

10. The first rule for vowel loss is simply that short vowels of all qualities, whether at the ends of stems or suffixes, are lost at the end of words (with one exception that will be explained in sec. 17):

[la·ba] /la·b/ 'whiskey'
[q^{w}alala] /q^{w}alal/ 'seagull'
[sit̓a] /sit̓/ 'tail'
[ʔaƛa] /ʔaƛ/ 'two'
[kawadi] /kawad/ 'killer whale'
[wi·yu] /wi·/ 'three'
[bi·ɬ sa·̌t̓a] /bi·ɬsa·t̓/ 'flat forehead'
[bu· cx̣i] /bu·cx̣/ 'four wives'
[ba·b i·qsu] /ba·bi·qs/ 'older sibling or cousin'.

This rule means that when either of the suffixes -ʕ̌i 'third person' or -ʔ̓i 'imperative' occurs word-finally after a consonant, its vowel will be lost and its presence will be perceptible, if at all, only in the effect its initial morphophoneme has on the preceding consonant, as in these examples:

[q̓idi·ƛ] /q̓idi·ƛ/ 'dog' : [q̓idi·ƛ ʕ̌i] /q̓idi·l/ 'it's a dog'
[cu·wit] /cu·wit/ 'silver salmon' : [cu·wit ʕ̌i] /cu·wid/ 'it's a silver salmon'
[ha·diq] /ha·diq/ 'goose' : [ha·diq ʕ̌i] /ha·diq̓/ 'it's a goose'
[ʔax^{w} ši ƛ] /ʔaxši ƛ/ 'to shake something' : [ʔax^{w} ši ƛ ʔ̓i] /ʔaxši ƛ̓/ 'shake it!'.

These morphophonemes have no effect on preceding fricatives, so that word-finally after such consonants the presence of these suffixes is not overtly apparent. Thus certain nominal forms and certain third person verbal forms become homophonous on the surface, e.g.:

[šu·yu·ɬ] /šu·yu·ɬ/ 'halibut' : [šu·yu·ɬ ˇi] /šu·yu·ɬ/ 'it's a halibut'

[q̓ʷa·la·š] /q̓ʷa·la·š/ 'raccoon' : [q̓ʷa·la·š ˇi] /q̓ʷa·la·š/ 'it's a raccoon'

[q̓ʷa·lis] /q̓ʷa·lis/ 'crane' : [q̓ʷa·lis ˇi] /q̓ʷa·lis/ 'it's a crane'.

(This section, together with sections 17 and 18, will be seen to explain as regular the puzzling appearance of this third person suffix on the surface as zero, consonant change, /ʔi/, or /ʔu/.)

11. The other environment for loss of short vowels is before a glottal stop (ʔ). This does not affect vowels of initial syllables, and not only the vowel preceding the ʔ, but also the one following it, must be short before the rule can operate.[9] A glottal stop actually has several underlying sources, not only ʔ itself, as far as ascertainable, but also the "hardening" and "softening" morphophonemes ˀ ˬ and ˂ ˃ (cf. sec. 15). (The morphophonemes ˬ and ˃ occur in "incremental" or outer-layer formations; they differ from their "formative" or inner-layer, counterparts at least in that only the latter affect preceding fricatives. The equation between the two "softening" morphophonemes is made on rather tenuous grounds -- they mostly affect complementary sets of consonants. I may have sometimes written a ʔ in an underlying form when its insertion would be predictable by rule.) These distinctions will mostly not concern us in what follows, so that we should be understood to subsume all the underlying sources when speaking of loss "before ʔ".

Only a few examples need be given now, as they will occur repeatedly in the following sections:

[hita ˀas] /hitʔas/ 'on the ground'

[la·ba ˀiˇks] /la·bʔiks/ 'to drink whiskey'

[q̓u·ya ˃i] /q̓u·yʔi/ 'it's medicine'

[tuqʷ ši ˬaɬ ˃i] /tuqʷšʔal/ 'it's melted'.

Retention of long vowels is shown by forms such as:

[k̓up a· ˬaɬ ˃i] /k̓upa·ʔal/ 'he's pointing'

[ta·la· ʕi q] /ta·le·ʔiq/ 'the money'.

Inhibition of loss by following long vowels may also be exemplified:

[q̓iba·da ʔu·c] /q̓iba·daʔu·c/ 'his umbilical cord'

[di·ti·da ʔa·tx̣] /di·ti·daʔa·tx̣/ 'Nitinat'.

Except for contractions with immediately following vowels, morpheme-final short vowels will generally be retained in environments other than those indicated for loss, which is to say before a suffix beginning with a consonant other than ʔ. A few examples of such retention are the following:

[la·ba sis] /la·basis/ 'my whiskey'

[q^{w}alala bʔu] /q^{w}alalabʔu/ 'it was a seagull'

[kibta·la či·s] /kibta·lači·s/ 'riding on a horse'

[ʔaƛa cx̣i] /ʔaƛacx̣/ 'two wives'

[ku·la x̣tida k^{w}i·ɬ s] /ku·lax̣tidaki·ɬs/ 'I'm making it of gold'.

The environments calling for vowel loss or contraction occur so frequently, however, that morpheme-final vowels are absent on the surface much, if not most, of the time. This gives one, wrongly, at first the impression of vowel insertion rather than vowel loss in instances where they are seen to be retained.

One case of additional environments for loss concerns the final -u after the consonant cluster -qs- in the suffix -i·qsu (-e·qsu, -si·qsu) occurring on many kinship terms. For at least several speakers this vowel is lost not only in the previously specified environments, but also before (at least) s and before ʔ even when the following vowel is long:

[ba·b i·qsu sis] /ba·bi·qssis/ 'my older sibling or cousin'

[ba·b i·qsu ʔu·c] /ba·bi·qsu·c/ 'his older sibling or cousin'.

It is retained, however, before voiced consonants:

[ba·b i·qsu dis] /ba·bi·qsudis/ 'our older sibling or cousin'.

These facts make it strategic, from a practical point of view, to elicit forms, when possible, with either the possessive suffix -dis 'our' or the third person past tense suffix -bʔu (-ʔu after consonants -- see sec. 17 for retention of this final vowel), in order to ascertain the presence and quality of a final vowel. The third person suffix -ʕi will also indicate the presence of a preceding a or i if it appears as /ʔi/, and of a preceding u if it appears as /ʔu/.

12. A third rule which we may treat, because of its relationship to other rules under consideration, even though it does not change the number of syllables in forms, is that of vowel shortening. This is simply that final long vowels, except in monosyllables, are shortened:

[bu·la·] /bu·la/ 'motor, machine, engine'
[lalu·pa·] /lalu·pa/ 'ribbon'
[biƛ a·] /biƛa/ 'rain'
[ba·dawi·] /ba·dawi/ 'smelt'
[lu·lapi·] /lu·lapi/ 'hand'
[bi·c i·] /bi·ci/ 'meat'
[k^{w}išu·] /k^{w}išu/ 'pig'
[quɬ u·] /quɬu/ 'slave'.

These morpheme-final long vowels are preserved as such when any consonant-initial suffix follows. There is no parallel shortening before ʔ to match the vowel loss in that environment.

[biƛ a· ʔaƛ ʕi] /biƛa·ʔal/ 'it's raining'
[ba·dawi· paɬ ʕi] /ba·dawi·paɬ/ 'it smells like smelt'
[lu·lapi· sis] /lu·lapi·sis/ 'my hand'
[k^{w}išu· dis] /k^{w}išu·dis/ 'our pig'.

The relationship of this rule to the rules for vowel loss will be discussed in sec. 14, and its effect on suffix-final variable-length vowels, in sec. 21.

13. The effect of the rules for vowel loss on the relationship between the underlying and surface phonological structures is that the former will often contain a larger number of syllables than the latter, and these additional syllables will be open ones. In observing these rules for vowel loss we are seeing the reflection of the latest of what must have been a long historical sequence of loss of vowels at different times, leading to the acquisition in Makah and related languages of the consonant clusters so typical of Northwest languages.[10] The syllable-structure of all Wakashan languages is striking: syllables begin with one and only one consonant, followed by one vowel, long or short, but may end in from zero to at least three consonants. The Makah vowel-loss rules introduce new syllable-final voiced and glottalized consonants, and new consonant clusters ending in ʔ, but the latter appear only medially, not finally. Word-final glottal stops are also introduced after vowels, and the number

of syllable-final voiceless consonants is also increased.

If a word seems to end on the surface in a voiced consonant (b d w y l) or a glottalized consonant (only t' č' č' so occur), one may be sure that there is actually a final underlying vowel. The quality of this is unpredictable, but it will be a most of the time. There are some partial correlations between particular final vowels and preceding consonants, for example, i seems to occur only after d from among this set of consonants. A word seeming to end in a voiceless stop or fricative may or may not have an underlying final vowel; if there is one, it is more apt to be any one of the set a, i, u.

Many borrowings of English words ending in a voiceless consonant show a final -a, such as wa·pa 'dock, wharf', wa·ča 'clock, watch', li·lu·ta 'train, railroad', and ha·psa 'hops'. There is some suspicion that this may be an absolutive or durative suffix, but most such words are not attested in any other form so as to allow its segmentation; on the other hand, this may have been added by analogy to become part of the stem. Many words ending in long vowels are borrowed from other languages, such as k^{w}išu· 'pig', bu·la· 'motor, machine, engine', and ta·la· 'money'. The Makahs hearing a word-final vowel in another language take it as representing an underlying long vowel.

14. We may now begin to consider some of the ordering relationships shown by these rules for loss and shortening, to each other and to other rules. A simple relationship obtains between the rules for loss and that of final shortening. Clearly shortening of final long vowels must take place after the loss of final short ones, since the shortened vowels are not themselves lost. Shortening also seems to follow loss of vowels before ?, in that a final long vowel immediately following the ? will inhibit loss, even though it is itself shortened, in forms such as:

[]čič i?i·[] /čiči?i/ 'tooth'

[]qal i?i·[] /qali?i/ 'eye'.

15. Another rather obvious ordering relationship concerns the fact that the hardening and softening morphophonemes are represented as ? after vowels that are lost just as they are after ones that are not. Thus it is simplest to say that the rules selecting this representation take effect before the rules for vowel loss here.

Ordering the rules this way also makes the rule for vowel loss itself a little simpler, in that it can be said to occur merely before ? rather than before the several morphophonemes so represented. A few examples of ? after retained vowels:

[ya· ʾiɬta] /ye·ʔiɬt/ 'sore nose'
[čʾi· ʾiˑks] /čʾi·ʔi·ks/ 'drinking from a cup'
[čʾu ʿis] /čʾuʔis/ a place name, lit. "stinking beach"
[ti· ʿi q] /ti·ʔiq/ 'the tea'
[ta·la· ʿi q] /ta·le·ʔiq/ 'the money'
[siṫa ʾu·c] /siṫaʔu·c/ 'its tail'
[ʔiki· ʾu·c] /ʔiki·ʔu·c/ 'his son'.

16. Another process which precedes vowel loss before ? is reduplication. A short vowel of the first syllable is not lost before ?, but when reduplication adds another syllable, putting this vowel into the second syllable, it will then be lost. The first vowel is sometimes lengthened under these circumstances.

[ba· baʔaẋ si·qsu] /ba·bʔaẋsi·qs/ 'sisters, female cousins (of a female)'
[ƛa ƛa ʾas yak^{w}] /ƛaƛʔasyak/ 'fence post', lit. "for standing in the ground"
[ba· t ba ʾas] /ba·tbʔas/ 'houses' (beside /batba·ʔas/).

17. The relationship of the vowel loss in word-final environment to that before ? may now be considered. A possible interaction arises only when a word would end (before vowel loss) in two short vowels separated by a ?, so that both these vowels would seem to be candidates for loss according to the two rules. The situation seems to arise only in the case of the suffixes -ʿi 'third person' and -ʾi 'imperative', when they are added after a vowel. If the preceding vowel is long, the vowel of the suffix is lost by regular rule, giving rise to otherwise non-occurring word-final /ʔ/:

[bu· ʿi] /bu·ʔ/ 'there are four'
[ƛʾuq^{w} u· ʿi] /ƛʾuq^{w}u·ʔ/ 'it's wide'
[qac pa· ʿi] /qacpa·ʔ/ 'it's on the left'
[su· ʾi] /su·ʔ/ 'hold it!'
[lakč sa· ʾi] /lakčsa·ʔ/ 'light it!'.

But if the preceding vowel is short, it is lost by the regular rule, before the ?. The language avoids, however, creating a word-

final consonant cluster ending in /ʔ/, so the final vowel is kept. (As discussed in the following section, it may undergo change of quality by assimilation to the lost vowel.) This seems to show that the rule for vowel loss before ʔ precedes that for loss in word-final environment; the latter rule could be amended to stipulate that it does not apply to final vowels preceded by -Cʔ. Some examples follow:

[ha·ca ˇi] /ha·cʔi/ 'it's long'
[qatawa ˇi] /qatawʔi/ 'it's a beaver'
[haku ʼiˇxa ˇi] /hakʔuxʷʔi/ 'he's hungry'
[ku·tx ku·tx a ˇi] /ku·txku·txʔi/ 'he's drumming repeatedly'
[haʔta·di ˇi] /haʔta·dʔi/ 'he's bathing'
[hup aˇ·s ˇa ˇi] /hupa·sʔa/ 'boil it!'.

18. When a vowel is lost before ʔ, it may have an assimilative effect on the preceding short vowel. The particular quality of the outcome for a given sequence of vowels seems to depend in certain instances on the layer of formation in the word, on the particular intervening morphophoneme, and even on the individual morphemes involved. I will not attempt to catalog the possibilities in detail, but will merely emphasize that two different ordering relationships can be observed. On the one hand, we find general rules of assimilation that will affect the second vowel regardless of whether the first vowel is lost. One such is the assimilation of an i to a preceding u, that was discussed in sec. 5 (including the labialization of a following dorsal as per sec. 8). In this case the assimilation must precede the vowel loss. The following are examples:

[wi·yu ˇi] /wi·ʔu/ 'there are three'
[ti ti qsu ˇi] /titiqsʔu/ 'wipe them (dishes)!'
[haku ʼiˇxa] /hakʔuxʷ/ 'hungry'.

On the other hand, certain rules affect the second vowel only when the first vowel is lost; when the first vowel is retained, the second vowel is also kept unassimilated. This kind of assimilation must of course also take place before the first vowel is lost, but in a realistic sense it can be said to be simultaneous with the vowel loss. Such rules are those giving rise to vowels /e/ and /o/, vowels which are generally of secondary origin. Within the stem formation sequences of a and i in either order generally give rise to /e/:

[]p̓a p̓a ʿis[] /p̓ap̓ʔes/ 'cranberries', lit. "scattering on the beach"
[]ʔu·q^{w} či ʲaṯx̣ id[] /ʔu·q^{w}čʔeṯx̣id/ 'we live in a nice place'.

This also occurs when the allomorph -ʲa of the causative suffix precedes the passive suffix -ʲit:
[]haʔu k ʲa ʲit s[] /haʔuk̓^{w}ʔets/ 'he's feeding me'.

In similar fashion, sequences of a and u in either order give rise to /o/:
[]wi·yu ʾak^{w} s[] /wi·ʔoks/ 'I have three'
[]dač uʔał s[] /dačʔoɬs/ 'I see it'
[]q̓a q̓a ʔuk^{w} ʾas[] /q̓aq̓ʔok̓^{w}as/ 'many puddles, ponds'
ƛaʔuˇ 'another, again', as postclitic: []... ƛaʔuˇ[] /... ƛʔo/.
(It is not known whether the apparent difference in rounding between /-oks/ and /-ok̓^{w}as/ will show a consistent correlation with the difference between underlying preceding a vs. u; this seems unlikely, but if so would indicate that the rounding rule discussed in sec. 8 precedes vowel loss.)

19. The relationship of vowel loss to the preconsonantal and word-final delabialization process that was discussed in sec. 6 is in a sense the converse of that of vowel insertion. A following vowel generally serves to preserve the labialization of a preceding dorsal consonant, even though the vowel itself is lost. Thus both vowel insertion and vowel loss follow the application of the delabialization rule. This preservation of labialization occurs both word-finally:
[]ƛax̣^{w}u[] /ƛax̣^{w}/ 'ten'
[]si· sit ck^{w}iˇ[] /si·sitck^{w}/ 'chips from splitting wood'
and also before ʔ:
[]ƛax̣^{w}u ʿi[] /ƛax̣^{w}ʔu/ 'there are ten'
[]si· sit ck^{w}iˇ ʿi[] /si·sitck^{w}ʔi/ 'they're chips from splitting wood'
[]ti ti tk^{w}i ʲaƛ ʲi[] /tititk^{w}ʔaƛ̓/ 'wipe your hands!'
[]k^{w}a k^{w}aʔak ʾabiɬ[] /k^{w}ak^{w}ʔak̓abiɬ/ 'little ears'.

The underlying form ƛax̣^{w}u that is set up is artificial in that the labialization of the dorsal is lost, by regular rule, when the following -u is preserved:
[]ƛax̣^{w}u daˇk^{w} s[] /ƛax̣udaks/ 'I have ten'.
It may be possible to set this up as *ƛax̣u instead, and recognize a rule that labializes a dorsal consonant when a following u is lost.

The suffix -a of the repetitive form sometimes also protects preceding labialization, but the outcome is variable, as labialization is, on the other hand, sometimes lost before this suffix even when the vowel is retained:

[ha· ha·ʔicx^{w} a] /ha·he·ʔicx^{w}/, /ha·he·ʔicx/ 'to sneeze repeatedly'
[q̓ak^{w} q̓a·k^{w} a ʕi] /q̓aka·q̓a·k^{w}ʔi/, /q̓aka·q̓a·kʔi/ 'he's whittling repeatedly'.

20. The relationship between the rules for vowel loss and those for variable-length vowels is intriguing. As with vowel insertion (sec. 7), the rules for determining the length of such vowels precede those for loss and shortening. In this section we will consider the case where a preceding vowel is lost, and in the following section those wherein the variable-length vowel itself is lost or shortened.

A variable-length vowel in the third syllable is short even if the vowel of the second syllable is lost, so that the variable-length vowel is in the second syllable of the surface form. Two suffixes previously exemplified in sec. 7 occur in these examples:

[la·ba ʾi˘·ks] /la·bʔiks/ 'to drink whiskey'
[baqi ʾi˘·ks i· k] /baqʔiksi·k/ 'what are you eating, drinking?'
[haku ʾi˘·x̣a] /hakʔux̣^{w}/ 'hungry'
[baqi ʾi˘·x̣a ...] /baqʔix̣aqa·ɬ/ 'what happened that he got hurt, died, got killed?'.

21. If a variable-length vowel is at the end of a suffix, it will be acted upon by the rules that determine whether such vowels are long or short, but after that, if long, it may be shortened, and if short, it may be lost. This means that such suffixes may ultimately appear in any one of three shapes: with long vowel, short vowel, or no vowel. The possibilities may be illustrated with the suffixes -c̓u˘· 'packed in', -x̣sa˘· 'to crave, wish to eat', -qi˘· 'on the head, summit', -cpa˘· 'over', and -ck^{w}i˘· 'debris from ...-ing, remains of ...'.

The vowel will be long if the suffix follows a monosyllabic stem and is in turn followed by another suffix which protects it from word-final shortening:

[wik c̓u˘· ʾaƛ ʕi] /wiki·c̓u·ʔal/ 'it's empty (of box, etc.)'
[bi·c x̣sa˘· s] /bi·cx̣sa·s/ 'I'm wishing for meat'
[q̓iɬ qi˘· ba] /q̓iɬqi·b/ 'feather in hair, feathered head-dress'

[yac cpǎ· diƛ ˇʕi] /yaccpa·dil/ 'he's stepping over'
[his ck^{W}ǐ· ˇʕi] /hisck^{W}i·ʔ/ 'it's chips from chopping'.

The vowel will be short in two different circumstances. If it is in the second syllable but word-final, shortening will secondarily apply to the long variant:

[ƛ̓ǐ· c̓ǔ·] /ƛ̓i·c̓u/ 'being gathered for a party (in a room, hall)'
[wičq qǐ·] /wičqqi/ 'bald on top'
[yac cpǎ·] /yaccpa/ 'stepping over'
[ƛ̓ ax ck^{W}ǐ·] /ƛ̓axck^{W}i/ 'chips from adzing'.

These examples show this situation combined with the vowel insertion that was discussed in sec. 7:

[daš c̓ǔ·] /daša·c̓u/ 'packed in tight'
[du·k^{W} c̓ǔ·] /du·k^{W}u·c̓u/ 'radio, phonograph', lit. "singing packed in".

The vowel will also be short if it is in a third or later syllable and is followed by another suffix which begins with a consonant other than ʔ. Here the shortening is primary:

[cu·wit x̣sǎ· s] /cu·witx̣sas/ 'I'm wishing for silver salmon'
[ƛ̓a kiš qǐ· ʔa·] /ƛ̓akišqiʔa/ 'standing on top of a rock'
[ʔackat cpǎ· s] /ʔackatcpas/ 'I jumped over'
[hi his ck^{W}ǐ· q k̓uk^{W}] /hihisck^{W}iqk̓uk^{W}/ 'soda crackers', lit.
"resembling chips from chopping".

If the variable-length vowel is in a third or later syllable so that the short variant is selected, this may then be lost by the regular rules. These examples show word-final loss:

[bi· bi·c c̓ǔ·] /bi·bi·cc̓/ 'canned meat'
[ci· ci·yap ux^{W}s qǐ·] /ci·ci·yapux^{W}sq/ name of a rock formation, lit.
"wearing hats"
[ʔackat cpǎ·] /ʔackatcp/ 'jumping over something'
[si· sit ck^{W}ǐ·] /si·sitck^{W}/ 'chips from splitting wood'.

And the following show the loss of such vowels before ʔ:

[ʔackat cpǎ· ˇʕi] /ʔackatcpʔi/ 'it's jumping over'
[si· sit ck^{W}ǐ· ˇʕi] /si·sitck^{W}ʔi/ 'it's chips from splitting wood'.

22. In a form such as /la·baʔu·was/ 'tavern', formed from <u>la·ba</u> 'whiskey', the long <u>u·</u>, which by its length inhibits loss of the <u>a</u>, is due to hardening of a consonant in a sequence of suffixes, <u>-ʔuƚ^{W}</u> 'place' plus <u>-ʼas</u> 'on the ground'. The long vowel has arisen from

compensatory lengthening on the loss of glottalization of the semivowel (< *-ʔuẃas). This would indicate that, as expectable, hardening precedes vowel loss (as well as vowel insertion). However, it seems somewhat doubtful whether this rather etymological relationship is strongly apparent synchronically (especially since ± usually hardens to ·l or ·y in Makah).

23. We have seen that shortening of final vowels follows vowel loss. Only two rules have been found to follow either of these, and these are both rules that avoid prohibited sequences in the surface phonotactics. The first that we will consider avoids a sequence */i·y/ in the same syllable, i.e., before another consonant or word-finally. When the loss of a vowel would produce such a sequence, the y is also lost, leaving merely /i·/. This may happen word-finally:

[wi·yu] /wi·/ 'three'

[si· ɬ si· ya] /si·ɬsi·/ 'to stir repeatedly'

and also before ʔ:

[si· ɬ si· ya ʕ̌i] /si·ɬsi·ʔi/ 'he's stirring repeatedly'

[wi·yu ʕ̌i] /wi·ʔu/ 'there are three'

[wi·yu ʼak^{w} s] /wi·ʔoks/ 'I have three'

[wi·ya ʕ̌i] /wi·ʔi/ 'he never ...'.

The fuller shapes with final vowels, and hence with the y also preserved, are seen in forms such as these:

[si· ɬ si· ya s] /si·ɬsi·yas/ 'I'm stirring repeatedly'

[wi·yu cx̣i] /wi·yucx̣/ 'three wives'

[wi·yu da·k^{w} s] /wi·yudaks/ 'I have three'

[wi·ya s] /wi·yas/ 'I never ...'.

It will be seen that the operation of this rule produces new word-final long vowels that are not shortened, hence this rule follows vowel shortening as well as vowel loss.

There is a situation in the language which introduces a final long /u·/ and which can be thought of as avoiding in parallel fashion a word-final sequence */uw/. The morphophoneme ʕ̌ changes a preceding k^{w} to /w/ when it follows a or i, but to /·/ when it is final after u (and to /k̓/ after a consonant):

[čʼa ʔak^{w} ʕ̌i] /čʼaʔaw/ 'it's water'

[ɬis uk^{w} ʕ̌i] /ɬisu·/ 'it's white'.

It seems meaningful to think of the latter case as sharing a change to *w, thus passing through a stage *ɬisuw.

24. The other rule that follows vowel loss is one of vocalization of y to i when a following vowel (only u is attested) is lost. This may be exemplified by the suffix -yu forming the irregular, also reduplicated, plural of ya·daq-ak^{W} /ya·daqak/ 'baby, child'. The u, and hence the y, are retained in forms such as:

[yak ya·daq yu dis] /yakya·daqyudis/ 'our babies, children'

[yak ya·daq yu b?u] /yakya·daqyub?u/ 'they were babies, children'.

Forms such as the following show the vowel loss and consequent vocalization of the semivowel:

[yak ya·daq yu] /yakya·daqi/ 'babies, children'

[yak ya·daq yu ʕi] /yakya·daqi?u/ 'they are babies, children'

[yak ya·daq yu ʕi q] /yakya·daqi?uq^{W}/ 'the babies, children'.

This rule avoids a word-final cluster -Cy, which never occurs, but a medial cluster -ky?- is in fact attested, in a form which shows the infix -k- that derives the potentially free forms for stems with medial -y- or -w-:

[?a k ya ʼak^{W} s] /?aky?aks/ 'I have many'.

This is paralleled by a form with medial -kw?-:

[da k wa ʼas] /dakw?as/ 'to sit and look around outside'.

It is not clear to what factor this difference of result should be attributed; perhaps the location of the preserved semivowels in the first syllable of the word is relevant.

NOTES

[1]Two other major sets of rules, not explicitly described in this paper, must also be controlled before one is fully equipped for Makah segmentation, namely the rules for contraction of contiguous vowels, and those for "hardening" and "softening" of consonants. Makah is a language in the Nootkan branch of the Wakashan family, originally spoken in the vicinity of Cape Flattery, Washington. My work on Makah and comparative Nootkan was supported during 1962-64 by National Science Foundation grant GS-19 to the University of Washington. Field work on Makah has been continued during parts of the summers 1965-68 with the support of the Desert Research Institute, University of Nevada, and during parts of the summers of 1969 and 1971 with the support of the Research Advisory Board, University of Nevada, Reno.

[2]For a partial description of Nitinat phonology see Mary Haas Swadesh and Morris Swadesh, A Visit to the Other World, A Nitinat Text, IJAL 7.195-208 (1933), especially pp. 199-202. In spite of many basic similarities, the phonologies of Nitinat and Makah have come to diverge in many ways.

[3]These seem to be an instance, or sub-type, of the notion of "persistent rules" introduced by Wallace L. Chafe in his article The Ordering of Phonological Rules, IJAL 34.115-136 (1968), sec. 5.1.

[4]This . morphophoneme tends to occur after fricatives and consonant clusters ending in stops. Its presence is doubtless predictable (hence unnecessary) after certain consonants, but not after others, such as š. There is some fluctuation in its occurrence after certain stems, and as to whether it has an effect after non-initial syllables.

[5]Information on this compensatory lengthening is given in my unpublished paper Traces of Glottalized Resonants in Makah, presented to the Linguistic Society of America in December, 1968, and also distributed to the mailing list of the 1969 Salish Conference.

[6]For further discussion of the occurrence of labialization, see my paper Labialization in Nootkan, presented to the Fourth International Conference on Salish Languages, August, 1969.

[7]Although I discovered this relationship for myself in Makah, I find it is clearly stated for Nitinat in Mary Haas Swadesh and Morris Swadesh, op. cit., p. 199. These authors speak of "inorganic vowels" that do not count as a syllable in this connection. They happen to quote as an example the cognate of the stem found in my first example: ɬučida·k 'possessing a woman'. (Nitinat inserts short vowels, and i is found after u of the stem as well as after i.) They did not seem to realize, though, that the insertion of these vowels at this point in the structure is predictable from the class of the suffix-initial consonant.

[8]My paper Labialization in Nootkan (fn. 6) discusses alternative analyses in connection with this relationship.

[9]Another Indian language that shows an analogous pattern of loss of (unstressed) vowels before glottal stop, including assimilation of the following retained vowel, is Tunica. This language does not lost word-final vowels, but the loss before ? may operate across word boundaries. Cf. secs. 3:23, 3:25, and 3:32 of Mary R. Haas, A Grammatical Sketch of Tunica, pp. 337-366 in Linguistic Structures of Native America, Viking Fund Publications in Anthropology No. 6, 1946.

[10]Note the strikingly similar type of difference between deep and surface syllable structure in Cowlitz, even though the rules connecting them are quite different, as described by M. Dale Kinkade in his paper for this Conference, Third Person Possessives in Cowlitz.