

Some Hiaki 'Echo Vowels' Result from a Floating Glottal Feature

Heidi Harley, Meg Harvey

1. Introduction

Hiaki (ISO639-3 *yaq*, Tara-Cahitic, Uto-Aztecan) has a poorly understood system of prosodic phonology, in which pitch accent, vowel length, and syllable structure interact. One process which is ubiquitous in the language but has not been extensively studied is the appearance of 'echo vowels' (Dedrick and Casad 1999:28-29). This term is used to describe apparent $V_1?V_1$ sequences which surface in some lexically and morphologically conditioned contexts.

Table 1. Echo Vowel Examples¹

Word-final	Morpheme-final	Morpheme-internal
<i>vo'o</i> 'road'	<i>ko'o-ne</i> 'chew-FUT'	<i>chi'imu</i> 'stye'
<i>vehe'e</i> 'cost'	<i>kecha'a-vae</i> 'stand-PROSP'	<i>pa'akta</i> 'pry up'

Previous descriptions of echo vowels in Hiaki have appealed to phonotactic and metrical constraints on [?.C] clusters that trigger the insertion of a copied ('echo') vowel (Dedrick and Casad: 28-29). However Hiaki has another robust method of breaking up illegal clusters, using an epenthetic [i]. Instead we propose that the [?] seen in 'echo' $V_1?V_1$ sequences is not in fact a glottal consonant, but a glottal *feature* that is attached to certain vowels. Depending on its phonological environment, this feature surfaces as either a glottal onset (before a following vowel) or a preglottalized vowel (before a consonant-initial syllable).

To support these claims, we a) present syllable-count data indicating that syllables that would be predicted to be disyllabic under an epenthesis analysis are in fact monosyllabic, b) consider how consonant initial morphemes can trigger echo vowels where they are not seen with vowel-initial allomorphs (ex: *-u/-wi*) and c) finally compare Hiaki and Mayo cognates in which Mayo word has an echo vowel and following consonant (*/l/* or */r/*) that the Hiaki word lacks.

This paper proceeds as follows: first an explanation of the data presentation and a description of the distribution of echo vowels is provided, then Section 2 discusses echo vowels as a glottal feature on certain vowels. Section 3 provides a description of when this the glottal feature surfaces as the onset of a syllable (including presenting some confounding data), and Section 4 suggests future avenues of research.

* Heidi Harley, University of Arizona, hharley@email.arizona.edu. Meg Harvey, University of Arizona, mharvey3@email.arizona.edu. We would like to thank Maria and Santos Leyva for sharing and discussing their knowledge of Hiaki with us, and, Amy Fountain, Michael Hammond, Ryan Bochnak, Jason Henry Ostrove, Natalie Weber, Shanti Ulfsbjorninn, Peter Austin, Eric Raimy, Mike Shen, Ryan Bennett, and Amber Lubera. This work was partially supported by NSF grant BCS 1528295 to Harley

¹ The abbreviations used in this paper are: 1 = 1st person, 3 = 3rd person, CONJ = conjunction, ASP = aspectual, DIST = distal, EMPH = emphatic, EP = epenthetic vowel, DET = determiner, GEN = genitive, MED = medial, NEG = negation, O.REL = object relativizer, PFV = perfective, PL = plural, PSV = passive, PROSP = prospective, PROX = proximal, TR = transitive, VOICE.ACT = active voice

1.1 Data Sources

Data in this paper come from our own elicitation sessions unless otherwise noted. Elicitations were conducted with two speakers, Maria Leyva, who speaks the Arizona Hiaki dialect and Santos Leyva, who speaks the Sonora Hiaki dialect. There are no known phonological differences between these varieties that are relevant to the data discussed in this paper. For consistency, we use the orthography created by the Pascua Yaqui Tribe (Trujillo 1997). With a few exceptions, the orthography is generally phonetically transparent. The table below shows the areas in which the practical orthography differs from the International Phonetic Alphabet.

Table 2 Orthography

Symbol	Phoneme(s)	Example	Gloss
'	/ʔ/	<i>bwa'e</i>	eat
y	/j/	<i>Yoi</i>	Mexican
bw	/b ^w /	<i>bwiika</i>	sing
v	/β/	<i>vaaso</i>	grass
aa (<i>also ii, ee, etc.</i>)	/a:/	<i>aapo</i>	3.SG
ch	/tʃ/	<i>chiki</i>	brush off

Not every orthographic V₁ʔV₁ sequence represents an echo vowel: the glottal stop is a separate phoneme of Hiaki and thus only some such sequences are the result of the manifestation of a glottal feature as a preglottalized vowel. Table 2 below shows three different types of Hiaki words: those where the glottal feature manifests as a glottalized preceding vowel, those where the glottal feature has been syllabified as an onset ('Glottal Onset (Feature)'), and those that are the result of a glottal phoneme ('Glottal Onset (Phoneme)').

Table 3. Types of [ʔ]

Glottalized Preceding V	Glottal Onset (Feature)	Glottal Onset (Phoneme)
<i>o'ola</i> 'old.man'	<i>ye'e</i> 'dance'	<i>bwa'e</i> 'eat'

2. Echo Vowels as a Glottalized Preceding Vowel

In Section 1, we introduced the hypothesis that many echo vowels are actually the manifestation of a lexically encoded glottal feature on some vowels. In this section, we look more closely at the evidence for this interpretation and discuss why an alternative proposal, that echo vowels are simply a phonotactic repair of syllables with an illicit glotta coda consonant, is insufficient to explain the patterns in the data.

To illustrate this first claim, we offer example 1 below with focus on the object relativizer morpheme *-'*, which we hypothesize is a floating glottal feature, rather than a consonant. These examples are slightly atypical in that the glottal feature is, in this case, a morpheme rather than something pre-designated on the vowel itself. However, the glottal feature behaves the same in these examples as it does when it is instead designated on the vowel.

1. Before a vowel-initial postposition (*-u*)

va'ata kom sika'u ne weevae
 va'a -ta kom sika -' -u =ne wee -vae
 water -GEN down went -O.REL -to =1.SG go -PROSP
 "I'm going to where the water went down"

When the object relativizer morpheme precedes a vowel-initial postposition, it is realized simply as the glottal stop onset of the final syllable. However, when the object relativizer appears before the consonant initial allomorph of that postposition (*-wi*)², it is realized as a glottalized preceding vowel, which is written "a'a".

² Dedrick and Casad (1999:30) describe *u/wi* as occurring in somewhat free variation, with *-wi* being especially common phrase-finally. Ex: *ne-u* ('to me') and *ne-wi* ('to me').

2. Before a consonant-initial postposition (-wi, an allomorph of -u).

va'ata kom sika'awi ne weevae
 va'a -ta kom sika -'a -wi =ne wee -vae
 water -GEN down went -O.REL -to =1.SG go -PROSP
 "I'm going to where the water went down"

In this environment, the floating glottal feature cannot be syllabified as the onset of the following syllable. Instead, it is realized as a preglottalized vowel. We see this same alternation when we combine the object relativizer with the postposition -po ('at') in example 3 below:

3. Before a different consonant-initial postposition (-po)

va'ata kom sika'apo ne weevae
 va'a -ta kom sika -'a -po =ne wee -vae
 water -GEN down went -O.REL -at =1.SG go -PROSP
 "I'm going to where the water went down"

Why consider this a glottalized preceding vowel, rather than the affixation of a glottal stop morpheme that then triggers vowel epenthesis? The answer to this lies in two domains: syllable count information and Hiaki phonotactic repair.

2.1 Echo Vowels and Syllable Count

If an echo vowel were an epenthetic vowel inserted to break up [ʔ.C] clusters, which are illicit in Hiaki (Dedrick and Casad 1999: 27), and thus allowing the [ʔ] to be syllabified as the onset of a [ʔV] syllable, we would expect echo vowels to be disyllabic sequences. However, when we asked our speakers to count the syllables in words containing these V₁ʔV₁ sequences followed by consonants, they counted them as only one syllable .

Table 4. Echo Vowel Syllable Counts³

Word	Syllabification	Syllable Count	Expected Syllable Count if Epenthetic
kaate-ka -'a -po sit.SG-PFV-O.REL-at	kaa.te.ka'a.po	Four (not five) syllables	*kaa.te.ka.'a.po
yee -mahta-wa -'a -po people-teach-PSV -O.REL-at	yee.mah.ta.wa'a.po	Five (not six) syllables	*yee.mah.ta.wa.'a.po
paro'os-im hare -PL	pa.ro'o.sim	Three (not four) syllables	*pa.ro.'o.sim
saka'a-vae go.PL -PROSP	sa.ka.a'a.vae	Four (not five) syllables	*sa.ka.'a.vae

In each of the examples above, the echoed vowel was considered by the speakers to be monosyllabic. This includes not only the preglottalized vowels yielded by the attachment of the object relativizer morpheme as in *kaateka'apo*, but also the lexically determined ones such as *paro'osim*.

2.2 Hiaki Phonotactic Repair

Recall the alternative hypothesis we considered above, that a copied, epenthetic vowel that counts as a syllable nucleus is inserted in order to break up an illicit consonant cluster, creating a new syllable. In Section 2.1, we used

³ The syllable count data was acquired by first having speakers count syllable breaks in Spanish words as a training exercise, and then in Hiaki words that were presented as a word list (both speakers are fluent in Spanish as well as Hiaki). Both speakers were confident about both the syllable count and the syllabification of each word.

syllable count data to illustrate that echo vowels are monosyllabic rather than disyllabic, which runs contrary to what we would see if the glottal was, in fact, serving as an onset of a syllable with the ‘echo’ vowel as its nucleus. However, the syllabification data are not the only challenge to that claim. A second issue is that Hiaki has an independent, robustly attested method of breaking up illicit clusters: the insertion of epenthetic [i].

Epenthetic [i] is used frequently throughout Hiaki, with one notable case being in the plural marker *-(i)m*. The plural suffix [m] alternates with [im] when affixed to a consonant-final word:

4. *taawe* taawe-m
 hawk.SG hawk-PL
5. *sochik* *sochik -i-m*
 bat.SG bat -EP-PL

While it is, of course, possible for multiple methods of phonotactic repair to exist within the same language, there is no evident motivation for why we would find [i] in some contexts and echo vowels in others if they both solely serve to break up illicit clusters. We cannot appeal to phonotactic constraints to explain why [i] is not used in the echo vowel contexts, as there is no restriction on glottal stops and [i] patterning together. In fact, we see [i] both following the glottal stop phoneme in several lexical items, as in *wo'i* (‘coyote’), and bearing the glottal feature as in *chi'ila* (‘mother’s older sister’) and *hi'ibwa* (‘feed’).

3. Floating Glottal Feature as an Onset

In Section 2, we looked at scenarios in which the floating glottal is realized as a preglottalized vowel, using evidence from Hiaki syllable information and phonological rules. In this section, we discuss the second claim of the hypothesis: that a glottal feature preceding a vowel is realized as the onset of the following syllable.

This phenomenon was illustrated above in example 2, repeated below. When a floating glottal feature precedes a vowel rather than a consonant, the floating glottal feature surfaces as the onset of the following syllable, rather than triggering the ‘echoing’ of the preceding vowel:

6. *va'ata kom sika'u ne*
 va'a-ta kom sika -' -u=ne
 water-ACC down went -O.REL -to=1.SG
 'where the water went down'

We can garner further insight into similar alternations within lexical items by comparing Hiaki and Mayo cognates. Hiaki and Mayo are closely related languages, both being members of the Tara-Cahitic branch of the Uto-Aztecan family (Dedrick and Casad 1999: 3), and are mostly mutually intelligible. Many Hiaki and Mayo cognates differ in respect to two factors: First, that Mayo words have a segment (either /l/ or /r/) that Hiaki cognates lack and second that the Mayo words with these segments have an echo vowel we do not see in the Hiaki word.

The tendency for Hiaki to drop intervocalic /l/ and /r/ where Mayo retains them is already well-documented (Dedrick and Casad 1999: 30).

Table 7. Mayo/Hiaki intervocalic liquid-drop⁴

Mayo	Hiaki	Gloss
<i>Yori</i>	<i>Yoi</i>	‘Mexican’
<i>sawali</i>	<i>sawai</i>	‘yellow’

In the above examples, the intervocalic liquid is lost in the Hiaki cognate. Interestingly, there are examples that contain both an /r/ and a preceding echo vowel in Mayo, but only a glottal surfaces in Hiaki; the echo vowel seems to disappear with the /r/:

⁴ Mayo data in these tables come from Collard and Collard (1961) and Hiaki data come from Molina et al. (1999)

Table 8. Mayo/Hiaki Echo Vowel Alternations

Mayo	Hiaki	Gloss
<i>wiko'ori</i>	<i>wiko'i</i>	'rifle'
<i>soto'ori</i>	<i>soto'i</i>	'pot'
<i>tu'uri</i>	<i>tu'i</i>	'good'

In table 8, the echo vowel in Mayo precedes a consonant that is not present in the Hiaki form. If the echo vowel is indeed triggered by the glottal feature being attached to a vowel that precedes a consonant, it would follow that the Hiaki form, which has dropped the trigger consonant, would not manifest echo vowels. When we affix the consonant-initial suffix *-po* onto these words we can see the echo vowel resurface in the Hiaki word⁵:

7. *wiko'i* ('rifle') + *-po* ('in') → *wiko'opo*
8. *soto'i* ('pot') + *-po* ('in') → *soto'opo*

3.1 Disyllabic Echo Vowels

The picture so far is built upon data in which the V'V sequence is counted as a single syllable. However, there are cases, though infrequent, where we see an apparent echo vowel counted as its own syllable, wherein the glottal feature has surfaced as the onset of a syllable. Table 6 below shows some examples of these.

Table 6. Disyllabic Words with Possible Glottal Features

Word	Syllabification
<i>ye.'e</i> 'dance'	<i>ye.'e</i>
<i>voo.'o</i> 'road'	<i>voo.'o</i>
<i>o.'ou</i> 'man'	<i>o.'ou</i>
<i>e'e</i> 'no'	<i>e.'e</i>

It is possible that some of these words are not examples of echo vowels, but instead a consonant phoneme followed by a vowel of the same quality as the one preceding the glottal; this is an especially plausible analysis for *o'ou*. However, some these vowels do seem to behave differently than we might predict from a segmental analysis. For example, the word *ye'e* is morphologically complex. It consists of the root *yi'i* ('dance') and the active voice suffix *-e* (Yu et al. 2016: 10). When *-e* is suffixed onto an *-i*-final stem, as in 13 and 14 below, it 'overwrites' the *-i*. We show this affixation process on two Hiaki verbs:

9. *hamti* ('break') + *e* (VOICE.ACT) → *hamte*
10. *putti* ('shoot') + *e* (VOICE.ACT) → *putte*

We see the suffix vowel [e] coalesce with the stem vowel [i] to yield [e] (Yu et al. 2016:10). 15 below illustrates this process with *ye'e*:

11. *yi'i-* ('dance') + *e* (VOICE.ACT) = *ye'e*

⁵ These forms are constructed from a stem plus a stativizing *-i* suffix that is dropped when *-po* is affixed (see other nouns like *kecha'i* 'things stood up'). These examples thus are parallel to *the -u/-wi* cases in (2) above; the floating glottal is an onset when preceding the vocalic suffix *-i* and a preglottalized vowel when preceding the consonant initial suffix *-po*.

If the glottal in *yi'i-* were a segment, we might predict *yi'e* as the affixed form, however the vowel quality of the active voice suffix [e] spreads to the root vowel. There is no phonotactic limitation preventing this: [iʔe] is a possible vowel sequence. For example, *yi'i'e'a* ('feel like dancing') is a multimorphemic word consisting of *yi'i* and the desiderative *'e'a* ('to feel'). However, it is worth noting that, while *ye'e*, *soto'i*, and *wiko'i* all seem to involve a vocalic suffix following a root vowel that is designated as having a floating glottal feature, only *ye'e* shows spread of the vowel quality of the suffix to the root vowel.

A possible explanation for some echo vowel examples that are not clearly accounted for by a floating glottal feature comes from Mayo. Hagberg (2000) proposes that some Mayo echo vowels are the result of a floating glottal feature, and other word-final echo vowels are the result of an insertion of a [ʔV₁] sequence, where the second vowel is a copy of the vowel preceding the glottal. This special epenthetic process occurs on phrase-final words because Mayo does not include the final syllable in a phrase in the domain to which word-level rules apply (Hagberg 2000: 96). In other words, Mayo has phrase-final invisibility which influences the shape of some words. Under this analysis, words that frequently occur phrase-finally (like those in table 6) may have an epenthetic [ʔV₁] sequence to allow a phrase-final word to meet metrical requirements, which could account for why the echo vowels in these words are considered disyllabic. For example, *e'e* ('no') can be used as a response on its own, and therefore would be very frequently phrase final.

Hagberg's proposal of epenthesis motivated by phrase-final invisibility may also provide a potential explanation for data like the allomorphic alternations of the determiner *ume/ume'e* below:

12. *Ume paro'osim haivu bwasa*
 ume paro'os -im haivu bwasa -wa
 DET.MED.PL hare -PL already cook -PSV
 "The hares are already being cooked"
13. *Ime'e, ume'e, o wame'e?*
 ime'e, ume'e o wame'e
 DET.PROX.PL DET.MED.PL CONJ DET.DIST.PL
 "These ones, those ones, or those ones (way over there)?"

The *ume'e* in (13) occurs before a pause, making it possible that we are seeing something similar to the phrase-final invisibility described by Hagberg here. We can see a similar alternation using the emphatic *hunuka('a)* below.

14. *Hunuka lutu'uriata*
 hunuka lutu'uria-ta
 DET.MED.ACC.EMPH truth -ACC
 "That truth"

(Leyva and Florez Leyva:2018)

15. *Hunuka'a nee kaa uusek*
 Hunuka'a nee kaa uuse-k
 DET.MED.ACC.EMPH I NEG father-ASP
 "That one is not my child" or "That one, I did not father"

(Leyva and Florez Leyva:2008)

The echo vowel-less *ume* in example 12 is functioning as a determiner modifying the noun *paro'osim*, whereas *ume'e* in example 13 and the *hunuka'a* in 15 are each functioning as a noun phrase on their own. If these noun phrases are prosodic phrase units, as seems likely, it may be the case that we are seeing the echo vowel form where the word occurs phrase-finally, and seeing the echo vowel-less form where it does not. Finally, we do not have confirmation on syllable count for words like *ume'e* in a phrase, so at this point we are unable to determine whether a syllable-based argument for these alternations would be relevant.

Although Hiaki and Mayo are closely related, it is important to note that there are not currently proposals that Hiaki also displays phrase-final invisibility. Some analyses of tone and prosody in Hiaki identify the mora as being the more fundamental cue for word-level prosody, rather than the syllable (Demers et al. 1999: 52-53). This poses a

problem for adapting the Mayo analysis for Hiaki, as it relies on echo vowels being a repair based on words having too few syllables, and Hiaki has not presently been described as having phrase-final invisibility. Ultimately, phonetic and phonological analysis of conversational or narrative data is necessary for analyzing alternations like those discussed in this section.

4. Conclusion

This paper proposed that some instances of the echo vowel phenomenon in Hiaki, in which a $V_1?V_1$ sequence occurs in some lexically and morphologically conditioned environments, result from a floating glottal feature. Rather than being an epenthetic two-vowel sequence, echo vowels are the realization of a floating glottal feature as a preglottalized vowel. When this floating glottal feature occurs before a following vowel, it is syllabified instead as the onset of the syllable. We explored this proposal using syllabic, morphological, and phonological data however there are other domains of research that could further illuminate the process.

One promising avenue of research is gathering phonetic information on the echo vowels. Demers et al (1999) considered prominence in Hiaki using vowel duration; while this study looked primarily at long vowels, short vowels, and diphthongs, comparing the duration of echo vowels to other Hiaki vowels may be informative. Additionally, comparing the phonetic data on each of the proposed glottal realizations (preglottalized vowel, floating glottal feature as onset, phonemic glottal) could help clarify their distribution and categorization.

The role of the pitch accent system and phrasal prosody in the realization of echo vowels is another essential point of inquiry. A stronger foundation of knowledge in this regard could help not only strengthen understanding of the preglottalized vowels, but also of cases like *hunuka'a* and *ume'e* where the realization of the echo vowel is connected to its position or function in the phrase.

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