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On Mohawk Ghost Vowels: Audibility vs. Visibility

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Mohawk GHOST VOWEL *e* materialises to break up consonantal clusters. It has generally been analysed as epenthetic. The aspect of Mohawk phonology which has probably received most attention in the literature involves the intricate interaction between epenthesis and stress. Some ghost vowels are taken into account by stress, while others are not. The phonetic presence, i.e. AUDIBILITY, of ghost vowels is then not always accompanied by their VISIBILITY with respect to stress.

In this paper I propose an account of the apparently inconsistent stress behaviour of Mohawk ghost vowels. I will argue that ghost vowels materialise as a result of two independent sets of phonotactic well-formedness conditions: INTERNUCLEAR ones and INTERSEGMENTAL ones. Only the former type of conditions, being prosodic in nature, trigger the materialisation nuclei which are phonetically audible as well as stress-visible. On the other hand, intersegmental conditions can only determine the phonetic presence, i.e. the audibility of nuclei, but not their visibility to stress. Both types of well-formedness conditions which I will be talking about have been recognised in the literature on Government Phonology.

1. DATA

1.1 GHOST VOWELS IN MOHAWK

Mohawk is a Northern Iroquoian language, still spoken on reserves in Quebec, Ontario and New York State. The basic sources on Mohawk phonology are studies by Michelson (1981, 1983, 1988 and 1989) and that is where all the examples below come from. Other sources and studies on Mohawk include Alderete (1995), Beatty (1974), Bonvillain (1973), Chafe (1977), Hagstrom (1997), Mithun (1979), Piggott (1995), Postal (1968) and Potter (1994). (For a discussion of some of the analyses see Rowicka in prep.).

There are three vowels in Mohawk traditionally analysed as epenthetic which are phonetically identical to their non-epenthetic counterparts. The vowel *i* is added initially in subminimal words to satisfy a prosodic minimality condition on Mohawk verb forms. A well-formed verb form must minimally contain one branching foot (for a discussion see Piggott 1995). The vowel *a* appears between specific morphemes (as a 'stem joiner'). These vowels will not be considered in this paper. (For an analysis of the stem joiner vowel see Rowicka, in prep.) I will focus on the epenthetic vowel *e* since only this vowel exhibits the special prosodic behaviour to be discussed below. I will refer to it as the 'ghost vowel'.

The ghost vowel *e* materialises after the first member of a triconsonantal cluster or to split up a biconsonantal cluster if its second member is a sonorant /n, r, w/ or a word-final glottal stop /ʔ/. Ghost vowels fail to break up clusters containing /s, ʔ, h/ in certain positions.

Consider the examples in (1) where ghost vowels are capitalised.

- (1)
- | | | | |
|----|-------------------------------|------------|----------------------------------|
| a. | BETWEEN C AND WORD-FINAL /ʔ/: | | |
| | /ʌ-k-arət-ʔ/ | ʌká:ratEʔ | 'I lay myself down' |
| | /ro-kut-ot-ʔ/ | rokú:totEʔ | 'he has a bump on his nose' |
| b. | BETWEEN C AND SONORANT: | | |
| | /ʌ-k-r-ʌʔ/ | ʌkErʌʔ | 'I will put it into a container' |
| | /w-akra-s/ | wákEras | 'it smells' |
| c. | TO BREAK UP CLUSTERS: | | |
| | /s-rho-s/ | sÉrhos | 'you coat it with something' |
| | /s-k-ahkt-s/ | skáhkEts | 'I got back' |

The acute accent indicates main stress. There is no secondary stress.

1.2 GHOST APPEARANCE VS. STRESS

In words with no ghost vowels main stress falls on the penultimate syllable. Stressed vowels in open syllables are subject to lengthening.

- (2)
- | | | |
|----------------|------------|---------------------|
| /s-atorat/ | sató:rat | 'hunt'-IMPERATIVE |
| /wak-ashet-u/ | wakashé:tu | 'I have counted it' |
| /k-atirut-haʔ/ | katirúthaʔ | 'I pull it' |
| /s-ho-ahkt-u/ | shóhktu | 'he went back' |

Apart from closed syllables, tonic lengthening is also blocked before some ghost vowels in the next syllable (see § 1.3 below). The ghost vowel is sometimes visible to stress and sometimes it is not.

- (3)
- | | | | |
|----|------------------------------------|------------|------------------------------------|
| a. | GHOST BEFORE A SINGLE CONSONANT | | |
| | /ʌ-k-arət-ʔ/ | ʌká:ratEʔ | 'I lay myself down' |
| | /t-ʌ-k-rik-ʔ/ | tʌkErikEʔ | 'I will put together side by side' |
| b. | GHOST BEFORE A CONSONANTAL CLUSTER | | |
| | /wak-nyak-s/ | wakÉnyaks | 'I get married' |
| | /s-k-ahkt-s/ | skáhkEts | 'I got back' |
| | | *ÍskahkEts | |

Roughly speaking, in a closed syllable it is VISIBLE to stress, whereas in an open syllable it is INVISIBLE. Syllables ending in word-final /ʔ/ do not count as closed and ghost vowels preceding such /ʔ/ are invisible. Compare, for instance, the pre-antipenultimate stress in *tʌkErikEʔ* where none of the ghosts contributes to the metrical structure, and the penultimate stress in *skáhkEts* where the ghost vowel is included in the foot. If it were not, *i*-prothesis would apply (in order to satisfy the above-mentioned prosodic minimality condition) and stress would fall on the prothetic vowel. (An example where prothesis does actually take place in Mohawk is given in (4a) below.)

1.3 ADJACENT GHOSTS

Sequences of ghost vowels complicate the situation. Ghost vowels in non-neighbouring syllables are invisible for stress (cf. the pre-antipenultimate stress in (4a)). On the other hand, in a sequence of two contiguous syllables with ghost vowels one is visible and the other is invisible for stress (cf. the antipenultimate stress in (4b)).

- (4) a. GHOSTS IN NON-ADJACENT SYLLABLES:
- | | | |
|-------------|-----------|------------------|
| /t-n-ehr-ʔ/ | ítEnehrEʔ | ‘you and I want’ |
| /o-nraht-ʔ/ | ónErahtEʔ | ‘leaf’ |
- b. GHOSTS IN ADJACENT SYLLABLES:
- | | | |
|-------------------|------------------|---------------------|
| /te-wak-ahsutr-ʔ/ | tewakahsú:tErEʔ | ‘I have spliced it’ |
| | *tewakáhsutErEʔ | |
| | *tewakahsutÉ:rEʔ | |
| /yo-t-r-ʔ/ | yó:tErEʔ | ‘it’s in the dish’ |
| | *Í:yotErEʔ | |
| | *yotÉ:rEʔ | |

In the first example in (4a) *i*-prothesis takes place. This indicates that none of the non-adjacent ghost vowels are visible to stress and may contribute to the minimally required word size. On the other hand, no prothesis takes place in the last example in (4b), which shows that the prosodic minimality condition is fulfilled by one of the adjacent ghost vowels.

Visible and invisible ghost vowels have a different effect on tonic lengthening in the preceding syllable. Tonic lengthening is blocked before invisible ghost vowels in the following syllable, again as in *ítEnehrEʔ* in (4a). On the other hand, visible ghosts, just like contentful vowels, do allow for tonic lengthening in the preceding syllable, for instance, as in *yó:tErEʔ* in (4b).

1.4 EVIDENCE FOR THE NON-UNDERLYING STATUS OF GHOSTS

To recapitulate, evidence for the non-underlying status of the ghost vowel involves vowel-zero alternations (not always available) and invisibility to stress and the prosodic minimality condition just mentioned. The examples in (5) illustrate:

- (a) the alternation between an audible visible vowel and phonetic zero within the root /ahkt/ ‘go back’,
- (b) the alternation within the root /ahsutr/ ‘splice’ where the ghost vowel alternates between stress-invisible and stress-visible, and,
- (c) the alternation between zero, an invisible ghost vowel and a visible one at the end of the 1-P-AGENT prefix /k/.

- (5) a. VISIBLE [E] VS. \emptyset
 /s-k-ahkt-s/ skáhkÉts 'I got back'
 /s-ho-ahkt-u/ shóhktu 'he went back'
- b. VISIBLE [E] VS. INVISIBLE [E]
 /te-k-ahsutr-ha?/ tkahsutÉrha? 'I am splicing'
 /te-^k-ahsutr-^?/ t^kahsútEr^? 'I shall splice'
- c. VISIBLE [E] VS. INVISIBLE [E] VS. \emptyset
 /k-r-ha?/ kÉrha? 'I fill it in'
 /^k-r-^?/ ^kEr^? 'I will put it into a container'
 /k-hninu-s/ khní:nus 'I buy'

2 ANALYSIS

2.1 MOHAWK AS A STRICT CV LANGUAGE

For the analysis, I adopt a version of Government Phonology known as the Strict CV approach or the CVCV model (cf. Lowenstamm 1996, as well as Larsen 1995 and Scheer 1998). In this model, every consonant is followed in phonological representation by a nucleus, either filled by a lexically contentful vowel or empty. The distribution of empty nuclei is subject to strict well-formedness constraints. Vowel epenthesis does not involve the insertion of a position. It involves providing an existing empty nucleus with phonetic interpretation when it is required by well-formedness constraints.

I interpret Mohawk ghost vowels as empty nuclei. Given this, consider some words and their representations in 0:

- (6) a. wákÉras /wakərasə/ 'it smells'
 b. skáhkÉts /səkahəkətəsə/ 'I got back'
 c. kÉrha? /kərhə?ə/ 'I fill it in'
 d. ónÉrahtE? /onərahətə?ə/ 'leaf'

where 'ə'=empty nucleus

In the output some of the empty nuclei from the representations in (6) acquire phonetic interpretation, while others remain inaudible.

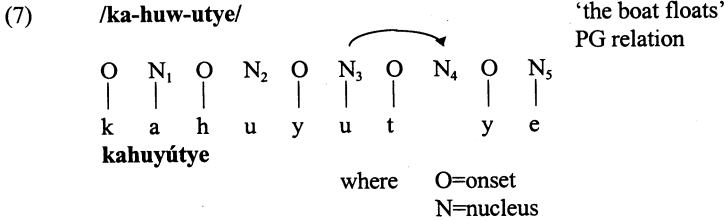
Cross-linguistically, empty nuclei are licensed to remain inaudible when preceded by specific consonants, in particular by /s/. This has been called Magic Licensing (cf. Kaye 1996). For the purposes of this paper I assume that, apart from /s/, in Mohawk also laryngeals /h, ?/ may have this Magic Licensing property. It affects, for instance, the final empty nucleus in (6a) and the first empty nucleus in (6b). Magic Licensing is responsible for most consonantal clusters in Mohawk. Almost all clusters of more than two consonants contain one (or more) of the Magically Licensing consonants (cf. Michelson 1988:12-3). For a more detailed discussion of the special properties of /s, h, ?/ in Mohawk see Rowicka (in prep.).

2.2 GHOST VOWELS AND INTERNUCLEAR RELATIONS

I argue that empty nuclei in Mohawk materialise as a result of two independent sets of phonotactic well-formedness conditions: INTERNUCLEAR ones and

INTERSEGMENTAL ones.

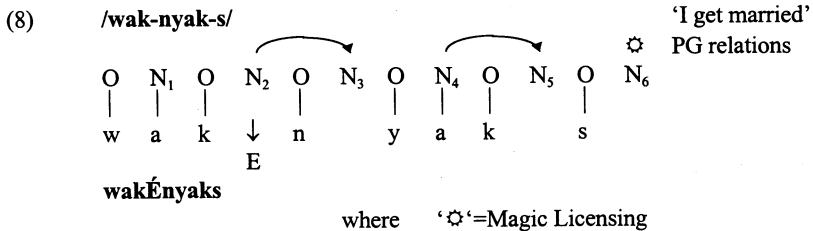
Internuclear conditions resemble well-formedness conditions on metrical feet. In rhythmic languages, sequences of unstressed syllables are banned. Analogically, sequences of empty nuclei are ruled out phonotactically. An empty nucleus requires the company of a contentful nucleus. Together they form a ‘phonotactic foot’. Consider the representation of the word *kahuyútye* in (7). The simplification of the input sequence /uwu/ has been ignored as irrelevant.



The empty nucleus N₄ forms a ‘phonotactic foot’ with the preceding contentful nucleus N₃, N₄ being the head and N₃ being the dependent. An empty nucleus which is parsed into a foot like this is licensed to remain inaudible.

Relations between empty and contentful nuclei, called PROPER GOVERNMENT (PG), have been postulated in Government Phonology and shown to play a role in the phonology of many languages. In van der Hulst & Rowicka (1997) it has been argued that PG relations should be interpreted as lexicalised foot structure. Contrary to mainstream Government Phonology, I assume that PG feet are TROCHAIC: an empty nucleus is parsed together with the PRECEDING contentful vowel, and not the FOLLOWING (cf. Rowicka, in press).

Phonotactic lapses, i.e. sequences of empty nuclei, are resolved by providing one of the empty nuclei with phonetic interpretation. Consider the representation of the word *wakÉnyaks*.



The representation in (8) contains a few empty nuclei. The last one N₆ is magically licensed and does not participate in internuclear relations. The preceding N₅ occupies the dependent position in a PG foot the head of which is contentful N₄. In other words, it is PROPERLY GOVERNED by N₄. It is correctly predicted to remain inaudible. Empty N₂ and N₃ constitute a lapse. In order to solve the lapse, they form

together a trochaic PG foot. To be the head of this foot N_2 must acquire phonetic interpretation, as shown in (8).

The phonetic surfacing of heads in PG relations is required by the phonological Empty Category Principle (ECP) in the formulation given below (for the formulation of the ECP in standard Government Phonology, see Kaye, Lowenstamm & Vergnaud 1990: 219):

- (9) THE REVISED ECP (Rowicka, in press)
 An empty nucleus is phonetically realised if it properly governs another empty nucleus.

The Revised ECP boils down to a fairly uncontroversial requirement that phonological heads should be phonetically present.

Cross-linguistically, nuclei which are not heads in PG feet generally remain INAUDIBLE, just like N_3 , N_5 and N_6 in (8). However, the situation in Mohawk is a little different.

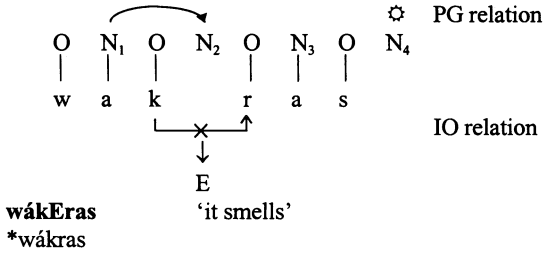
2.3 GHOSTS AND INTERSEGMENTAL RELATIONS

Proper Governing relations are formed between nuclei by and large irrespective of the nature of the surrounding consonants. By licensing the intervening empty nucleus to remain inaudible, they should be able to produce any type of consonantal clusters.

However, in Mohawk certain clusters are not tolerated at all. Clusters of a consonant and a sonorant or a glottal stop are always broken up by a ghost vowel. This indicates that not only internuclear relations are relevant in the determining the audibility of empty nuclei, but interconsonantal relations play a significant role as well. The existence of relations between consonants in separate onsets across an empty nucleus has also been recognised in Government Phonology. Two consonants separated only by an empty inaudible nucleus, and hence melodically adjacent, contract a relation, called INTERONSET GOVERNMENT (see, e.g. Guerssel & Lowenstamm 1988, Kaye 1990, Cyran 1996 as well as Cyran & Gussmann, in press). Sonorants can generally only be dependents in such relations. The headedness in Interonset (IO) relations is set parametrically in every language. It expresses the language's preference for 'branching onset-like' clusters or 'codan-onset-like' clusters.

In Mohawk 'branching onset-like' clusters are ruled out. They are always broken up by a ghost vowel. This indicates that no sonorant can be the dependent of the preceding consonant in an left-headed IO relation in Mohawk. Consider the representation in (10).

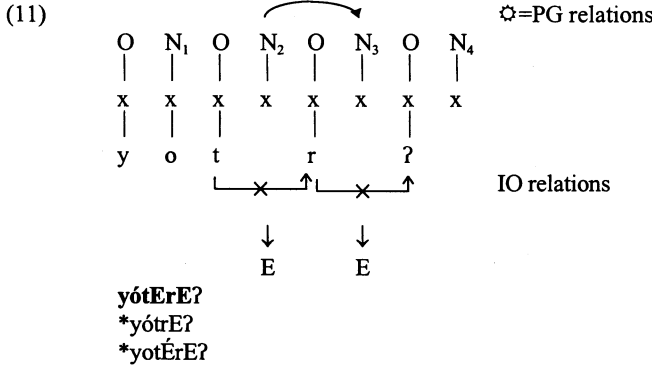
(10) NO LEFT-HEADED INTERONSET GOVERNMENT IN MOHAWK



The crossed out arrow in (10) indicates that there is no left-headed IO Government in Mohawk. That is why the melodic sequence /kr/ must be broken up by an audible nucleus.

One may conclude that IO in Mohawk is right-headed, rather than left-headed. Michelson (1988) does indeed report the occurrence of /rk/ clusters, but consonantal sequences do not generally exhibit falling sonority. I suggest that IO functions in Mohawk only in the form of NEGATIVE CONDITIONS on melodic sequencing.

The glottal stop patterns in behaviour with sonorants. Clusters of a consonant and /ʔ/ are impossible, not only in word-final position. Consider the word *yó:tErEʔ* ‘it’s in the dish’:



The glottal stop cannot be in an IO relation with the consonant it stands next to. Therefore their melodic adjacency has to be broken up by a surfacing nucleus. Notice that N_2 in (11) must surface both due to the internuclear and due to the intersegmental requirements. On the other hand, the presence of N_3 is only required by Interonset.

2.4 PROPER GOVERNMENT RELATIONS AND STRESS

Compare how stress treats ghost vowels which emerge due to Proper Government, i.e. internuclear constraints, and ghost vowels which appear due to Interonset

Government, i.e. intersegmental constraints. The nucleus N_2 which emerges in (11) as the head of a PG relation does count for stress, while N_3 does not. The analysis of other examples also confirms this generalisation.

All and only those ghost vowels which must be heads in PG relations are visible to stress. None of the empty nuclei which are dependents in PG feet count for stress, whether they are inaudible, like N_3 and N_5 in (8), or they are audible for reasons of Interonset, like N_2 in (11).

This situation is hardly surprising. Under the present analysis stress-visible nuclei are heads of internuclear relations, i.e. prosodic heads. It is to be expected that such heads are relevant for some other level of prosodic structure, while non-heads are not.

2.5 TONIC LENGTHENING

Visible and invisible ghost vowels have different effect on tonic lengthening in the preceding syllable. Stressed vowels in open syllables are generally subject to lengthening (cf. (12a)). Tonic lengthening fails to take place when a consonantal cluster follows (cf. (12b)) and before an invisible ghost vowel [e] in the next syllable (cf. (12c)). Visible ghost vowels do not block the lengthening (cf. (12d)).

- (12) a. TONIC LENGTHENING:
- | | | |
|---------------|------------|---------------------|
| /s-atorat/ | sató:rat | 'hunt'-IMPERATIVE |
| /wak-ashet-u/ | wakashé:tu | 'I have counted it' |
- b. NO TONIC LENGTHENING BEFORE A CLUSTER:
- | | | |
|----------------|------------|----------------|
| /k-atirut-ha?/ | katirútha? | 'I pull it' |
| /s-ho-ahkt-u/ | shóhktu | 'he went back' |
- c. NO TONIC LENGTHENING BEFORE AN INVISIBLE GHOST:
- | | | |
|-------------|-----------|-------------|
| /w-akra-s/ | wákEras | 'it smells' |
| /o-nraht-?/ | ónErahtE? | 'leaf' |
- d. TONIC LENGTHENING BEFORE A VISIBLE GHOST:
- | | | |
|-------------------|-----------------|---------------------|
| /te-wak-ahsutr-?/ | tewakahsú:tErE? | 'I have spliced it' |
| /yo-t-r-?/ | yó:tErE? | 'it's in the dish' |

Under the present analysis, both contexts where tonic lengthening is blocked involve stress-invisible empty nuclei, either audible or inaudible. The blocking of tonic lengthening also follows from the present analysis. (It is accounted for analogically to the long vowel shortening in Turkish and Yawelmani in Rowicka, in press.)

Within the Strict CV approach, tonic lengthening is viewed as addition of an empty syllable, i.e. an empty Onset + Nucleus sequence, to the vowel under main stress (cf. Larsen 1994 on Italian). The tonic vowel (underlined below) spreads its melody to the following empty nucleus so that a long vowel results. As argued in Rowicka (in press), there must be a PG relation between the vowel spreading its melody (N_2 below) and the empty target (N_3 below).

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