

A note on the glottal fricative in Maori¹.

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Introduction.

Hohepa (1967:5-8) states that the Maori fricative represented orthographically as *h* may be realised as a glottal, velar or palatal fricative: 'The fricatives have two linear distinctions, bilabial through dental /f/, and a palatal through glottal /h/. ..h/ is regarded as a consonant on phonological grounds; its allophones range from a velar to a palatal fricative'. A similar claim is made by Biggs (1978:706) who writes: 'Tokelauan, a non-Eastern Polynesian Nuclear language has [hy] before non-front vowels, which was also true of the now extinct Moori language of the Chatham Islands, and of New Zealand Maori in the 18th century. By the early 19th century Maori [hy] from *s had become [h] everywhere except in the far north of the North Island. It has now become [h] everywhere.'

In this paper I shall present evidence that the velar/palatal fricative, bearing the feature [+high], in alternation with /t/ is the underlying reflex of English /s, z, ʃ, ʒ/ in borrowed vocabulary, and is the source of the feature [+high] spread to epenthetic /i/: it is the underlying form of Maori /h/.

Borrowing processes.

The assimilation of English words into Maori requires the elimination of closed syllables, by vowel epenthesis and consonant deletion. Epenthetic vowels acquire feature specifications either by variable default assignment or by the spreading of features from neighbouring seg-

¹ I wish to thank Noam Chomsky, Michael Kenstowicz and Donca Steriade for helpful discussion of this paper; any howlers are of course all my own work.

ments, either vowels or consonants. A few examples are given below².

(1) a. (by apparent default)

thread	t <u>a</u> rete	coat	koti <u>i</u>
October	oket <u>o</u> pa	map	map <u>i</u>
John	h <u>o</u> ne	coffin	kaaf <u>e</u> na
doll	ta <u>a</u> re	mile	maa <u>e</u> ro

b. (spreading from a vowel in the preceding syllable)

Auckland	aak <u>a</u> rana	cent	hen <u>e</u> ti
wolf	wuru <u>u</u> hi	apostle	aapoto <u>o</u>
ink	ij <u>i</u> ki		

c. (spreading from a vowel in the following syllable)

blanket	paraik <u>e</u> te	slate	te <u>r</u> eti
priest	pi <u>r</u> iti, pi <u>r</u> ihi	cloth	ko <u>r</u> oihe
blue	pu <u>r</u> uu		

d. (spreading from a consonant)

umpire	am <u>u</u> paea	purple	pa <u>u</u> pura
plate	pu <u>r</u> eti		
	(also per <u>e</u> ti)		

Variable default realisations and feature-spreading processes also apply to reflexes of English schwa, as in (2).

(2) a. (apparent default)

organ	ook <u>a</u> na	canon	keen <u>a</u> na
cornet	koon <u>a</u> ta	button	paat <u>e</u> ne
mustard	maat <u>e</u> te		

b. (spreading from a vowel)

Europe	oor <u>o</u> pi	orange	aar <u>o</u> ni
paling	peer <u>o</u> ni	melon	mer <u>o</u> gi

The processes of consonant deletion, vowel epenthesis and feature

²For brevity's sake, I shall not discuss in detail the Maori realisations for all English phonemes, assuming that in general the correspondences are sufficiently clear, nor shall I review the processes of consonant deletion and epenthesis.

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spreading in these data are not claimed to be part of the phonology of Maori. I consider them to be common strategies available to any speaker challenged to assimilate foreign words which violate his or her grammar. For example, an English speaker will often pronounce the Russian word *mglā* ('bear') as [mɛglā], inserting an epenthetic vowel, because although English has a variety of consonant clusters it does not tolerate initial /mgl/. But we do not want to conclude from this that English phonology has a rule of vowel epenthesis; surely it is more plausible to say that non-language-specific, common rules of this kind are available to any speaker when the need arises, precisely to deal with non-native input. The assumption that the borrowing rules are not found in the phonology of Maori is consistent with the unpredictability of their operation; rules may apply in variable order and may fail to apply when the structural description is met. This variability of derivation is most clearly shown by those borrowed words which have more than one borrowed form, as the reader will note.

With these provisos in mind, I turn now to the reflexes of English sibilants and the high front vowels in question.

The English sibilants /s, z, ʃ, ʒ/.

The English sibilants /s, z/ are realised in Maori as /h/, preserving the manner of articulation, or less commonly /t/, preserving the place of articulation. In the corpus of borrowings considered, of 128 occurrences of English /s, z/, 109 were realised as /h/ and 19 as /t/. Of 41 occurrences of English /ʃ, ʒ/, 40 were realised as /h/ and one, in (3d), as /t/, this last being perhaps an instance of interference from the spelling (cf. the usual realisation of the suffix *-tion* as *-hana*). A few illustrations appear below.

(3) a. /s, z/ → /h/

pass	pahi	sign	haina
molasses	marahihi	Joseph	hoohepa
rose	rouihi		

b. /s, z/ → /t/

princess	pirinitete	Sir	taa
poison	paitini	trousers	tarautete
	(also paihini)		

c. /ʃ, ʒ/ → /h/

shoe	huu	dish	riihi
measure	meiha, meehua		

d. /ʒ/ → /t/

motion	mootini
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The affricates /tʃ, dʒ/ are realised as Maori /h/ or /ti/: of 73 occurrences of /tʃ, dʒ/, 30 were realised as /h/ and 40 as /ti/, with three realisations of /dʒ/ as /ri/; these will be discussed further below.

(4) a. /tʃ, dʒ/ → /h/

orchard	oohete	church	haahi
John	hone		

b. /tʃ, dʒ/ → /ti/

watch	wati	cheque	tiaki
charge	tiaati	chalk	tioka
general	tianara		

c. /dʒ/ → /ri/

George	hori	sergeant	hariana
cartridge	kariri		

Epenthetic high front vowels.

Where an English sibilant is realised as /h/, an adjacent non-final epenthetic vowel is usually /i/, as shown in (5).

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(5) a.

council	kaun <u>i</u> hera	ox	ok <u>i</u> ha
pension	pen <u>i</u> hana	launch	roon <u>i</u> hi
taxi	taak <u>i</u> hi	section	teek <u>i</u> hana
wax	waak <u>i</u> hi		(also tekiona)
	(also waki)		

b.

Australia	ah <u>i</u> tereiria	hospital	hoo <u>i</u> hipera
master	maah <u>i</u> ta	postmaster	pohim <u>i</u> ta
basketball	pah <u>i</u> ketepooro	Presbyterian	
whisky	weh <u>i</u> kee		pereh <u>i</u> pit <u>i</u> iriana
	(also wihikee)		
National	nah <u>i</u> nara		

The epenthetic vowels indicated are followed or preceded by /h/ in (5a) and (5b) respectively³. The generalisation that epenthesis adjacent to /h/ surfaces as /i/ word-medially is also supported by the examples in (6a), where the vowel features may have spread from the preceding syllable, and is contradicted only by the words in (6b), where a vowel other than /i/ has spread features to the epenthetic vowel.

(6) a.

policeman	pirih <u>i</u> mana	quince	kuin <u>i</u> hi
Christmas	kirih <u>i</u> mete	biscuit	pih <u>i</u> kete
prince	pirin <u>i</u> ha	boardinghouse	
			porin <u>i</u> hauhi

b.

angel	an <u>a</u> hera	wolf	wuru <u>h</u> i
benzine	pen <u>e</u> hini	compensation	
			kamupene <u>e</u> hiana

The generalisation that word-medial epenthetic /i/ occurs only where

³Note that in *taakihi* and *pereh*i*pit*i*iriana* one might suppose that the vowel features have spread from the vowel of the following syllable. Nevertheless, I have included these words here because such backward spreading of features from a vowel is otherwise only found to an epenthetic vowel in the first syllable, as in (1c) above.

features are spread from /i/ in an adjacent syllable, or adjacent to /h/, is contradicted only by the words in (7).

(7) a.
 Scotsman katimana
 blacksmith parakimete

b.
 napkin napikena
 tractor tarakitaa
 wheelbarrow huripara

In (7a) the epenthetic vowel indicated appears at the site of an English /s/, and I shall assume that these occurrences also involve an adjacent /h/ at some point in the derivation; /s/ is realised as /h/ and subsequently deleted.

It is possible that the /i/ of *huripara* is spread from a reflex of English /i/, subsequently deleted, according to the derivation below.

wheelbarrow	hwilbærou	
	huirparV	
	huirVparV	epenthesis
	huripara	spreading
	huripara	/i/ → Ø

Alternatively, *huripara* may be a case of folk etymology from Maori *huri* 'turn'. This seems more likely, as the deletion of /i/ as above is unmotivated in Maori and not found elsewhere in the data.

This leaves only two exceptions to the generalisation that word-medial epenthetic /i/ is either spread from a neighbouring /i/, or adjacent to /h/. In other words, /i/ is not a common default value for word-medial epenthesis.

With word-final epenthesis, on the other hand, /i/ is a common default value, as illustrated in (8).

(8) soap hopi gate keeti
 egg heki paling peereni
 melon meregi yard iari
 (also mereni)

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But where the preceding consonant is /h/, the word-final epenthetic vowel is /i/ with few exceptions, as in (9).

(9) a.

pass	pahi	brush	paraahi
bus	paahi	toast	toohi
purse	paahi	case	keehi
church	haahi	nurse	naahi
brass	paraahi	nurse	neehi
Nagash	naakahi	post	poohi
press	perehi		

b.

goose	kuihi	rose	rouihi
breakfast	parakuihi	boardinghouse	
		poorigihauhi	

c.

cockroach	kokoroihe	grass	karaihe
class	karaehe	glass	karaehe
March	maehe	horse	hooiho
jackass	kaihe		

(first syllable lost)

d.

wireless	waerehe	compass	kapehu
cask	kaho	prince	piriniha
ox	okiha	paralyse	pararaiha

'polio'

The examples in (9a,b) obey the prediction straightforwardly, while the examples in (9c) show a further peculiar property shared by those in (9b); an /i/ or /e/ not required for syllabification is inserted before /h/. The same phenomenon appears in the words in (10a) and perhaps (10b) below.

(10) a.

butcher	poiha (also piha)	measure	meiha (also meehua)
pheasant	peihana	Port Jackson	
cushion	kuihana		poihaakena
percent	paiheneti		

b.

compensation	kamupeneheihana
station	teihana
accommodation	kamareihana
carnation	kaaneihana
corporation	kaporeihana
coronation	koroneihana
probation	poropeihana
regulation	rekureihana
arbitration	apitireihana

The examples in (10b) are included here because although English /ei/ may be realised as Maori /ei/, in which case the indicated /i/ would not be epenthetic, the more common realisation of /ei/ is /e/. Excluding the examples here, in 50 occurrences of English /ei/ only 15 surface as Maori /ei/ in the data reviewed.

Every case of epenthetic /i/ or /e/ not required for syllabification is followed by /h/, and there are no other patterns of epenthesis of this kind⁴.

I shall assume that in every case in (9b,c) and (10) the added vowel is first specified as /i/ and spread to the final vowel in (9b,c), with subsequent lowering in some cases. Vowel lowering applies first in the final vowel, as in (11a), and may spread leftward as in (11b); this is consistent with the absence of any forms in this group ending in *-ehi*, or forms such as *cushion* - **kuehana*, in which lowering applies

⁴In the only other comparable pattern, found in the words below, /i/ appears at the site of a deleted /ʉ/. For these cases I suggest that the [+high] specification of /ʉ/ survives on the indicated /i/; in other words, /i/ replaces /ʉ/, unlike (10b,c), where no substitution is apparent.

tank	tajka	handkerchief	hajkiha, ajkiha
anchor	hajka	blanket	parajketa

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non-finally.

(11) a.
cockroach kokoroihe
jackass kaihe
grass karaihe

b.
class karaehe
March mache

Bearing in mind that the borrowing processes apply in variable order, it seems reasonable to assume that the word-final vowel in *hooiho* has received features spread from the preceding syllable prior to insertion of /i/ before /h/, as in (12), leaving only five exceptions (see (9d)) to the generalisation that wordfinal epenthesis after /h/ is /i/, if not spread from the vowel of the preceding syllable.

(12) horse hoo*h*
 hoo*h*V
 hoo*h*o
 hoo*h*o

English schwa.

I noted above that reflexes of English schwa are specified in the same way as epenthetic vowels, acquiring features by spreading or variable default. Accordingly, we would expect the reflex of schwa to be /i/ where it is adjacent to /h/, and this is usually the case as in (13)⁵.

(13) scholarship karah*i*pi
 harness haan*i*hi
 officer aapi*h*a
 English iqari*h*i

⁵The reader will have noticed that I have grouped together English /ə/ and unstressed /ɪ/, on the grounds that the contrast is preserved fully only in British Received Pronunciation. This lack of contrast is also indicated by borrowings such as: basin peihana holiday hararei
turnip toonapi coffin kaafena
in which a possible /ɪ/ is not distinguished from /ə/.

chemist	keemi <u>hi</u>
president	perehi <u>ti</u> ni
register	rehi <u>ta</u>
tennis	teeni <u>hi</u>
virgin	waahi <u>na</u>
varnish	waani <u>hi</u>
molasses	marahi <u>hi</u>
passage	paahi <u>hi</u>
circus	taaki <u>hi</u>
December	tii <u>he</u> ma

(possibly spread from preceding syllable)

Irish	airi <u>hi</u>
handkerchief	haiki <u>ha</u>
bicycle	paihi <u>ka</u> ra

(possibly spread from the following syllable)

machine	mihi <u>ini</u>
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Realisation of /ə/ as /i/ by default also occurs in varying environments where there is no /h/, for example:

prophet	poropi <u>ti</u>
servant	haawi <u>ni</u>
paddock	paati <u>ki</u>
pannikin	pani <u>ke</u> na
olive	oori <u>wa</u>

but the generalisation that /ə/ if adjacent to /h/ becomes /i/ has only four exceptions:

August	aaku <u>h</u> ata
compass	kaape <u>h</u> u
orchard	oohe <u>h</u> e
wireless	waere <u>h</u> e

The case of *waerehe* may perhaps be assimilated to examples like *March - maehe* above (see (13b)).

To sum up so far, I have demonstrated that a vowel which at some stage of the derivation lacks features (either an epenthetic vowel or reflex of /ə/), if adjacent to (surface or underlying) /h/ almost always surfaces as /i/, or in some cases as /e/ derived from /i/ by lowering. In

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the absence of an adjacent /h/ a word-medial epenthetic vowel rarely receives the features of /i/ by default specification, although /i/ is a fairly common default value for word-final epenthesis and reflexes of schwa.

The English palatals.

The last cases to be reviewed here are the reflexes of English affricates /tʃ, dʒ/, which are /ti/ as in (15a) (all examples given), /h/ as in (15b), and /dʒ/ - /ri/ as in (15c) (all examples given).

(15) a. /tʃ, dʒ/ → /ti/

watch	wati	porridge	paareti
cabbage	kaapeti	garage	karaati
college	kaareti	carriage	kaareti
coach	kooti	peach	pititi
perch	paati	patch	paati
barge	paati	judge	tiati
charge	tiaati	bridge	piriti
sandwich	hanawiti	match	mati
chalk	tioka	chocolate	tiokareti
general	tianara	chain	tiini
gin	tiini	sausage	tootiti
JP	tieipii	jam	tiaamu
German	tiamana	Japanese	tiapanii
archdeacon	atiriikona	cheese	tiihi
engineer	enetinia	wedge	weti
cheque	tiaki	jack ('flag')	tiaki
	(also haki)		(also haki)
jug	tiaka	chairman	tiamana
	(also haaka)		(also heamana)

b. /tʃ, dʒ/ → /h/

Egypt	iihipa	July	huurae
register	rehita	orchard	oohete
church	haahi		

c. /dʒ/ → /ri/
 George hori
 sergeant hariana
 cartridge kariri

The examples in (15a) fall under the generalisation that /i/ which is not derived from English /i/ or spread from neighbouring /i/ is adjacent to /h/ at some point of the derivation, if we assume the analysis in (16) where the affricates are treated as consonant sequences.

- (16) a /tʃ, dʒ/ → /tʃ/ → /th/ → /ti/
 b /tʃ, dʒ/ → /tʃ/ → /th/ → /h/
 c /dʒ/ → /dʒ/ → /rh/ → /ri/

Note that (16c) applies to the examples in (15c), and is consistent with the fact that almost half the occurrences of English /d/ in the data become Maori /r/.

The source of /i/.

In presenting the data of the previous sections I have asserted without discussion that the characteristic environment I demonstrate for /i/ is an adjacent /h/. On common assumptions this is a puzzling phenomenon, given that a 'characteristic environment' of this kind is generally explained by rules of feature spreading, such as the spreading of [+labial] from /p/ to /u/ in *whip* → *wepu*: (see also (1d)). The problem here is that the glottal fricative is standardly analysed as bearing no supralaryngeal features at all. This suggests that we should reconsider the possibility that the recurring presence of /h/ in the relevant data is fortuitous, and that the significant feature of the environment is something else.

The English palatals.

I suggested above (16) that the derivation of the affricates is

/tʃ, dʒ/ → /tʃ/ → /th/ → /ti/

thus grouping the /i/ of *chalk* → *tioka* with the /i/ of *blacksmith* →

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parakimete, appearing at the site of a deleted /h/. Now we could alternatively propose that the [+high,-back] specification which surfaces as /i/ originates as the [+high,-back] specification of /ʃ, ʒ/, perhaps by direct substitution of /ti/ for /ʃ, ʒ/, so that /ti/ is fully specified in the initial representation; such an analysis seems reasonable for these words.

It does, however, leave open the question of the survival of the [+high,-back] features in those cases where /ʃ, ʒ/ → /h/, and the effects shown above still apply, as in *church* → *haahi* etc; we would have to fall back on the notion of floating features for these.

But of course the real problem with using the palatals as the source of /i/ is that it leaves quite unaccounted for all those cases where the source of /h/ is not palatal, but non-original /i/ appears. Perhaps we should reexamine the set of phonemes realised as /h/.

The feature [grave]

When we take the set of English phonemes realised as /h/, /s, z, ʃ, ʒ, ʃ, ʒ/, and search for a possible relationship with /i/ and occasionally /e/, we seem to have found an answer: dental, alveolar, palato-alveolar and palatal consonants form a natural class with front vowels, defined by the acoustic feature [-grave]. This avoids the difficulties which arise when we seek an English source for [+high,-back], as the alveolars are included here.

There are two problems. First, the articulatory characteristics which produce acoustic gravity are supralaryngeal, and so /h/ is not specified for the feature [grave]. So where a sibilant is realised as /h/ we might propose that the feature [-grave] becomes a floating feature, which may be mapped to the left or right of /h/, or lost in the derivation, which would account for the cases in which /h/ as the reflex of a sibilant produces no /i/.

But where the reflex of a sibilant is /t/, which is specified as [-grave] in any case, we would expect /t/ to show the same properties as /h/. In fact, /t/ from any source, sibilant or nonsibilant, should show the relevant properties. This is not the case; compare the examples below.

(17)	<u>molasses</u>	<u>marahihi</u>	cf.	<u>trousers</u>	<u>tarautete</u>
	<u>officer</u>	<u>aapiha</u>	cf.	<u>post office</u>	
					<u>poutaapeta</u>
	<u>boardinghouse</u>		cf.	<u>publichouse</u>	
		<u>poorihihauhi</u>			<u>paaparakaauta</u>
	<u>harness</u>	<u>haanihi</u>	cf.	<u>princess</u>	<u>pirinitete</u>
	<u>hospital</u>	<u>hoohipera</u>	cf.	<u>slate</u>	<u>tereti</u>
	<u>chemist</u>	<u>keemihi</u>	cf.	<u>interest</u>	<u>initarete</u>

It seems that the feature [-grave] of English alveolars and palatals remains phonologically active only where the reflex is [0grave], not where it is [-grave], which is most unlikely.

We would also expect, if the feature [-grave] is responsible for the vowels at issue, that non-original /i/ would be found with other segments derived from [-grave] phonemes, in addition to the /t/ illustrated in (17); these are /t, r, n/. Although word-final epenthetic /i/ occurs commonly after these phonemes, this is probably a function of the absolute greater frequency in the data of alveolar consonants; /i/ is apparently a word-final default value and also appears after labial and velar consonants (see (8)). The other word-internal effects on epenthesis and schwa are not found with /t,r,n/.

This leaves us with Maori /h/.

Maori /h/.

I pointed out earlier that a glottal fricative has no supralaryngeal features to spread, and has no specification by which it forms a natural class with /i/ and possibly /e/. Assume then that /h/ in Maori is underlyingly not a glottal fricative, but a palatal/velar fricative ([+high, 0back]), as suggested by Hohepa's comments on its surface forms.

Recall that Biggs (op. cit.) states 'By the early 19th century Maori [hy] from *s had become [h] everywhere except in the far north of the North Island', thus disagreeing with Hohepa, who claims that the [hy] alternant is present in modern Maori.

This study has no bearing on the modern surface forms, but the data indicate that /h/ was [+high], at least in underlying representations, throughout the 19th century and into the 20th, when these

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borrowings were made (consider *Egypt*, *German*, *sergeant*, *cartridge*, *Japanese*/, which are probably wartime borrowings, although *Egypt* could be from the New Testament; *cornet*, *publichouse*, *wireless*, *pan-nikin*, *slate* (probably a child's writing slate), where either the terms are little used nowadays or the objects themselves are rare, and *Port Jackson*, the old name for Sydney.)

Biggs' remarks also raise the question whether Maori /h/ as a reflex of an English sibilant differs from Maori /h/ elsewhere in the borrowings or the native vocabulary: if Biggs is correct, /h/ in the native vocabulary, which derives from Proto-Polynesian *s, used to be /hy/ but had developed into /h/ almost everywhere by the early 1800s, at least in the surface forms. Supposing that Maori /h/ had really lost all its supralaryngeal features at all levels by the early 1800s, when extensive contact with English was just beginning. One might reactivate /s/ → /hy/ for the sibilants, but map other fricatives into /h/. Although very few examples bear on this question, because /h/ as the reflex of a non-sibilant is uncommon, those in (18) suggest that /h/ from any source is [+high].

(18)	Ruth	ru <u>hi</u>
	tablecloth	teparakoro <u>i</u> he
	wolf	wuru <u>hi</u>

cf. golf korofa

I conclude that /h/ in borrowed words generally is identical to native /h/, and is [+high], at least underlyingly.

The instances of non-original /i/ reviewed above can then all be described as the output of a process spreading the place features of a consonant onto an adjacent vowel; this will account for /i/ as the realisation of epenthetic vowels or schwa when adjacent to /h/.⁶ In

⁶I assume that the value [-back], or more probably [-labial], from which [-back] follows for vowels, is assigned by redundancy rule. Although space does not permit a discussion of this point in detail, the feature [labial] is 'strong', in that labial consonants are not subject to deletion. Moreover, rounded vowels are very rare as default values, accounting for only 14 out of 310 apparent default vowels. I conclude then that [+labial] is the contrastive underlying value for the feature and that a segment bearing no underlying value for Labiality will receive the negative value by redundancy rule. The assignment of [-back] to [-labial] segments is also redundant, and in fact it seems that [back] is not a contrastive feature in Maori (so not specified in underlying representations); although there are numerous examples

words like *goose* → *kuihi*, an epenthesis process adds a vowel slot between an existing vowel and a following /h/; subsequently the [+high] feature from /h/ spreads to the medial epenthetic vowel, and then to the vowel provided by word-final epenthesis, with subsequent lowering in some cases as above.

Where /i/ appears at the site of a deleted /h/ we could say that the feature [+high] spreads to an epenthetic vowel prior to deletion of /h/, as was suggested above; alternatively, there is evidence that a continuant consonant may link directly to a vowel slot, as in (19).

- (19) shave heu breakfast parakuihi
twine tuaina man o'war manuao

This suggests an account of, for example, *blacksmith* → *parakimete* in which /i/ derives by the direct linking of /h/ to a vowel position, where it becomes voiced by redundancy rule, and the same account may be given for the English affricates realised as /ti/ or /ri/.

Conclusion.

Despite the unpredictability of the data studied here, I believe it is clear that the occurrence of non-original /i/ is significantly related to the presence of /h/. I have claimed that the relationship between /h/ and /i/ in the relevant cases is one of spreading the feature [+high] from /h/ to /i/, which assumes that /h/ is underlyingly a [+high] fricative, in keeping with both Biggs' remarks on the history of Maori /h/, and Hohepa's remarks about its surface forms.

References.

The data were chiefly drawn from:

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of /u/ spread from /m, p/. /u/ spread from /k, ŋ/ occurs in at most three examples:
doctor takuta August sakuhata
humbug hamupuku

The glottal fricative in Maori

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